INFORMS 2011 ANNUAL MEETING

TransfORMation

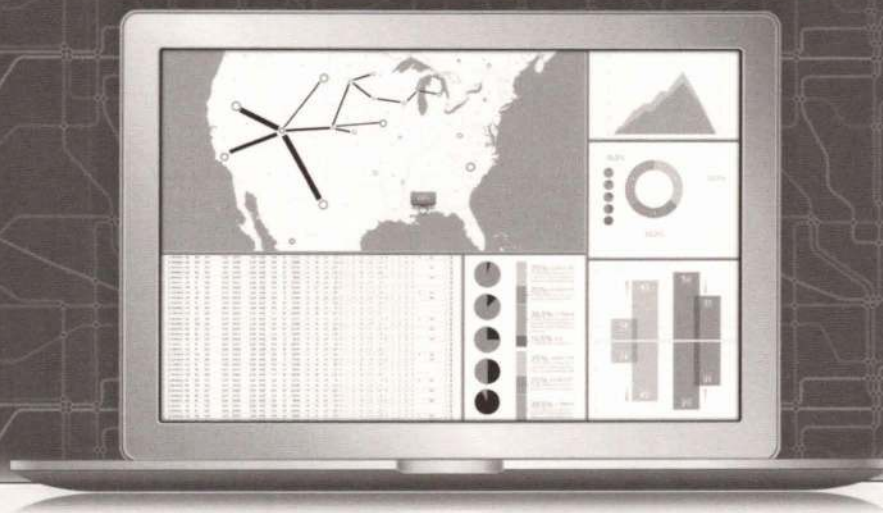


November 13-16, 2011
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Our simulation solutions have guided capital investments worth hundreds of millions of dollars for several Fortune 500 companies. We specialize in building very fast optimization-guided simulation engines for complex decision problems.



SOLUTION DEVELOPMENT APPROACH

We are flexible in our relationship with clients and tailor it to meet their requirements. We typically follow the following step-wise approach in an engagement.

STEP 1: Give a demonstration of our software solutions to give an overview of our past and current projects and technical capabilities.

STEP 2: Understand your business problem, outline proposed methodology, and give timelines and budget estimates.

STEP 3: Develop the solution in the rapid development mode as an augmentation of your team and bring to you our decades of experience of architecting, designing, and building successful applications.

STEP 4: Deploy and maintain the solution.

Innovative Scheduling builds and deploys turn-key data analytics, business intelligence, optimization, and simulation solutions in a rapid development mode. All of our technical team members have advanced degrees (M.S. or Ph.D.) in Operations Research or Computer Science from renowned universities. Please feel free to enquire how we can assist you in creating a success story for you and your organization.

InnovativeScheduling
OPTIMIZATION IN ACTION

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Copies of papers abstracted in the meeting program are available only from the authors. Requests for papers should be sent to the authors at the addresses shown in the program. Published annually prior to the meeting by the Institute for Operations Research and the Management Sciences. Individual issues of the program are available for $20US per copy. Orders must be prepaid and sent to INFORMS, 7240 Parkway Drive, Ste. 300, Hanover, MD 21076.

Sponsors 2
Welcome from the Chair 3
Program at a Glance 4
Schedule of Special Events 7
Job Placement Services 7
Going Green 8
Engage with Online Tools 10
Schedule of Community Business Meetings 11
Speaker Information 13
Guest Program, Guest & Plant Tours 15
Special Receptions 17
Networking & Social Events 18
Saturday Workshops 19
Focus on Analytics & O.R. Practice 20
Special Programs 21
Technical Program
- Interactive Sessions 22
- Plenary & Keynote Presentations 23
- Tutorials 28
- Software Demonstrations 32

Exhibitors 35
City Map with INFORMS Hotels 39
Maps & Floor Plans 40
Master Track Schedule 44
Invited Cluster Chairs 52
Sponsored Cluster Chairs 53
INFORMS Future Meetings 54
Technical Sessions
- Sunday 55
- Monday 141
- Tuesday 239
- Wednesday 340

Session Chair Index 444
Author Index 448
Session Index 474

INDEX OF ADVERTISERS

Innovative Scheduling ..... Inside Front Cover
Wiley-Blackwell 6
Oxford University Press 9
Palgrave Macmillan 12
SAS 16
SIAM 29
World Scientific Press ..... Inside Back Cover
IBM ..... Back Cover

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Dear Friends of INFORMS,

On behalf of the Organizing Committee for the INFORMS 2011 Annual Meeting, I welcome you to Charlotte. The Queen City of the South is "hip," "accessible" and pedestrian friendly. It is ranked as one of the best cities in the U.S. For decades it has been a major distribution and transportation hub. It is also the second largest financial center in the U.S., boasts a high-tech manufacturing sector with over 1,150 manufacturers, and is home to industrial power houses like Nucor and energy sector leader Duke Energy. All told, Charlotte is headquarters to eight Fortune 500 companies.

We have a world-class line-up of plenary and keynote speakers. Salah E. Elmaghraby, North Carolina State University, will give the opening plenary. James E. Rogers, Chairman of the Board, President and CEO of Duke Energy, will speak on leading the industry's transformation where "energy efficiency and energy optimization will rival energy production as two of the industry's core activities." Keith Collins, Senior Vice President and Chief Technology Officer of SAS, will speak on the evolution of analytics. We are also delighted to have Susan DeVore, President and CEO of the Premier Healthcare Alliance, give a plenary. Other speakers include academic leaders, Barry L. Nelson, Northwestern University, and Yves Crama, HEC Management School, University of Liège.

The most fun evening of the conference will be the general reception on Tuesday which will be held in the NASCAR Hall of Fame. Everyone will have the opportunity to test their racing and pit crew skills. Serious competitors are welcome to frequent the NASCAR Hall of Fame to practice before the reception.

I would like to take this opportunity to thank Terry Cryan, Cheryl Clark, Paulette Bronis and their staff at INFORMS and the members of the Organizing Committee. I am deeply grateful to Brian Denton, Program Chair, for his tireless efforts and leadership in putting together an amazing program. Special thanks goes to Invited Sessions Co-Chairs Scott Mason and Justin Yates, Sponsored Sessions Chair Peng Sun, Contributed Sessions Co-Chairs Mary Beth Kurz and Miguel Anjos, and Manoj Chari, Practice Program Chair. I also would like to thank Ertunga Ozelkan and Nilay Tanik Argon for their outstanding work in revising and running the poster sessions, Joe Geunes for putting together a wonderful set of tutorials, and Joe Mazzola for arranging plenary and keynote speakers. Finally, I take my hat off to Lauren Davis and Moutaz Khouja for recruiting and coordinating nearly 60 student volunteers who will help support implementation of the program on site.

I would like to express my gratitude to the following leading companies and universities, who so generously gave their support: IBM, GAMS, Booz Allen Hamilton, AIMMS, PROS Pricing, UNC Charlotte, SAS, McGraw-Hill, NC State University, and UT Dallas.

I hope you will benefit from this well-organized conference and enjoy your time in Charlotte.

Cem Saydam

Cem Saydam

Program at a Glance

NOTE:
Technical sessions are held at the Charlotte Convention Center, Westin Charlotte and Hilton Center City.
Check the Master Track Schedule on pages 44-51 for specific room locations.

KEY
C-Convention Center
W-Westin
H-Hilton

BADGES REQUIRED FOR TECHNICAL SESSIONS

INFORMS Annual Meeting 2011 badges must be worn to all sessions and events. Badges will be checked at the entrance to technical session areas, as well as the Exhibit Hall. Attendees without badges will be directed to the INFORMS registration desk to register and pick up their badges. *All attendees, including speakers and session chairs, must register and pay the registration fee.* Lost badges can be replaced at the registration desk for a fee of $5.00.

QUICK REFERENCE

including the Master Track Schedule
Don't miss this handy reference.
It's a separate flyer that came with your program. The Master Track Schedule is also printed on pages 44-51.

THANK YOU

Email Center

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FRIDAY, NOVEMBER 11

6:00pm-8:00pm	Combined Colloquia	W – Providence I-II

SATURDAY, NOVEMBER 12

8:00am-5:00pm	CIST Conference	W – Sharon & Independence
8:00am-5:30pm	DM-HI Workshop	C – 209A & 209B
8:15am-4:30pm	Future Academician Colloquium	W – Grand D
8:15am-4:30pm	Future Practitioner Colloquium	W – Harris
8:15am-4:30pm	Teaching Effectiveness Colloquium	W – Trade
9:00am-5:00pm	ED Workshop	C – 207A
9:00am-5:30pm	Vendor (Exhibitor) Workshops	C – See p.19
1:00pm-5:00pm	DSS Workshop	C – 207BC
2:00pm-7:00pm	Registration Opens	C – Concourse C
5:00pm-6:00pm	INFORMS Membership Meeting	W – Providence II-III

SUNDAY, NOVEMBER 13

7:00am-5:00pm	Registration	C – Concourse C
8:00am-9:30am	Technical Sessions (SA)	Center, Hilton, Westin
8:00am-5:30pm	CIST Conference	W – Sharon & Independence
9:30am-10:00am	Coffee Break	Center, Hilton, Westin
10:00am-10:50am	Welcome/Plenary: Salah Elmaghraby	C – Ballroom A
11:00am-12:30pm	Technical Sessions (SB)	Center, Hilton, Westin
12:00pm-5:00pm	Exhibits, Job Fair, Email Ctr., Wireless	C – Exhibit Hall
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (SC)	Center, Hilton, Westin
3:10pm-4:00pm	Plenary: James Rogers	C – Ballroom A
4:00pm-4:30pm	Coffee Break	Center, Hilton, Westin
4:30pm-6:00pm	Technical Sessions (SD)	Center, Hilton, Westin
4:30pm-5:30pm	New Member Orientation	W – Grand C
6:15pm-7:15pm	INFORMS Community Business Meetings	See p. 11
7:30pm-9:00pm	Welcome Reception-Exhibits Open	C – Exhibit Hall
8:30pm-9:45pm	Awards Ceremony & Dessert Reception	C – 217
	Reception open to ceremony attendees only, doors close at 8:45pm.	

MONDAY, NOVEMBER 14

7:00am-5:00pm	Registration	C – Concourse C
8:00am-9:30am	Technical Sessions (MA)	Center, Hilton, Westin
8:00am-9:30am	HAS Poster Session	C – 217A
9:00am-5:00pm	Exhibits, Job Fair, Email Ctr., Wireless	C – Exhibit Hall
9:30am-10:00am	Coffee Break	Center, Hilton, Westin
10:00am-10:50am	Plenary: Keith Collins	C – Ballroom A
11:00am-12:30pm	Technical Sessions (MB)	Center, Hilton, Westin
11:00am-12:30pm	QSR Poster Session	C – 217D
12:30pm-1:30pm	Lunch Break (on your own)	
12:30pm-2:30pm	General Interactive Session	C – Ballroom Foyer
1:30pm-3:00pm	Technical Sessions (MC)	Center, Hilton, Westin
3:10pm-4:00pm	Plenary-Omega Rho: Barry Nelson	C – Ballroom A
4:00pm-4:30pm	Coffee Break	Center, Hilton, Westin
4:30pm-6:00pm	Technical Sessions (MD)	Center, Hilton, Westin
6:15pm-7:15pm	INFORMS Community Business Meetings	See p. 11

TUESDAY, NOVEMBER 15

7:00am-5:00pm	Registration	C – Concourse C
8:00am-9:30am	Technical Sessions (TA)	Center, Hilton, Westin
9:00am-5:00pm	Exhibits, Job Fair, Email Ctr., Wireless	C – Exhibit Hall
9:30am-10:00am	Coffee Break	Center, Hilton, Westin
10:00am-10:50am	Plenary: Susan DeVore	C – Ballroom A
11:00am-12:30pm	Technical Sessions (TB)	Center, Hilton, Westin
12:30pm-1:30pm	Lunch Break (on your own)	
12:30pm-2:30pm	General Interactive Session	C – Ballroom Foyer
1:30pm-3:00pm	Technical Sessions (TC)	Center, Hilton, Westin
3:10pm-4:00pm	Keynote: Edelman Reprise	C – Ballroom A
3:10pm-4:00pm	Keynote-IFORS: Yves Crama	C – 217A
4:00pm-4:30pm	Coffee Break	Center, Hilton, Westin
4:30pm-6:00pm	Technical Sessions (TD)	Center, Hilton, Westin
6:00pm-7:00pm	INFORMS Community Business Meeting	See p. 11
7:30pm-10:00pm	General Reception	C – Crown Ballroom & NASCAR Hall of Fame

WEDNESDAY, NOVEMBER 16

7:00am-4:30pm	Registration	C – Concourse C
8:00am-9:30am	Technical Sessions (WA)	Center, Hilton, Westin
9:00am-1:00pm	Exhibits	C – Exhibit Hall
9:00am-3:00pm	Job Placement, Email Ctr., Wireless	C – Exhibit Hall
9:30am-10:00am	Coffee Break	Center, Hilton, Westin
10:00am-10:50am	Plenary: 2011 Wagner Presentation	C – Ballroom A
11:00am-12:30pm	Technical Sessions (WB)	Center, Hilton, Westin
12:45pm-2:15pm	Technical Sessions (WC)	Center, Hilton, Westin
2:15pm-2:45pm	Coffee Break	Center, Hilton, Westin
2:45pm-4:15pm	Technical Sessions (WD)	Center, Hilton, Westin
4:30pm-6:00pm	Technical Sessions (WE)	Center, Hilton, Westin

COFFEE BREAKS

Sunday

9:30am-10:00am	C – Ballroom Foyer W – Grand Promenade H – Piedmont Promenade
4:00m-4:30pm	C – Exhibit Hall W – Grand Promenade H – Piedmont Promenade

Monday

9:30am-10:00am	C – Exhibit Hall W – Grand Promenade H – Piedmont Promenade
4:00m-4:30pm	C – Exhibit Hall W – Grand Promenade H – Piedmont Promenade

Tuesday

9:30am-10:00am	C – Exhibit Hall W – Grand Promenade H – Piedmont Promenade
4:00m-4:30pm	C – Exhibit Hall W – Grand Promenade H – Piedmont Promenade

Wednesday

9:30am-10:00am	C – Exhibit Hall W – Grand Promenade H – Piedmont Promenade
4:00m-4:30pm	C – Ballroom Foyer W – Grand Promenade H – Piedmont Promenade

THANK YOU

Monday Coffee Breaks

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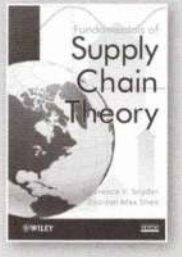
Operations Research & Management Science Publications

Stop by the **Wiley Booth# 202** to check out new titles in the field!

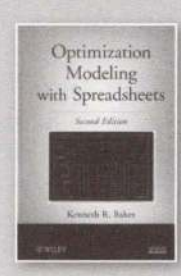
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Wiley Encyclopedia of Operations Research and Management Science, 8 Volume Set
James J. Cochran, Louis Anthony Cox, Jr., Pinar Keskinocak, Jeffrey P. Kharoufeh, J. Cole Smith
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Hardcover • Mar 2011 • 6,408 pgs
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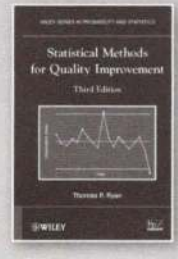
Fundamentals of Supply Chain Theory
Lawrence V. Snyder and Zuo-Jun Max Shen
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Conference price: $88.00



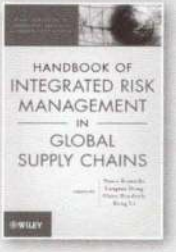
Optimization Modeling with Spreadsheets, 2nd Edition
Kenneth R. Baker
978-0-470-92863-9
Hardcover • May 2011 • 432 pgs
List price: $115.00
Conference price: $92.00



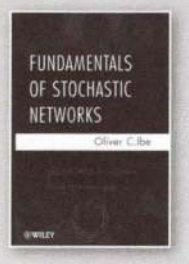
Scheduling in Supply Chains Using Mixed Integer Programming
Tadeusz Sawik
978-0-470-93573-6
Hardcover • Aug. 2011 • 492 pgs
List price: $125.00
Conference price: $100.00



Statistical Methods for Quality Improvement, 3rd Edition
Thomas P. Ryan
978-0-470-59074-4
Hardcover • Aug. 2011 • 704 pgs
List price: $125.00
Conference price: $100.00



Handbook of Integrated Risk Management in Global Supply Chains
Panos Kouvelis, Lingxiu Dong, Onur Boyabatli, Rong Li
978-0-470-53512-7
Hardcover • Nov. 2011 • 600 pgs
List price: $150.00
Conference price: $120.00



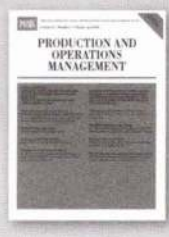
Fundamentals of Stochastic Networks
Oliver C. Ibe
978-1-1180-6567-9
Hardcover • Sept. 2011 • 312 pgs
List price: $125.00
Conference price: $100.00













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FRIDAY, NOVEMBER 11

Combined Colloquium Dinner	W – Providence I-II	6:00pm-8:00pm

SATURDAY, NOVEMBER 12

Combined Colloquia		
Breakfast	W – Grand C	7:30am-8:15am
Lunch	W – Grand C	11:45am-1:15pm
Future Academician Colloquium	W – Grand D	8:15am-4:30pm
Future Practitioner Colloquium	W – Harris	8:15am-4:30pm
Teaching Effectiveness Colloquium	W – Trade	8:15am-4:30pm
Colloquia Dinner	H – Coastal Kitchen Restaurant	7:00pm-9:00pm
Meetings Committee	H – Suite 2100	8:30am-12:00pm
CIST Breakfast/Welcome	W – Providence I	8:30am-9:00am
CIST Conference	W – Sharon & Independence	9:00am-5:30pm
DM-HI Breakfast/Welcome	C – 208B	8:30am-9:00am
DM-HI Workshop	C – 209A & 209B	9:00am-5:30pm
INFORMS Executive Committee	W – Stonewall Boardroom	9:00am-12:00pm
ISR Editors	W - Queens	8:30am-2:00pm
Organization Science Competition	C – 201	8:30am-5:00pm
ED Workshop	C – 207A	9:00am-5:00pm
Vendor Workshops – Session I		
American Optimal Decisions	C – 219B	9:00am-11:30am
AnyLogic	C – 212A	9:00am-11:30am
Forio Online Simulations	C – 218B	9:00am-11:30am
Oracle Crystal Ball	C – 211A	9:00am-11:30am
Salford Systems	C – 211B	9:00am-11:30am
SAS Global Academic Program	C – 219A	9:00am-11:30am
Tableau Software	C – 218A	9:00am-11:30am
Vendor Workshops – Session II		
AIMMS (Paragon)	C – 219B	12:00pm-2:30pm
Gurobi Optimization	C – 218B	12:00pm-2:30pm
Lumina Decision Systems	C – 211A	12:00pm-2:30pm
Maximal Software	C – 218A	12:00pm-2:30pm
Palisade Corp.	C – 211B	12:00pm-2:30pm
SAS Institute, JMP Division	C – 219A	12:00pm-2:30pm
Syncopation Software	C – 212A	12:00pm-2:30pm
INFORMS Board Meeting	W – Grand B	12:00pm-4:30pm
DSS Workshop	C – 207BC	1:00pm-5:00pm
Vendor Workshops – Session III		
FICO	C – 219B	3:00pm-5:30pm
Frontline Systems	C – 218B	3:00pm-5:30pm
GAMS Development Corp.	C – 211A	3:00pm-5:30pm
IBM-ILOG Optimization	C – 218A	3:00pm-5:30pm
LINDO Systems	C – 211B	3:00pm-5:30pm
Responsive Learning Technologies	C – 212A	3:00pm-5:30pm
SAS	C – 219A	3:00pm-5:30pm
INFORMS Membership Meeting/Reception	W – Providence II-III	5:00pm-6:00pm
Roundtable Reception	W – Harris	5:30pm-6:15pm
CIST/ISR Editors Reception	W – Tryon	6:00pm-7:30pm
University of Texas at Dallas Reception	W – Trade	6:00pm-9:00pm
Roundtable Meeting	W – Grand A	6:15pm-7:45pm
Roundtable Dinner	W – Harris	7:45pm-9:00pm

KEY
C-Convention Center
W-Westin
H-Hilton

JOB PLACEMENT SERVICES

Job Fair
Sunday
12:00pm-5:00pm
Convention Center – Exhibit Hall
The Job Fair provides an opportunity for job seekers to meet participating employers in an informal atmosphere and to discuss employment opportunities within those organizations. Employers meet and collect resumes from many job seekers in a short period of time early in the meeting, giving them the chance to set up interviews during the meeting.

INFORMS Job Placement Service
Monday-Tuesday, 9:00am-5:00pm
Wednesday, 9:00am-3:00pm
Convention Center – Exhibit Hall
This service provides employers and applicants with a convenient venue for on-site interviews to explore opportunities in academia, industry and government. In addition, the job placement service offers:
– Online access to job listings and applicant files,
– Expanded information about jobs and applicants,
– Weekly updates of the database,
– Improved database search capabilities,
– Online data entry for applicants and employers,
– Extended availability of the database.
www.informs.org/JPS/

Job Placement Panel Discussions
Select panels will lead informal discussions about the industry and academic interview processes.

The Academic Job Search
Tuesday – TA68, 8:00am-9:30am
Westin - Grand B, Fl. 2

The Industry Job Search
Tuesday – TB68, 11:00am-12:30pm
Westin - Grand B, Fl. 2

GOING GREEN

INFORMS is committed to making the Annual Meeting environmentally friendly. We encourage all attendees to join in this effort by being aware of opportunities to minimize our mutual carbon footprint.

Recycling and Green Initiatives - The Charlotte Convention Center makes every effort to promote sustainable practices, including the use of green cleaning products and composting of organic waste. There are clearly marked bins for recyclables through the facility. The Hilton has recycle receptacles in all meeting rooms and participates in the Global Soap Project which takes discarded soap, reprocesses it into new bars and distributes it to vulnerable populations throughout the world. The Westin provides purified water stations in each meeting room with biodegradable corn-based drinking cups.

Printed Program – approximately 35% of meeting attendees chose to not receive the hard-copy printed program. PDFs of the final program were provided online so these attendees could print out sections of interest before traveling to Charlotte. Reference copies of the program will be available at all Session Monitor desks and the Program Information booth (see maps on pages 40-43 for locations). In addition, all attendees received the Quick Reference, which summarizes the technical session schedule, special events and community business meeting listings, and maps of the Center, Hilton and Westin.

Sustainable Registration Materials – the meeting badge holder is made from recycled materials. We hope you will reuse or donate your bag when you return home. At the end of the meeting, INFORMS will provide special bins at the Registration Desk where you can deposit these materials if you don't want to take them home.

KEY
C-Convention Center
W-Westin
H-Hilton

SUNDAY, NOVEMBER 13

Roundtable Breakfast	W – Harris	7:00am-8:00am
JPS Breakfast	W – Grand D	7:30am-9:00am
Guest Breakfast	H – Coastal Kitchen Restaurant	7:30am-9:00am
INFORMS Board	W – Grand B	8:30am-4:30pm
Roundtable Meeting	W – Grand A	8:00am-4:30pm
CIST Conference	W – Sharon & Independence	8:00am-5:30pm
Plenary: Salah E. Elmaghraby	C – Ballroom A	10:00am-10:50am
Combined Colloquia Committee	W - Davidson	10:00am-11:00am
CIEADH	Omni Hotel	10:00am-5:45pm
OMEGA RHO Lunch/Meeting	W – Brevard	11:00am-1:00pm
SPPSN Lunch/Meeting	W – Grand C	12:30pm-1:30pm
Plenary: James E. Rogers	C – Ballroom A	3:10pm-4:00pm
Roundtable/INFORMS Board	W – Grand A	4:30pm-6:00pm
New Member Welcome & Orientation	W – Grand C	4:30pm-5:30pm
President's Reception Roundtable	W – Grand B	6:00pm-7:00pm
IOL Reception	W - Trade	6:00pm-7:00pm
Welcome Reception-Exhibits Open	C – Exhibit Hall	7:30pm-9:00pm
Minority Issues Forum Reception	W - Harris	8:00pm-9:00pm
Awards Ceremony & Dessert Reception	C – 217	8:30pm-9:45pm

Reception open to ceremony attendees only, doors close at 8:45pm

MONDAY, NOVEMBER 14

Board/Editors/Committee Chair Breakfast	W- Grand A	7:00am-8:00am
ACORD Breakfast/Meeting	W – Independence	7:30am-9:00am
Guest Breakfast	H – Coastal Kitchen Restaurant	7:30am-9:00am
Chapters/Fora Committee	W – Davidson	9:30am-10:30am
Section/Societies Committee	W – Sharon	9:30am-10:30am
Decision Analysis Editors	W - Harris	9:30am-11:00am
Plenary-Keith Collins	C – Ballroom A	10:00am-10:50am
Publications Committee	W – Caldwell	10:30am-12:00pm
OR Editors Lunch/Meeting	W – Trade	12:00pm-1:30pm
COIN-OR Members & Users	C – 211A	12:15pm-1:15pm
International Activities Committee	W – Davidson	12:30pm-1:30pm
Junior Faculty Interest Group Lunch	BlackFinn American Saloon	12:30pm-2:30pm
Publications/Editors in Chief	W – Grand B	12:30pm-3:30pm
Fellows Luncheon	W – Grand C	12:45pm-2:30pm
Subdivisions Council	W – Harris	2:30pm-4:30pm
Plenary-OMEGA RHO: Barry L. Nelson	C – Ballroom A	3:10pm-4:00pm
Isolated Academics	W - Davidson	3:15pm-4:15pm
University of Florida-ISE Reception	W – Grand A	6:00pm-7:30pm
Carnegie Mellon-Tepper School Reception	W – Sharon	6:00pm-8:00pm
CPMS Isolated Practitioners Workshop	C – 218A	6:15pm-7:15pm
Interfaces Editors	W – Independence	6:15pm-7:15pm
Northwestern University Reception	W – Providence II	7:00pm-9:00pm
University of Michigan Reception	W – Trade	7:00pm-9:00pm
Military Applications Reception	C – 208A	7:15pm-10:15pm
University of Texas at Austin Reception	W – Grand B	7:30pm-9:00pm
Student Reception	W – Grand C	7:30pm-9:00pm
Wharton School PhD Alumni Reception	W – Harris	7:30pm-9:30pm



TUESDAY, NOVEMBER 15

Chapters/Fora Officers Breakfast	W – Grand C	7:00am-8:00am
Transportation Science Editors	W – Stonewall Boardroom	7:30am-9:00am
Guest Breakfast	H – Coastal Kitchen Restaurant	7:30am-9:00am
Student Chapter Officers	W – Grand C	8:00am-8:45am
Charlotte Area Math Teacher Workshop	Off-Site	8:00am-3:00pm
Meetings Committee	H – Suite 2100	8:30am-5:00pm
Plenary-Susan D. DeVore	C – Ballroom A	10:00am-10:50am
Sections/Societies Officers Lunch	W – Harris	12:00pm-1:30pm
JOC Editors Meeting/Lunch	W - Trade	12:30pm-1:30pm
Women in OR/MS Lunch	W – Grand C	12:30pm-1:30pm
Keynote-2011 Edelman Reprise	C – Ballroom A	3:10pm-4:00pm
Keynote- IFORS: Yves Crama	C – 217A	3:10pm-4:00pm
Organizing Committee/Exhibitor Reception	H – Coastal Kitchen Restaurant	5:00pm-6:00pm
General Reception	C – Crown Ballroom & NASCAR Hall of Fame	7:30pm-10:00pm

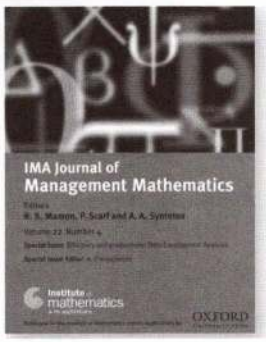
WEDNESDAY, NOVEMBER 16

Plenary-2011 Wagner Prize Presentation	C – Ballroom A	10:00am-10:50am

EXCELLENCE IN EVIDENCE

IMA JOURNAL OF MANAGEMENT MATHEMATICS

Edited by Rogemar S Mamon, Philip Scarf and Aris A Syntetos



This quarterly, peer reviewed, scholarly journal focuses on insightful research in selected areas of OR and management science including:

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Blogs
Visit the Annual Meeting website during the meeting for commentary from your friends and colleagues. Blogs will be posted to the website before, during and after the meeting. Be sure to check back frequently for new posts.

Tweets
All attendees are invited to share what they are doing and seeing in real time. Remember to add hashtag "#informs2011" to your tweets, and they will appear on the Annual Meeting homepage during the meeting. Be sure to pick up your "Tweeter" ribbon at the INFORMS booth (121) in the exhibit hall. Also "follow" the official conference twitter feed, @INFORMS2011, to make sure you receive important conference announcements. All tweets appear on a large monitor near registration.

LinkedIn
Connect with other attendees on the Annual Meeting LinkedIn Group to discuss key topics. RSVP to the LinkedIn Meeting Event to let your colleagues know you are attending. Go to the Annual Meeting website homepage to find a link leading to the Annual Meeting LinkedIn group.

Photos and Video
Attendees are encouraged to take photos and video at the meeting; send your photos to photosandvideo@mail.informs.org and we'll post them on the Annual Meeting website. New this year – great prizes for your homemade videos! Check the Annual Meeting home page for suggested topics. Go to http://meetings.informs.org/charlotte2011/video.html for video contest instructions and rules.

eNews Daily
INFORMS is publishing the fourth volume of its popular Annual Meeting eNews Daily in Charlotte. This official record of the Annual Meeting is delivered each day to your in-box, providing a recap of the previous day's happenings and a preview of the upcoming day's can't-miss events. There are links to each issue on the Annual Meeting website.

Podcasts
Liven up your travel to and from the INFORMS Annual Meeting by bringing along an INFORMS podcast for the road. Download a podcast at www.scienceofbetter.org/podcast.



SUNDAY, NOVEMBER 13

Public Programs, Services & Needs	W – Grand C	12:30pm-1:30pm
Information Systems	W – Independence	5:30pm-6:30pm
Aviation Applications	C – 208B	6:15pm-7:15pm
Data Mining & Artificial Intelligence	C – 219A	6:15pm-7:15pm
eBusiness	C – 209B	6:15pm-7:15pm
Energy, Natural Resources & Environment	C – 208A	6:15pm-7:15pm
Forum on Education (INFORM-ED)	C – 210A	6:15pm-7:15pm
Location Analysis	C – 201A	6:15pm-7:15pm
Manufacturing & Service Ops. Mgt.	C – 203	6:15pm-7:15pm
Military Applications Board	C – 206A	6:15pm-7:15pm
Minority Issues Forum	C – 202A	6:15pm-7:15pm
Multiple Criteria Decision Making	C – 201B	6:15pm-7:15pm
Optimization	C – 213A	6:15pm-7:15pm
Railway Applications	C – 218A	6:15pm-7:15pm
Revenue Management & Pricing	C – 207D	6:15pm-7:15pm
Service Science	C – 205	6:15pm-7:15pm
Simulation	C – 207BC	6:15pm-7:15pm
Telecommunications	C – 209A	6:15pm-7:15pm
Transportation Science & Logistics Board	C – 202B	6:15pm-7:15pm
Decision Analysis Council	C – 218B	6:15pm-7:30pm
Revenue Management & Pricing Board	C – 207D	7:15pm-8:15pm

MONDAY, NOVEMBER 14

Decision Analysis	C – 213BC	6:00pm-7:15pm
Technology Management	C – 211B	6:00pm-7:15pm
Analytics	C – 203A	6:15pm-7:15pm
Applied Probability	C – 207A	6:15pm-7:15pm
Computing	C – 207BC	6:15pm-7:15pm
Financial Services	C – 210B	6:15pm-7:15pm
Health Applications	C – 217A	6:15pm-7:15pm
Military Applications	C – 208A	6:15pm-7:15pm
Quality, Statistics & Reliability	C – 217BC	6:15pm-7:15pm
Spreadsheet Productivity Research	C – 209B	6:15pm-7:15pm
Transportation Science & Logistics	C – 217D	6:15pm-7:15pm
Women in OR/MS	C – 209A	6:15pm-7:15pm
Behavioral Operations Management	C – 201A	7:15pm-8:15pm
Military Applications Reception	C – 208A	7:15pm-10:15pm

TUESDAY, NOVEMBER 15

CPMS Council	W – Trade	7:00am-9:00am
SpORts	C – 214	6:00pm-7:00pm

KEY
C-Convention Center
W-Westin

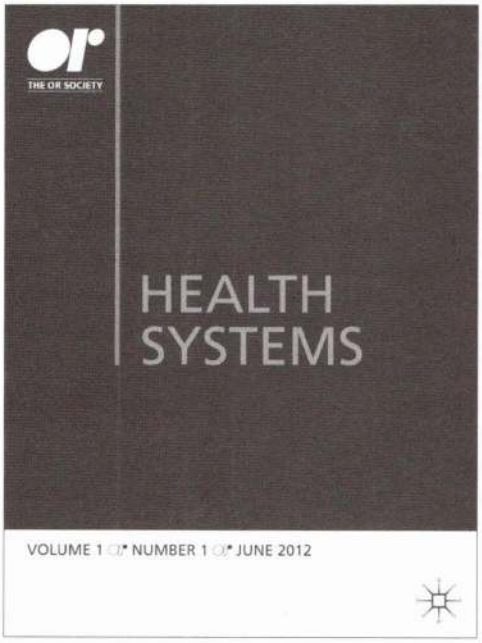
Speakers Book Store at INFORMS Booths
The INFORMS Speakers Bookstore will feature recent publications written by a number of this year's INFORMS Annual Meeting presenters. Stop by INFORMS booths 121-125-127 in the exhibit hall to check out a wide selection of titles.

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SPEAKER GUIDELINES

Audio/Visual Equipment

All session rooms will be equipped with a computer projector, but please note that you must provide your own laptop or pre-arrange to share with others in your session. Please follow these guidelines to ensure a successful presentation:

- Bring your laptop to your session. We recommend that you pre-arrange with other speakers in your session to ensure that at least one of you brings a laptop from which you can project your talks.
- Bring a power adaptor with you. We recommend that you do not attempt to run your presentation off the laptop battery.
- If your laptop is not compatible with AC power, please bring an electrical adaptor so that you can connect to U.S. electricity.
- If your laptop is a Mac, you will need the appropriate adapter for the external video output.
- Arrive at your session at least 15 minutes before it begins. All presenters in a session should set up and test the connection to the projector before the session begins.
- We encourage speakers to put their presentations on a USB flash drive as a backup.

Speaker Ready Room

There will be a Speaker Ready Room available in the Convention Center, Exhibit Hall, Ballroom BCD, during the meeting. You can stop by and practice connecting your laptop to the projector. We will also have quick instructions at each session room and technical assistance available for any problems.

Presentation Guidelines

The room and location of your session are listed in the Technical Sessions section and in the Master Track Schedule. Please be on time for your session and check in with the session chair. Presentations should be limited to key issues with a brief summary. Time your presentation to fit within your designated time span and leave an opportunity for questions and audience participation. INFORMS does not produce proceedings with complete papers. To obtain complete copies of any papers abstracted in the program, please contact the authors directly at the addresses supplied with each abstract.

For Questions about the Program: Program Information Desk

If you have general questions about the meeting and/or questions about your own presentation, stop by the Program Information Desk located in the Convention Center, Concourse C (near INFORMS Registration). We ask Session Chairs to notify the Information Desk about any last-minute changes or cancellations; these changes will be posted outside the meeting rooms.

For Assistance during Your Session: Session Monitor Desks

Session Monitor Desks are located in several areas in the Convention Center, Hilton and Westin (see maps on pages 40-43 for specific locations). If you have a problem in your session room related to AV needs or any other requests, go to the Session Monitor Desk in the area to ask for assistance.

SESSION CHAIR GUIDELINES

The role of the Chair is to coordinate the smooth running of the session. The Chair:

- Begins and ends the session on time. Each session lasts 90 minutes, with the time per presentation determined by the number of papers in the session. Equal time should be given to each paper.
- Introduces each presentation (just the title of the paper and the name of the presenting author).
- Ensures that presentations are made in the order shown in the program. This allows for "session jumping." If a speaker cancels or does not attend, the original time schedule should be adhered to rather than sliding every talk forward.
- Completes the session attendance forms (forms will be in the room).

THANK YOU

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AIMMS 3

EXHIBITS

Name badges must be worn for admittance to the Exhibit Hall, located in the Convention Center, during the following hours:

Sunday, Nov. 13 (Welcome Reception)	12:00pm-5:00pm 7:30pm-9:00pm*
Monday, Nov. 14	9:00am-5:00pm
Tuesday, Nov. 15	9:00am-5:00pm
Wed., Nov. 16	9:00am-1:00pm

*The Exhibit Hall is open Sunday evening for a gala Welcome Reception. All registrants are invited to the reception for the chance to meet colleagues and renew acquaintances.

INTERNET ACCESS CONVENTION CENTER

Free wireless Internet and an email center are located in the Exhibit Hall in the Convention Center, at the back of the hall. There are a limited number of computers available in the email center if you do not have your own computer. Name badges must be worn for admittance. The Email Center will be open:

Sunday, Nov. 13	12:00pm-5:00pm
Monday, Nov. 14	9:00am-5:00pm
Tuesday, Nov. 15	9:00am-5:00pm
Wed., Nov. 16	9:00am-3:00pm

Hilton: wireless access is available in the third floor Piedmont Promenade.
Westin: there is free wireless in the lobby.

BUSINESS CENTERS

Westin: the Westin's self-serve business center is located on the second floor, near the main passenger elevator bank. Hours are Sunday 8:00am-4:00pm, Monday-Wednesday, 7:00am-6:00pm. Non-guests can access the business center using a credit card.

Hilton: the self-serve business center is open 24 hours a day (accessible for guests only using room keys).

REGISTRATION

Badges Required for Technical Sessions
INFORMS Annual Meeting 2011 badges must be worn to all sessions and events. Badges will be checked at the entrance to technical session areas, as well as the Exhibit Hall. Attendees without badges will be directed to the INFORMS registration desk to register and pick up their badges. All attendees, including speakers and session chairs, must register and pay the registration fee. Lost badges can be replaced at the registration desk for a fee of $5.

Registration Fee
Your registration fee includes admittance to the complete technical program, the Exhibit Hall, Email Center and most special programs. The following social/food events are also included: Sunday evening Welcome Reception, Sunday evening Awards Ceremony, Tuesday evening General Reception, and all morning and afternoon coffee breaks. No other meals are included.

Guest Registration
If your guest would like to accompany you to the major social events, you can purchase a guest registration ($75) that covers admission to the Sunday Welcome Reception, Sunday Awards Ceremony and Tuesday General Reception. Continental breakfasts on Sunday, Monday and Tuesday are also included. Guest breakfasts are held in the Hilton, Coastal Kitchen Restaurant (Plaza Atrium). Guests are not eligible to attend the technical sessions. Go to the Registration Desk to register your guest.

25+ Year Member Ribbon
If you have been an ORSA-TIMS-INFORMS member for 25 or more years, please stop by the INFORMS booth (#125 in the Exhibit Hall) to pick up a special ribbon designating your 25+ year membership. We salute our long-time members!

OTHER SERVICES

Luggage Check
A luggage check area will be located in the Convention Center, Concourse C. The luggage check will be open on Tuesday, 7:00am-6:15pm and Wednesday, 7:00am-6:15pm.

Charlotte Visitor Information
Located in the Convention Center, the Visitor Information Center offers maps, guides and brochures that will lead you to Center City Charlotte's main attractions. In addition, concierge services are available at the College Street entrance to the Center. The concierge can provide directions for events and information about Convention Center services, Food Court, etc. Information can also be obtained for transportation, entertainment and additional dining options in Charlotte.



WIN A KINDLE FIRE!

Everybody's talking about the new Kindle Fire, being released November 15 by Amazon. It's a 7" tablet with a color touchscreen, cloud-accelerated web browser and access to movies, apps, games, music, reading and more.

You can get in the running to win the Fire just by visiting the exhibits. INFORMS will award one Fire during each afternoon coffee break in the Exhibit Hall on Monday and Tuesday. Just follow these easy steps:

- Stop by one of the exhibit booths to pick up a raffle coupon (different coupon for each day).
- Fill out the coupon and get it stamped by the exhibitor.
- While you're at the booth, give the exhibitor an opportunity to tell you about their company's products!
- Place your completed coupon in the Kindle Raffle bin.
- **Be present** when the winning raffle ticket is drawn.
- **You can submit as many coupons as you like, but each must be from a different exhibitor.**

Note: Amazon is releasing the Kindle Fire on November 15. INFORMS has pre-ordered the Fire and will ship the winners' devices to them as soon as we receive them.

Schedule:

- Monday and Tuesday afternoon coffee breaks.
- Submit your coupon by 3:45pm.
- Drawing: 4:15pm. Location will be announced/watch for signs in the Exhibit Hall.
  Note: there is a different coupon for each day. Only coupons for that day will be eligible. You can submit as many coupons as you like, but each must be from a different exhibitor.

GUEST PROGRAM

The program for registered guests includes a continental breakfast on Sunday, Monday and Tuesday mornings; the Sunday Welcome Reception and Awards Ceremony; and Tuesday evening General Reception. Registered guests will receive a colored name badge that must be worn for admittance to these events. Guests are not eligible to attend the technical sessions. Guest registration is $75 – go to the INFORMS Registration Desk to register your guest.

Guest Breakfasts
Hilton, Coastal Kitchen Restaurant
(Plaza Atrium)
Sunday-Tuesday, 7:30am-9:00am
Identify yourself as an INFORMS guest and present your ticket when you arrive at the restaurant. Tickets are included in your registration packet, and will be collected at the door for each breakfast.

GUEST TOURS

You may still be able to register for the following guest tours. Go to the INFORMS Registration Desk for information on availability. **Meet in the Convention Center, Martin Luther King Blvd. doors (exit leading to the Hilton) for guest tour departures.** Buses will leave at the beginning time listed for each tour, and will return to the Convention Center at the ending time listed.

Carolina Raptor Center & Latta Plantation
Sunday, Nov. 13
1:00pm-5:00pm
$40 per person
(lunch not included)
The Carolina Raptor Center is dedicated to environmental education and the conservation of birds of prey through public education and rehabilitation of injured and orphaned raptors. There are approximately 25 different species of raptors to see and learn about. Historic Latta Plantation is a circa 1800 cotton plantation and living history farm, located within Latta Plantation Nature Preserve.



Charlotte City Tour
Monday, November 14
9:00am-1:00pm $49.50
(lunch not included)
A one-hour driving tour of the uptown area provides an introduction to Charlotte. Next are stops at the Levine Museum of the New South for a comprehensive interpretation of post-Civil War southern society, and the Charlotte Trolley Museum.

PLANT TOURS

You may still be able to register for the following plant tours. Go to the INFORMS Registration Desk for information on availability. **Meet in the Convention Center, Martin Luther King Blvd. doors (exit leading to the Hilton) for plant tour departures.** Buses will leave at the beginning time listed for each tour, and will return to the Convention Center at the ending time listed.

Duke Energy Downtown Building
Monday, November 14
9:15am-10:45am
$35 per person
(lunch not included)
The Duke Energy Center is the largest building in Charlotte with a 250,000-square-foot footprint. The tour will feature highlights of the building's environmental sustainability efforts, including water-saving plumbing devices, a water storage system that will treat rainwater to be used for cooling tower make-up water, a green roof and more.



Siemens Charlotte Turbine-Generator Center
Tuesday, November 15
9:00am-12:00pm $35 per person
(lunch not included)
Siemens Charlotte Turbine-Generator Center includes state-of-the-art new-unit generator manufacturing as well as service repairs for steam turbines and generators. Siemens Charlotte plant is the primary service center for generator and steam turbine equipment in the Americas, and the lead plant for manufacturing new electrical generators.





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YOUR BADGE IS YOUR TICKET

Wear your badge for admission to these events; your meeting registration fee includes these special receptions. If your guest would like to accompany you, a guest registration must be purchased (guests will receive a special badge). The $75 guest fee includes the Sunday Welcome Reception, Sunday Awards Ceremony, Tuesday General Reception at the NASCAR Hall of Fame, and continental breakfasts on Sunday, Monday and Tuesday.

SUNDAY

WELCOME RECEPTION & EXHIBITS

7:30pm-9:00pm
Convention Center – Exhibit Hall

INFORMS and the Charlotte Organizing Committee welcome you to the 2011 Annual Meeting with an evening of fellowship and fun. The Welcome Reception is the perfect venue to meet with colleagues and visit the exhibits. Light snacks will be served. Iced tea and lemonade are complimentary, with a cash bar for other beverages.

THANK YOU

UNC CHARLOTTE
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INFORMS AWARDS CEREMONY & DESSERT RECEPTION

8:30pm-9:45pm (doors close at 8:45pm*)
Convention Center – Room 217

The INFORMS Board of Directors invites you to honor and celebrate the achievements of our colleagues at the annual Awards Ceremony. You can attend the Welcome Reception first and then walk across the hall for the Awards Ceremony. Following the ceremony, you'll have an opportunity to congratulate the awardees at a special dessert reception.

**Please Note: this reception is part of the ceremony event, open to the awardees, their friends and colleagues, and all those who attend the Award Ceremony itself. We are sorry we cannot accommodate guests to the reception who do not also attend the ceremony.*

INFORMS Expository Writing Award
Ward Whitt, Columbia Univ.-City of New York

Philip McCord Morse Lectureship
William Pulleyblank, U.S. Military Academy

INFORMS President's Award
Kenneth R. Chelst, Wayne State University

INFORMS Prize for the Teaching of ORMS Practice
Jeffrey E. Kline, Naval Postgraduate School

George Kimball Medal
Brenda L. Dietrich, IBM T.J. Watson Research Ctr.
Stephen M. Robinson, Univ. of Wisconsin-Madison

John von Neumann Theory Prize
Gérard P. Cornuéjols, Carnegie Mellon University

Lanchester Prize
David Easley and Jon M. Kleinberg, Cornell Univ.

Bonder Scholarship for Applied Operations Research in Health Services
Lauren Cipriano, Stanford University

Bonder Scholarship for Applied Operations Research in Military Applications
James Morris, Air Force Institute of Technology

Four student awards will also be announced during the ceremony: the George E. Nicholson Student Paper Competition, the George B. Dantzig Dissertation Prize, the Doing Good with Good O.R. Student Competition, and the INFORMS Undergraduate Operations Research Prize.

THANK YOU

GAMS

TUESDAY

GENERAL RECEPTION NASCAR HALL OF FAME

7:30pm-10:00pm
Crown Ballroom, Convention Center and NASCAR Hall of Fame
Follow signs from the Convention Center Food Court area across the skywalk to the Crown Ballroom and NASCAR
Note: The main entrance to the NASCAR Hall of Fame will not be open during our exclusive event. The only entrance to NASCAR is through the Convention Center (Ballroom Level).

You don't have to be a NASCAR fan, car buff or gamer to get a kick from the "pedal-to-the-metal" fun at this hall of fame. In 150,000 square feet of displays and entertainment, NASCAR gives you a close-up look at 31 meticulously maintained automobiles spanning seven decades and lets you try your hand at more than 50 interactive experiences. You can test your skills and daring at the race simulator, the tire-changing station, the broadcast booth and a selection of hands-on digital kiosks. There's even a Kids Zone with pint-size displays and activities for the younger set.

We'll serve up a meal of real Southern cooking during the evening, with food buffets located in the Crown Ballroom. You can walk easily between the Ballroom and NASCAR. ***However, food cannot be taken into the Hall of Fame.*** As you enter NASCAR from the Crown Ballroom, you will receive a keycard providing access to all the interactive exhibits.

For our exclusive event, NASCAR will be closed to the public. The only entrance will be through the Convention Center. Go to the Food Court area on the Center Ballroom Level and follow the signs across the skywalk to Crown Ballroom and NASCAR.



SATURDAY, NOVEMBER 12

INFORMS Membership Meeting & Reception
5:00pm-6:00pm
Westin – Providence II-III
The INFORMS Board of Directors encourages all members to bring their ideas, opinions and suggestions to this annual meeting. Current business and future directions for INFORMS are on the agenda. Wine and cheese will be served.

SUNDAY, NOVEMBER 13

SPPSN Lunch
12:30pm-1:30pm
Westin – Grand C
$10 - Section member ($15 nonmember)
A limited number of tickets may be available on-site. Go to the INFORMS registration desk for information on availability.
This lunch and business meeting is open to members of the INFORMS Section on Public Programs, Service and Needs and also those who are interested in joining the section.

Sponsored by Georgia Institute of Technology and University of Massachusetts Boston.

INFORMS Online Reception
6:00pm-7:00pm
Westin - Trade
What's your social networking strategy for yourself or for INFORMS? We invite all contributors to IOL (the INFORMS website) and INFORMS social networking sites to come and meet face to face. Join us for refreshments and drinks – we are your INFORMS Online community!

Minority Issues Forum Reception
8:00pm-9:00pm
Westin – Harris
Come meet old friends and make new ones while talking about minority issues and other intellectual issues and opportunities.

Sponsored by Clemson University, Industrial Engineering; Carnegie Mellon University, Heinz College; Cornell University, ORIE; North Carolina State University, Industrial Engineering; Rice University, Computational & Applied Mathematics; University of South Florida, Dept. of Industrial & Management Systems Engineering.

MONDAY, NOVEMBER 14

COIN-OR Members & Users Meeting - Bag Lunch
12:15pm-1:15pm
Convention Center 211A
Anyone interested in open-source software tools, open standards, and data and model repositories for any aspect of operations research is encouraged to attend this Computational Infrastructure for OR (COIN-OR) meeting. Please bring your own lunch and ideas. For more information, visit www.coin-or.org.

Junior Faculty Interest Group Luncheon
12:30am-2:30pm
Offsite – BlackFinn American Saloon,
210 East Trade St.
$25 ($10 students) – *A limited number of tickets may be available on-site. Go to the INFORMS registration desk for information on availability.*
All junior faculty are invited to participate. This event gives junior faculty in engineering and business schools the opportunity to discuss career development and exchange ideas.

Sponsored by University of Alabama, Dept. of Operations Research; University of Michigan, Dept. of IOE; University of Toronto, Dept. of MIE.

NEW MEMBER WELCOME & ANNUAL MEETING ORIENTATION SESSION

Sunday, 4:30pm-5:30pm
Westin – Grand C

Don't miss this informative session. All new members and first-time meeting attendees are invited to attend. The session will feature a brief presentation on member benefits, including communities, from key INFORMS leaders, a thorough orientation to navigating the meeting from Annual Meeting veterans, and a chance to relax and network with colleagues by technical interest, geographic location or other professional interest.

CPMS Isolated Practitioner Workshop & Reception
6:15pm-7:15pm
Convention Center – 218A
CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. This 28th workshop will address timely issues that affect isolated practitioners. All are welcome to participate. Wine and cheese will be served.

Student Reception
7:30pm-9:00pm
Westin – Grand C
All students registered for the meeting are invited to join us for an evening of food and drink, fun and networking. Come eat and talk with invited guests who recently graduated and joined the workforce. With these panelists you can discuss the job market, different types of careers, tips for landing a job, and other issues facing soon-to-be graduates in the field of OR/MS.

Sponsored by PROS Pricing

PROS

TUESDAY, NOVEMBER 15

Women in OR/MS Forum Luncheon
12:30pm-1:30pm
Westin – Grand C
$15 ($8 students) – *A limited number of tickets may be available on-site. Go to the INFORMS registration desk for information on availability.*
All those interested in issues related to women professionals in OR/MS are invited to join us.

Sponsored by Lehigh University, Rossin College of Engineering; Ohio State University; SAS Institute, Inc.; Texas A&M University, Dept. of Industrial & Systems Engineering; University of Michigan, Dept. of IOE; Arizona State University, Carey School of Business; Arizona State University, Dept. of Industrial Engineering; Northwestern University; Penn State University-Erie, Business School; University of Texas-Arlington, Dept. of Industrial Systems & Manufacturing Systems Engineering; Virginia Commonwealth University, Dept. of Statistical Sciences & O.R.; Mississippi State University, Dept. of Industrial and Systems Engineering; George Mason University, Dept. of Systems Engineering & O.R.; Naval Postgraduate School Foundation.

Space may be available in these workshops. A separate fee is required, and you can inquire about availability at the registration table located outside Room 208.

DM-HI WORKSHOP

6th INFORMS Workshop on Data Mining and Health Informatics

Breakfast/Welcome Session
8:30am-9:00am – Convention Center, Room 208B

Workshop
9:00am-5:30pm – Convention Center 209A & 209B

The Data Mining (DM), Artificial Intelligence (AI) and Health Informatics (HI) sections of INFORMS are jointly organizing this workshop. The DM, AI and HI sections are interdisciplinary communities that bring together researchers and practitioners in science, engineering and business who are interested in the theories, applications and methodologies of DM, AI and HI. This workshop highlights the frontiers of fundamental and applied research in DM, AI and HI.

Sponsored by George Washington University, the Dept. of Information Systems & Technology Management and the Dept. of Decision Sciences.

DSS WORKSHOP

Developing Spreadsheet-Based Decision Support Systems
1:00pm-5:00pm, Convention Center – 207BC
The need to teach DSS development skills to industrial engineering, O.R. and business school students has been felt by many universities. Workshop participants will learn about some Excel extended functionalities and VBA for Excel, the use of Risk Solver Platform to solve mathematical programs and perform Monte Carlo simulation, and how to use these tools in order to build a DSS in Excel.

ED WORKSHOP

Setting Up a "No Wait" Emergency Dept. (ED) Using Basic OR-MS Principles
9:00am-5:00pm, Convention Center – 207A
For O.R. analysts, this workshop is a "train the trainers" preparation for effective consulting on the topic of improving the flow of patients into and through a hospital emergency department.

VENDOR WORKSHOPS

All Vendor Workshops are located in the Convention Center.
Free to registered meeting attendees. Walk-ins accepted as long as space is available.

9:00AM - 11:30AM

American Optimal Decisions - Portfolio Safeguard
Room 219B

AnyLogic - Combine Different Kinds of Models into Hybrid Models
Room 212A

Forio Online Simulations - How to Create Web Simulations
Room 218B

Oracle - Crystal Ball Software
Room 211A

Salford Systems - Applying Data Mining Methodology
Room 211B

SAS Global Academic Program - Rapid Predictive Modeler
Room 219A

Tableau Software - Dynamic Data Visualization
Room 218A

12:00PM - 2:30PM

AIMMS (Paragon) - Constraint Programming in AIMMS-101 and Beyond
Room 219B

Gurobi Optimization - Recent Improvements in the Gurobi Optimizer
Room 218B

Lumina Decision Systems - Introduction to Structured Optimization with Analytica
Room 211A

Maximal Software, Inc. - Optimization Modeling with MPL and Python: Integrating Optimization in Real-World Business Applications
Room 218A

Palisade Corporation – Risk & Decision Assessment using @RISK
Room 211B

SAS Institute, JMP Division - Bringing Analytics to Life
Room 219A

Syncopation Software - Practical Excel-Based Decision Models with DPL
Room 212A

3:00PM - 5:30PM

IBM ILOG Optimization - IBM ILOG Advanced Analytics Forum
Room 218A

FICO - Optimization Applications Design with FICO Xpress Optimization Suite
Room 219B

Frontline Systems, Inc. - Integrated Data Mining, Simulation and Optimization in Microsoft Excel
Room 218B

GAMS Development Corp. - How can I make this work??? ... arrgghh!!
Room 211A

LINDO Systems, Inc. - Exploiting the Smart Solvers in LINGO and What'sBest!
Room 211B

Responsive Learning Technologies - Play Online Games for Operations Management and Supply Chain Courses
Room 212A

SAS - Solving Business Problems with SAS Analytics and OPTMODEL
Room 219A

Whether you work in industry, government or consulting – whether you are doing descriptive, predictive or prescriptive analytics/O.R. work – you'll find the best applications resources at the INFORMS Annual Meeting.

ANALYTICS/PRACTICE TRACK
Sponsored by INFORMS Analytics Section and CPMS, The Practice Section of INFORMS
Sunday-Wednesday, Track 55
Hilton – Mecklenburg, 3rd Fl.
This full track of 17 sessions showcases O.R. and analytics in practice at a wide range of companies and organizations, including UPS, GE Global Research, SAS, Sasol, Booz Allen Hamilton, IBM and more. Several sessions cover current analytical work in industries such as energy, the public sector and financial services, while other sessions take a broad look at descriptive analytics and predictive analytics. A lively panel discussion on selling analytics will feature practitioners from Target, Con-Way Freight, Aspen and PROS. Another panel will focus on the emergence of a new MS degree in analytics, and a third panel offers consultants' perspectives on lessons learned in creating significant impact with optimization and advanced analytics. Don't miss the discussion on INFORMS' role in the analytics movement, with a consideration of where we've been, where we are, and where we're going. For detailed information on all these sessions, see the listings each day for Track 55.

Reprise of the 2011 Edelman Award-Winning Presentation: Midwest Independent Transmission System Operator (Midwest ISO)
Sponsored by CPMS, The Practice Section of INFORMS
Tuesday: Keynote, 3:10pm-4:00pm
Convention Center – Ballroom A
The Edelman Award – known as the "superbowl" of applied O.R. and held at the INFORMS Analytics and O.R. Conference each spring – recognizes analytics projects that had major impacts on their client organizations. In this session, Midwest ISO presents their award-winning work applying O.R. to electricity markets, resulting in nearly $3 billion in savings over a nine-year period.

2011 Edelman Finalists
Sponsored by CPMS, The Practice Section of INFORMS
Sunday-SC55 & SD55
Hilton – Mecklenburg, 3rd Fl.
The 2011 Edelman finalists – CSAV, Fluor Corp., Industrial and Commercial Bank of China (ICBC), InterContinental Hotels Group, and the State of New York – will reprise presentations they delivered during the Edelman competition, showcasing high-impact results from analytics and O.R. The CSAV team used strategic empty container logistics optimization to achieve direct savings of $75M, plus a 50% reduction in inventory stocks and a 60% increase in container turnover. Fluor Corp. transformed the company's project and change management through a system dynamics model-based system. The ICBC project on branch reconfiguration through O.R. provides a successful example of using analytical methods to transform the service channels of a large bank. Retail price optimization at InterContinental Hotels Group resulted in $145M in incremental revenue and is expected to generate $300M per year at full rollout. And the State of New York used a combination of data analysis and optimization to optimize tax collection. For details on these projects and presentations, see the listings for sessions SC55 and SD55 on Sunday.

2011 INFORMS Prize Winner: Sasol Technology
Monday-MA54
Hilton – Charlotte Hall, 3rd Fl.
The INFORMS Prize is awarded annually to a company that effectively integrates analytics into organizational decision-making, and has repeatedly applied ORMS principles in pioneering, novel and lasting ways. The 2011 winner, Sasol Technology, will deliver this presentation on how the company uses O.R. to analyze logistics, simulate plants, improve reliability, model processes and optimize performance.

2010 Daniel H. Wagner Prize Competition
Sponsored by CPMS, The Practice Section of INFORMS
Competition: Monday, Track 54 (MB, MC, MD)
Hilton – Charlotte Hall, 3rd Fl.
Award Presentation and Winner's Reprise:
Wednesday, 10:00am-10:50am
Center – Ballroom A
The Daniel H. Wagner Prize is awarded for a paper and presentation that describe a real-world, successful application of O.R. The prize criteria emphasize innovative, elegant mathematical modeling and clear exposition. 2011 competitors include the New York City Dept. of Education (on scheduling classes to facilitate personalized learning in schools), Intel Corp. (on designing/scheduling product lines in a large corporation), Chitika Inc. (determining when to show an Internet ad), La Poste (renewing fleet vehicles in a national postal service), Ford Motor Co. (planning/scheduling in automotive manufacturing) and Georgia Aquarium (predicting and managing guest flow in a new aquarium exhibit area). The winner will be announced and will reprise their presentation at the Wednesday morning plenary session (Convention Center, Ballroom A).

Software Demonstrations
Sunday-Wednesday, Track 10
Convention Center – 206B
See pages 32-34 for abstracts.
Featuring applications you can use at work or in research. Learn about new product releases, case studies and software presented by leading vendors and solution providers.

Continued on next page.

Tutorials
Sunday-Wednesday
See pages 28-31 for abstracts and location.
These 90-minute sessions offer an in-depth look at current methodologies. Topics include value-focused thinking, queues in service systems, forecast information sharing, dynamic optimization in radiotherapy, innovation and entrepreneurship, optimizing cancer screening, transforming U.S. Army supply chains and more.

All attendees receive free access to the *INFORMS 2011 TutORials in Operations Research* online book concurrently with the meeting. For access, go to http://www.informs.org/Journal/Tutorials-in-OR/2011-TutORials-in-Operations-Research-ONLINE and enter your INFORMS member username and password. Your username and password will be printed on your conference registration receipt; you can also request that information when you go to the online tutorials site. You can order the 2011 book or previous volumes (CDs 2005-2010). For more information, visit INFORMS booths 121-125-127.

CPMS Isolated Practitioner Workshop & Reception
Monday, 6:15pm-7:15pm
Convention Center – 218A
This special event is geared to the interests of isolated practitioners, the "Lone Rangers" of OR/MS. The 28th workshop in this series will address timely issues that affect the isolated practitioner community. All are welcome; wine and cheese will be served.

INFORMS Analytics Section Busines Meeting & Reception
6:15pm-7:15pm
Convention Center – 203A
The Analytics Section invites all attendees to participate in the Section Business Meeting and Reception. Enjoy light refreshments and listen to the officers discuss the accomplishments of our first year. Find out about the new Innovation in Analytics Award and help chart the course for the future of the section. The reception is sponsored by SAS.

2011 Combined Colloquia and Teaching Effectiveness Colloquium
Friday-Saturday
Westin - see page 7 for full information.
The Teaching Effectiveness (TEC), Future Academician (FAC) and Future Practitioner (FPC) Colloquia begin their activities with a Friday evening dinner meeting, and continue a full-day Saturday program. Participation in the colloquia is by nomination only.

Sponsored by Omega Rho and SAS.

Organization Science: Dissertation Proposal Competition
Saturday, 8:30am-5:00pm
Convention Center – 201
This competition is one of the most prestigious available to doctoral students studying organizations. Finalists present their dissertation proposals and receive detailed feedback from a panel of respected organizational scholars who act as judges.

CIST 2011 – Conference on Information Systems and Technology
Saturday-Sunday
Westin – Sharon & Independence, 2nd Fl.
The goal of CIST is to engage academic and industry researchers in a dialogue that examines all aspects of theoretical and empirical research in information systems.

Sponsored by Carnegie Mellon University, Tepper School of Business; Texas A&M University; University of Texas at Dallas; University of North Carolina, Belk College of Business; Carnegie Mellon University, H. John Heinz III College; Indian School of Business. SRITNE; Purdue University, Krannert School of Management; University of Connecticut; University of Minnesota, Carlson School of Management; and Georgia Institute of Technology.

In Honor of Paul Jensen
Monday, 1:30pm-3:00pm
MC46
Hilton – Room 403, 4th Fl.
This special session honors the memory of Paul Jensen with presentations that examine his influence on O.R. pedagogy. The recipient of the 2007 INFORMS Prize for the Teaching of OR/MS Practice, Professor Jensen's influence on the profession continues through the contributions of today's practitioners whose careers have been shaped by his guidance.

International Activities Committee-Invited International Journal Sessions
Monday, MC23 & MD23
Tuesday, TA23
Convention Center – 212B
Be sure to attend these special sessions featuring the papers in the international journals *Asian Journal of Industrial Engineering, European Journal of Operational Research,* and *Produção,* the Brazilian IE journal. All these journal editors will also present their journals' promoting areas and paper reviewing process, and answer your questions about their journals. These sessions are co-sponsored by INFORMS International Activities Committee and Quality, Statistics, and Reliability cluster.

Charlotte Area Workshop on O.R. for High School Math Teachers
Tuesday
Phillip O. Berry High School, Charlotte
8:00am-3:00pm
www.mindset.org
This workshop is based on a curriculum developed under NSF-funded Project MINDSET, (Mathematics Instruction using Decision Science and Engineering Tools). MINDSET uses decision making tools from industrial and systems engineering and operations research in a fourth-year high school mathematics curriculum. Principal performance related goals of the project are to improve upon the math students' ability to formulate and solve multi-step problems and interpret results, and to improve students' attitude toward mathematics.

Sponsored by UNC Charlotte, National Science Foundation, INFORMS, Wayne State University and North Carolina State University.

Researchers, practitioners and students share their O.R. and analytics projects in these special sessions presented as poster displays, laptop demonstrations and other creative formats. Presenters benefit from the interactive critique, suggestions and encouragement from colleagues working in similar areas. Attendees benefit by being exposed to a broad range of topics, application areas, problems, methodologies and solutions – all in a condensed format and space.

This year, the Charlotte Organizing Committee has expanded and enhanced the Interactive program with focused-topic sessions and improvements to the best-poster competition. The two focused sessions are sponsored by the INFORMS Health Applications Section and the INFORMS Section on Quality, Statistics and Reliability. Posters for these areas are scheduled as integral parts of those subdivisions' tracks.

THANK YOU

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Learn more. McGraw Hill Do more.

General Interactive Sessions
Monday, 12:30pm-2:30pm
Tuesday, 12:30pm-2:30pm
Convention Center – Foyer outside the Grand Ballroom/Exhibit Hall (adjacent to the Ballroom Terrace)
For a list of posters, including abstracts and authors, see pages 188-192 (Monday) and 287-291 (Tuesday).
Cluster Chairs: Ertunga C. Ozelkan, University of North Carolina Charlotte; Nilay Tanik Argon, University of North Carolina Chapel Hill

Health Applications Interactive Session
Monday, 8:00am-9:30am (MA31)
Convention Center – 217A
Cluster Chair: Steven Shechter, University of British Columbia
For a list of posters, including abstracts and authors, see pages 151-153.

Quality, Statistics & Reliability Session
Monday, 11:00am-12:30pm (MB33)
Convention Center – 217D
Cluster Chair: Roshan Joseph Vengazhiyil, Georgia Institute of Technology
For a list of posters, including abstracts and authors, see pages 176-177.

INTERACTIVE COMPETITION
INFORMS places special emphasis on high-quality poster presentations. All interactive session presenters, including those participating in the focused areas, were invited to submit their posters to the competition. In Round 1 of the process, submitters sent a PDF of their finished poster to the judging panel for review. The judges have evaluated these submissions and selected a group of semifinalists.

In Round 2, the judging panel will review the semifinalist presentations during the General Interactive Sessions in Charlotte. In Round 3 – also held during the sessions in Charlotte – the judges will name the 1st, 2nd and 3rd place winners. There will be three winners identified and awarded each day. Recognition includes a plaque, an award check, and announcements in INFORMS newsletters and web site.

The judging panel is made up of distinguished ORMS professionals, both academics and practitioners, many of whom are INFORMS leaders. The Interactive Session program is co-chaired by Ertunga C. Ozelkan, University of North Carolina Charlotte, and Nilay Tanik Argon, University of North Carolina Chapel Hill.

INFORMATICS RISING

INFORMS 2012 Annual Meeting

October 14-17, 2012
Phoenix Convention Center, Phoenix, AZ

General Chair: Ronald G. Askin, Arizona State University
Program Co-Chairs: John W. Fowler and Esma Gel, Arizona State University

http://meetings2.informs.org/Phoenix2012

Plus
INFORMS-SMDM Joint Program
in conjunction with the Society for Medical Decision Making

Special Joint Program
Wednesday, October 17

Followed by the
SMDM Annual Meeting
October 17-20

SUNDAY

WELCOME & PLENARY

10:00am-10:50am
Center, Ballroom A

Welcome

Rina Schneur, President, INFORMS
Director, Verizon Network & Technology

Cem Saydam
General Chair, INFORMS Annual Meeting Charlotte
BISOM Department Chair, Professor of Operations Management, UNC Charlotte

Plenary

Studies in Activity Networks: A Guided Tour

Salah E. Elmaghraby
University Professor of Operations Research and Industrial Engineering
North Carolina State University

Activity Networks (ANs) is a model for the planning and (dynamic) control of projects. I shall present a historical perspective of studies of the model from its inception over 50 years ago, and the various issues with which the original model of CPM/PERT has been enriched. These include: portfolio selection, the management of resources (including funds), the acquisition and dispensation of resources, coping with uncertainty (the popular name is "risk management"), and the graphical representation of progress to satisfy certain managerial desires. Of the myriad of issues raised in the field of project management and control, I shall elaborate on three areas of my continued research:

- Assuming deterministic environment Deterministic Activity Networks (DANs), can one resolve the "optimal crashing problem" under generalized precedence relations (GPRs)? How about the optimal scheduling of the activities subject to resource availabilities (the RCPSP under GPRs)?
- Still under the assumption of DANs, how to schedule the activities subject to limited resource availabilities (including how much to acquire of these resources in the first place) in order to achieve certain objectives.
- Assuming stochastic environment Probabilistic Activity Networks (PANs), how to model, and cope with, uncertainty relative to specifying the start time of the various activities and the scheduling of the resources required for their execution.



Salah E. Elmaghraby has been University Professor of Operations Research and Industrial Engineering at North Carolina State University since 1967. Previously, he was an Associate Professor at Yale University and Research Leader at the Western Electric Engineering Research Center in Princeton, NJ. He was a Visiting Professor at Cornell University, Ithaca, NY; the University of Alexandria, Egypt; the Catholic University of Leuven, Belgium; University Lyon I, France; and the Nagoya Institute of Technology, Japan. In addition, he has twelve years of industrial experience, including eight abroad. Elmaghraby has been awarded an Honorary Doctorate by the University Lyon I. He has written four books, edited/co-edited three books (including the *Handbook of Operations Research*), authored/co-authored eight book chapters, and authored/co-authored over 118 scientific papers. He is a registered PE, a Fellow of the IIE and INFORMS, and a member of APICS and NSPE. He received a BSME from Cairo University, an MSIE from Ohio State University, and a PhD from Cornell University.

PLENARY

3:10pm-4:00pm
Center, Ballroom A

The Electric Industry's Coming Transformation

James E. Rogers
Chairman, President and CEO, Duke Energy

The electric utility industry is embarking on a multi-decade transformation that's unprecedented in its 100-plus year history. A confluence of factors – ranging from rising costs to environmental regulations to technology breakthroughs – will move the industry toward a low-carbon future during the next 40 years. Energy efficiency and energy optimization will rival energy production as two of the industry's core activities. Charlotte-based Duke Energy – soon to become America's largest utility upon consummation of its pending merger with Progress Energy – is leading the industry's transformation. In the process, the company is reinventing itself to prepare for a future that will be radically different from its past.



James E. Rogers has been Chairman of the Board, President and CEO of Duke Energy since January 2007. He has more than 22 years of experience as a utility CEO. He was named President and CEO of Duke Energy following the merger of Duke Energy and Cinergy in April 2006. Before the merger, he served as Cinergy's Chairman and CEO for more than 11 years. Prior to the formation of Cinergy, he joined PSI Energy in 1988 as the company's Chairman, President and CEO. Rogers served as Executive Vice President of interstate pipelines for the Enron Gas Pipeline Group before joining PSI. Before joining Enron Corp., Rogers was a partner in the Washington, D.C., office of Akin, Gump, Strauss, Hauer & Feld. Before that, he was deputy general counsel for litigation and enforcement for the Federal Energy Regulatory Commission (FERC). The Jan. 5, 2009, edition of *Newsweek* named Rogers to The Global Elite list, "The 50 Most Powerful People in the World," saying, "The CEO of Duke Energy could make dreams of renewable power a reality."

MONDAY

PLENARY

10:00am-10:50am
Center, Ballroom A

The Evolution of Analytics
Keith Collins
Senior Vice President and Chief Technology Officer, SAS

Disciplines like operations research, statistics, forecasting and econometrics have distinct roots and continue to develop in their own right—in research and academia. In practice it's increasingly recognized that they have grown together, producing a hybrid known as "business analytics." INFORMS has endorsed and embraced this trend through its actions and in its mission statement. What is propelling the business analytics trend, what problems does it seek to address, and where is it going? Business analytics have evolved steadily over the past several decades, adapting to address changing needs and incorporate new technologies. Collins will step listeners back in time to better understand where we are now. As computational advances and the corresponding data deluge present ongoing challenges, Collins will lead us toward the future with insights into the tremendous opportunities these changes herald for all of us.



Keith Collins, Senior Vice President and Chief Technology Officer at SAS, is part of the executive team which drives corporate technology strategies for SAS® solutions. He is responsible for leading Research & Development, Information Services and Technical Support. He led the effort to develop SAS®9, the breakthrough platform that is redefining business analytics. A graduate of North Carolina State University, Collins is a founding member of the advisory board for the university's computer science department and holds a seat on the Friends of the North Carolina Museum of Natural Sciences.

OMEGA RHO DISTINGUISHED LECTURE

3:10pm-4:00pm
Center, Ballroom A

Why Good Simulations Go Bad
Barry L. Nelson
Walter P. Murphy Professor and Chair, Department of Industrial Engineering and Management Sciences, Northwestern University

Simulation is a powerful tool to design, evaluate and improve the kinds of systems and processes that concern operations researchers and management scientists. Far from its early role as the brute force method of last resort, simulation now supports decision making both routine and critical. The software, and knowledge about how to use it, are widespread. But simulation frequently involves a large commitment of time, effort and money, and users often do not get everything they paid for; even worse, the results they do get may be seriously misleading. This talk describes common ways that good simulations go bad and how to avoid (or at least recognize) them. No background in simulation is assumed, and lots of examples will be provided to support the technical points.



Barry L. Nelson is the Walter P. Murphy Professor and Chair of the Department of Industrial Engineering and Management Sciences at Northwestern University. He received his BA in mathematics and computer science from DePauw University and his MS and PhD in industrial engineering from Purdue University. Before coming to Northwestern in 1995 he was on the faculty at The Ohio State University. His research is on the design and analysis of computer simulation experiments on models of discrete-event, stochastic systems, with applications to manufacturing, services, finance and transportation. Nelson has published numerous papers and two books, including *Discrete-Event System Simulation,* 5th edition, which has been adopted by over 60 universities. He is a Fellow of INFORMS and IIE. In 2006 he received the Outstanding Simulation Publication Award from the INFORMS Simulation Society for his work on simulation optimization, and in 2007 and 2010 he was awarded the Best Paper-Operations Award from *IIE Transactions.* He has also received the Northwestern University Alumni Association Excellence in Teaching Award, and has twice been named McCormick Teacher of the Year in engineering at Northwestern.

OMEGA RHO

OMEGA RHO, the official Honor Society of INFORMS, was founded in 1976 to recognize superior scholarship and encourage leadership in operations research, management science, and related disciplines. The society has 39 active collegiate chapters, more than 5,000 student and faculty members and is a member of the Association of College Honor Societies. In addition to sponsoring OMEGA RHO Distinguished Lectures at INFORMS Annual and International meetings, OMEGA RHO provides financial support to the annual INFORMS Colloquium. Honorary Membership in OMEGA RHO is bestowed upon individuals who provide leadership and extraordinary support for the encouragement of operations research and management science through their professional activities. Prior to delivering the OMEGA RHO Distinguished Lecture, Barry L. Nelson will be inducted as the 45th Honorary Member of OMEGA RHO.

TUESDAY

PLENARY

10:00am-10:50am
Center, Ballroom A

Build, Test, Scale: Innovative Strategies that are Transforming the U.S. Healthcare System
Susan D. DeVore
President and Chief Executive Officer
Premier Healthcare Alliance

Susan DeVore will provide an overview of the imperatives that drove the 2010 healthcare reform legislation and how the innovative health systems in the Premier healthcare alliance are preparing for the most significant overhaul of the American healthcare system since the passage of Medicare in 1965.



Susan DeVore is President and CEO of the Premier Healthcare Alliance, the nation's leading alliance of hospitals, health systems and other providers dedicated to improving healthcare performance. An alliance of more than 2,500 hospitals and health systems and more than 70,000 other healthcare delivery sites, Premier uses the power of collaboration to lead the transformation to high quality, cost-effective healthcare. Premier membership includes more than 40 percent of all U.S. health systems. With the ultimate goal of helping its members improve the health of their local communities, Premier builds, tests and scales models that improve quality, safety and cost of care. Through successful initiatives such as the Hospital Quality Incentive Demonstration with CMS, and QUEST: High Performing Hospitals collaborative, the alliance has driven improvements in evidence-based care and safety, as well as significant reductions in mortality, harm and cost. Premier is a leader in the accountable care movement and recently announced a joint-venture with IBM to develop industry-leading population analytics tools. Under DeVore's leadership, Premier has built an industry leading code of ethics, has been named four times as one of the World's Most Ethical Companies by Ethisphere and has won the Malcolm Baldrige National Quality Award.

KEYNOTE

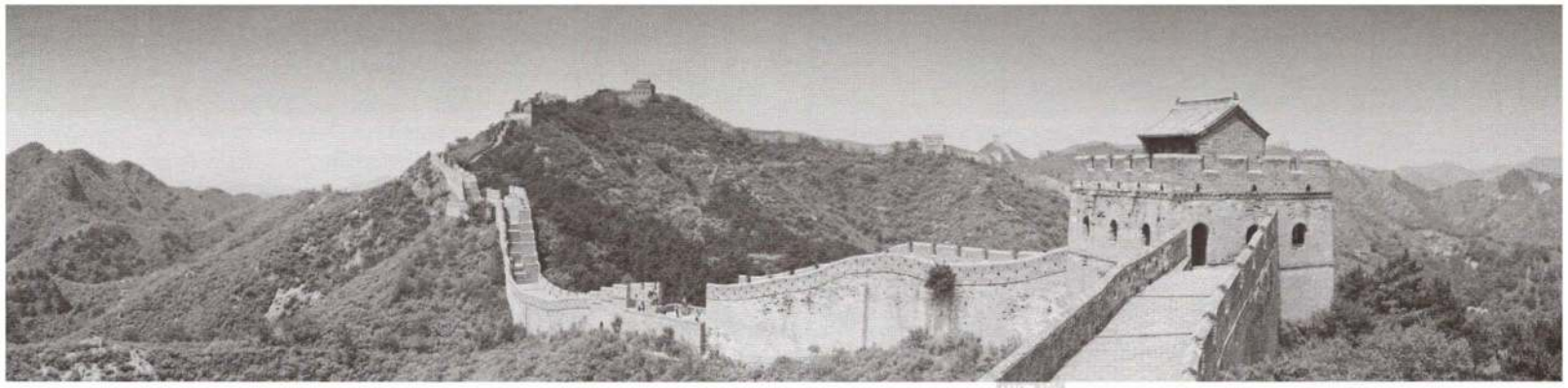
IFORS Distinguished Lecture
3:10pm-4:00pm
Center, Room 217A

Boolean Methods in Operations Research and Related Areas
Yves Crama
Professor of Operations Research and Production Management
HEC Management School, University of Liège

The title of this lecture is the title of a monograph co-authored by Peter L. Hammer and Sergiu Rudeanu, which appeared in 1968. Their pioneering work has stimulated a large amount of research and has been very frequently cited. Over the last year, the late Peter Hammer and Yves Crama have published two distant follow-ups to this classical book: a monograph entitled *Boolean Functions: Theory, Algorithms, and Applications* (700 pages, Cambridge University Press, 2011), and a collection of survey papers on *Boolean Models and Methods in Mathematics, Computer Science and Engineering* (780 pages, Cambridge University Press, 2010). The size of these two volumes and the size of their bibliographic sections are witnesses of the vitality of the field and of its impressive development. Boolean functions are actually among the most fundamental objects investigated in mathematics, and provide the basic building blocks for many models arising in operations research, computer science, artificial intelligence, economics, engineering, cryptography, biology and other fields of application. In this lecture, Crama proposes a brief overview of some fundamental Boolean models, discusses applications in corporate governance (modeling of shareholders' power) and in classification (Logical Analysis of Data), and mentions a few challenging research problems.



Yves Crama is Professor of Operations Research and Production Management, and the former Dean of the HEC Management School of the University of Liège, in Belgium. He holds a PhD in operations research from Rutgers University. Before moving to Liège, he held faculty positions at the University of Delaware and at Maastricht University. He is interested in discrete mathematics and combinatorial optimization, with an emphasis on Boolean models and algorithms, on production and operations management, and on financial applications. He has coauthored five books and 75 scientific papers on these subjects. He has delivered invited plenary lectures at major conferences in France, Israel, Italy, Lebanon, Switzerland and Turkey, and in 2009, he was awarded a prestigious Belgian Francqui Chair by the University of Leuven. He is a member of the editorial boards of *Discrete Applied Mathematics, Discrete Optimization, Journal of Scheduling* and *4OR - The Quarterly Journal of the Belgian, French and Italian Operations Research Societies*. He is a scientific partner of two university spin-offs, N-Side and Gambit Financial Solutions.



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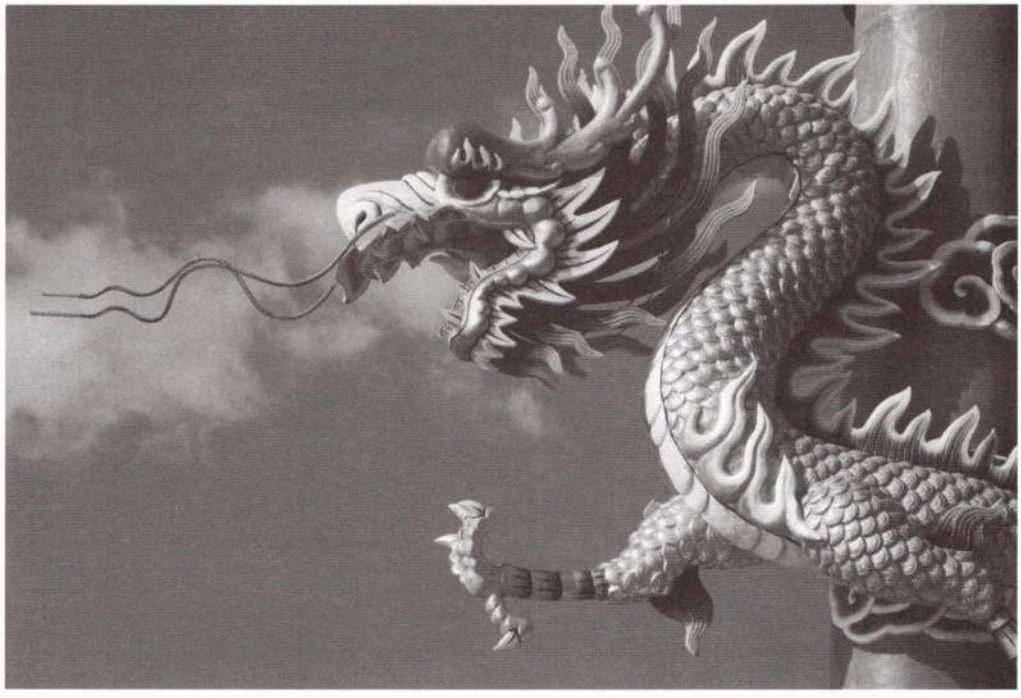
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INFORMS INTERNATIONAL Beijing 2012

In conjunction with The Operations Research Society of China

June 24-27, 2012 ▪ China National Convention Center ▪ Beijing, China



Submit an Abstract Today

Submission Deadline: February 13, 2012

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KEYNOTE

Reprise of 2011 Edelman Award-Winning Presentation
3:10pm-4:00pm
Center, Ballroom A

Midwest Independent Transmission System Operator Applies Operations Research to Electricity Markets, Unlocking Billions in Savings
Midwest ISO: Matthew Tackett, Kevin Larson, Kimberly Sperry, Yonghong Chen, Mingguo Hong, Brian Carlson, Doug Taylor, Roy Jones
ALSTOM Grid Inc.: Eugene Zak, Jie Wan
Utilicast: Xingwang Ma, Haili Song
Paragon Decision Technology Inc.: Peter Nieuwesteeg

Across the United States, utilities had a localized focus – maximizing their own power plants and transmission lines at the expense of the larger electrical system. The Federal Energy Regulatory Commission recognized this and began encouraging the formation of Regional Transmission Organizations (RTO) to reduce individual utilities' market power and drive more efficiency. As a result, Midwest Independent Transmission System Operator (MISO) launched in 2001 as the first RTO. In 2005, MISO leveraged advances in computing capabilities and O.R. algorithms to launch its initial energy market, and its upgraded energy and ancillary services market in 2009. MISO used O.R. to pool advantages among regional energy providers, improve reliability, and increase efficiencies. As a result, it realized nearly $3 billion in savings through last year and estimates as much as $8.1 billion of value through 2020.

THE FRANZ EDELMAN AWARD
Achievement in Operations Research

The Franz Edelman Award for Achievement in Operations Research and the Management Sciences calls out, recognizes and rewards outstanding, high-impact applications of OR/MS. Each year, six to seven finalists compete in the "Super Bowl" of O.R. in practice. The 2011 finalists include CSAV, Fluor Corp., Industrial and Commercial Bank of China, InterContinental Hotels Group and State of New York. In this keynote, the first-place MISO team will reprise their winning presentation.

WEDNESDAY

PLENARY

2011 Daniel H. Wagner Prize Presentation
10:00am-10:50am
Center, Ballroom A

The Daniel H. Wagner Prize is awarded for a paper and presentation that describe a real-world, successful application of operations research. The prize criteria emphasize innovative, elegant mathematical modeling and clear exposition, qualities that Dr. Wagner especially admired. 2011 competitors include author teams who report on applications implemented by the New York City Department of Education (schedule classes to facilitate personalized learning in schools), Intel Corp. (design/schedule product lines in a large corporation), Chitika Inc. (determine when to show an Internet ad), La Poste (renew fleet vehicles in a national postal service), Ford Motor Co. (plan/schedule in automotive manufacturing) and Georgia Aquarium (predict guest flow/allocate resources/schedule in a new aquarium exhibit area).



SUNDAY

■ SB05 - Center, 203A
11:00am-12:30pm
Value-Focused Thinking
Ralph Keeney, Duke University

Value-focused thinking involves identifying and using values to guide all aspects of decision making. This tutorial covers the concepts, procedures and applications of value-focused thinking. Topics addressed include structuring complex decisions, specifying objectives, creating alternatives, using value-focused thinking in brainstorming, and taking proactive control of your decision-making.

■ SC05 - Center, 203A
1:30pm-3:00pm
Queues in Service Systems: Customer Abandonment and Diffusion Approximations
Jim Dai & Shuangchi He, Georgia Institute of Technology

Parallel-server queues with customer abandonment serve as a building block to model service systems. Such a queue is able to be operated in the quality- and efficiency-driven (QED) regime to achieve both quality of service and high server utilization. We survey recent results for these queues. They include insensitivity of patience time distribution, data-driven modeling of customer abandonment, and diffusion models as a practical tool for performance analysis.

■ SC06 - Center, 203B
1:30pm-3:00pm
History of Operations Research
Saul Gass, University of Maryland, College Park
Arjang Assad, University at Buffalo (SUNY)

We discuss the history of operations research from the following perspectives: origins and people of OR; the major sites of early U.S. OR research; the best stories from contributors to early OR; and lessons learned or how history informs OR today.

■ SD05 - Center, 203A
4:30pm-6:00pm
One-Off Modeling with Excel
Harvey Wagner, University of North Carolina at Chapel Hill

Many real applications of analytic modeling are efforts described by short time spans of use, model development by only one or two non-expert staff, and reliance on Excel to provide computational implementation. This tutorial session surveys Excel modeling techniques that facilitate building medium-scale one-off models that encompass competition, uncertainty, combinatoric options and dynamic feedback.

■ SD06 - Center, 203B
4:30pm-6:00pm
Reinforcement Learning
Benjamin Van Roy, Stanford University

This tutorial will provide an overview of some past and ongoing research on algorithms for reinforcement learning in Markov decision processes, with an emphasis on efficient exploration and generalization through value function approximation. Some important unresolved issues will also be discussed. Aside from learning, these algorithms can be used to optimize fully specified Markov decision processes, so ideas we will discuss are also relevant to approximate dynamic programming.

All attendees receive free access to the *INFORMS 2011 TutORials in Operations Research* online book concurrently with the Meeting! For access, go to http://tutorials.pubs.informs.org/2011-TutORials-in-Operations-Research-ONLINE and LOGIN using your INFORMS username and password. Non-member meeting attendees: use the username and password you selected as part of the online registration process. **NOTE: your username and password also appears on the receipt in your registration envelope.**

You can order the 2011 book or previous volumes or CDs (2005-2010) through the TutORials website http://tutorials.pubs.informs.org.
For more information, visit INFORMS booths 121-125-127.

MONDAY

■ MA05 - Center, 203A
8:00am-9:30am
Laboratory Experiments in Operations Management
Elena Katok, Pennsylvania State University

Controlled laboratory experiments give researchers a great deal of control, making them useful for testing analytical models. In this tutorial I introduce laboratory experiments and discuss methodological issues in designing and conducting laboratory experiments. I will also discuss several research programs that recently benefited from laboratory experiments.

■ MA06 - Center, 203B
8:00am-9:30am
Non-Parametric Data-Driven Policies for Stochastic Inventory Models
Retsef Levi, Massachusetts Institute of Technology

In this talk, we will survey several recent non-parametric data-driven algorithmic approaches to core stochastic inventory control models. Instead of the traditional assumption that demand distributions are specified as part of the input, one assumes that only historical demand/sales information is available. We will discuss several techniques to devise data-driven policies and analyze their performance.

■ MB05 - Center, 203A
11:00am-12:30pm
On the Analysis of Queueing Systems with Abandonments
Amy Ward, University of Southern California

In this tutorial, we discuss approximation results for the GI/GI/N+GI queueing model. Our objective is to find situations in which simple performance measure approximations can be developed. To do this, we study the behavior of the GI/GI/N+GI queue in the conventional heavy traffic and Halfin-Whitt limit regimes, as well as the overloaded regime.

■ MB06 - Center, 203B
11:00am-12:30pm
Forecast Information Sharing: The Role of Contracts Behavior and Timing
Ozalp Ozer, The University of Texas at Dallas

Forecast information sharing is among the most active research area because information affects fundamental decisions. This tutorial focuses on issues arising in forecast information sharing. We illustrate how contracts/incentives affect forecast communication. We take on a new perspective on information sharing by considering the role of trust in communication. We discuss when and how to share forecasts that are evolving over time. We conclude with a discussion on open research questions.

■ MC05 - Center, 203A
1:30pm-3:00pm
Simple Heuristics for Optimal Inventory Policies in Supply Chains
Kevin Shang, Duke University

This tutorial summarizes recent development on simple heuristics for optimal inventory policies in supply chains. The considered policies are (r,Q) policies and (s,T) policies. The former (latter) policies are often implemented in a continuous-review (periodic-review) inventory system. The proposed heuristics share a common approach that solves a set of independent, single-stage problems, whose parameters are obtained from the original system data.

■ MC06 - Center, 203B
1:30pm-3:00pm
Applying Production and Inventory Management Theory to Sustainable Energy System
Owen Wu, University of Michigan

In this tutorial, we discuss sustainable energy systems, focusing on the management challenges brought by intermittent energy generation resources. We apply the production and inventory management theory developed over the past decades to address these new challenges. We study the similarities and the differences between classical systems and energy systems in the new era, and extend the impact of the operations management theory to the field of sustainable energy system management.

■ MD05 - Center, 203A
4:30pm-6:00pm
Mixed-Integer Optimization Approaches for Deterministic and Stochastic Inventory Management
Simge Kucukyavuz, Ohio State University

We survey recent mixed-integer programming (MIP) methods for various lot sizing and inventory control problems. We consider problems with dynamic demand, both deterministic and random, over a finite planning horizon. We use polyhedral combinatorics to develop cutting planes or extended formulations to tighten the original MIPs, which prove to be highly effective in solving difficult capacitated multi-echelon multi-item order lot-sizing problems.

■ MD06 - Center, 203B
4:30pm-6:00pm
Bayesian Methods for Global and Simulation Optimization
Peter Frazier, Cornell University

This tutorial shows how Bayesian statistics can be used to solve large-scale global optimization and simulation optimization problems. The optimization problems considered are non-convex, with noisy and computationally-expensive function evaluations. We discuss well-established techniques for continuous problems, as well as emerging techniques for large discrete problems. We also discuss connections to sequential experimental design, ranking and selection, and optimal learning.

TUESDAY

■ TA05 - Center, 203A
8:00am-9:30am
Dynamic Optimization in Radiotherapy
Archis Ghate, University of Washington

The goal in radiotherapy is to maximize tumor-damage while limiting toxic effects on nearby healthy anatomies. This is achieved through spatial localization and temporal dispersion of radiation dose using static-deterministic optimization methods. In this tutorial, we review a recently proposed stochastic control framework, where the ultimate objective is to design treatment strategies that dynamically adapt to tumor-response, to deliver the right dose to the right location at the right time.

■ TA06 - Center, 203B
8:00am-9:30am
Contract Complexity and Performance: A Brief Look at Theory and Behavior
Feryal Erhun, Stanford University

This tutorial discusses theoretical and behavioral aspects of contract design with an emphasis on complexity as a design factor. We first introduce the concept of dynamic procurement and then establish a link between dynamic procurement and quantity discounts. Next, we introduce behavioral aspects of contract design and discuss trade-offs between contract design and contract performance. Finally, we demonstrate how simple quantity discount contracts can effectively eliminate inefficiencies.

■ TB05 - Center, 203A
11:00am-12:30pm
Innovation and Entrepreneurship: A Process Framework
Stefanos Zenios, Stanford University

Innovation and entrepreneurship courses are rarely taught by OR faculty. In this tutorial we will argue that this should not be the case because innovation and entrepreneurship is not an event but a process, and OR scholars are well positioned to teach courses on processes. We will describe the (29-step) innovation process we are now teaching at Stanford in the context of health care innovation and explain how the process can be expanded to other industry verticals.

■ TC05 - Center, 203A
1:30pm-3:00pm
Analysis of Misspecified Models in Revenue Management and Repeated Decision Problems
William Cooper, University of Minnesota

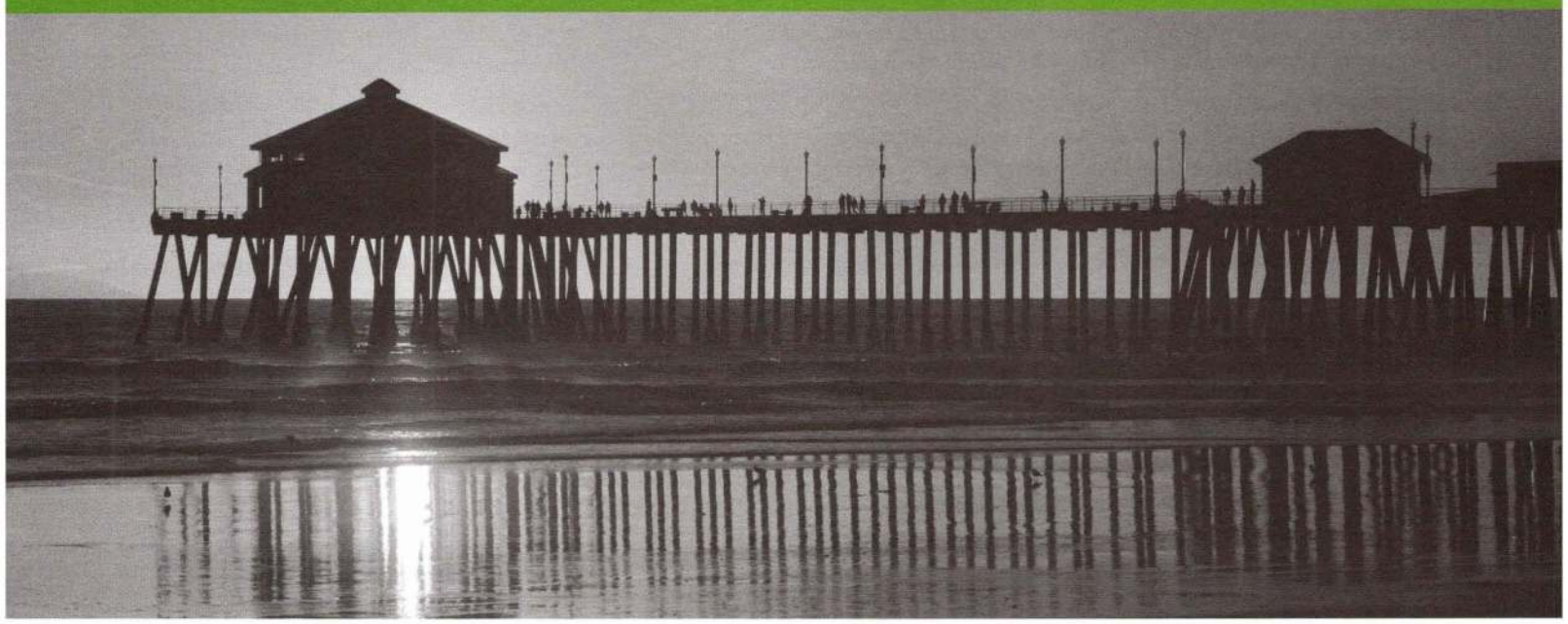
A parametric optimization model is said to be misspecified if no setting of its parameter values yields a correct representation of the actual objective function of the decision maker. This talk describes recent research on the dynamics of application of misspecified models over a sequence of problem instances, where parameter estimates are dynamically updated as the instances unfold. Particular attention will be give to problems in revenue management and pricing.

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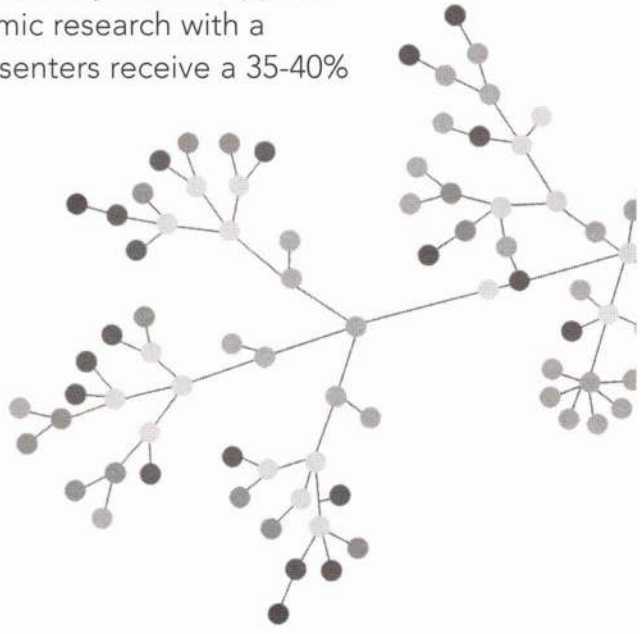
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■ TC58 - Westin, Providence II
1:30pm-3:00pm
Transforming US Army Supply Chains: Management Innovation in DoD for Improved Efficiency, Productivity, and Cost-Effective Global Operations
Greg Parlier, Institute for Defense Analyses

This tutorial offers a practical approach for understanding the Army's extremely complex global logistics system, one of the largest in the world. Logically structured using an operations research (OR) approach with an enterprise analytical framework, the new concept of "management innovation as a strategic technology" (MIST) is introduced and described. Cutting-edge supply chain theory, powerful analytical methods, and innovative strategic planning and management concepts are applied to this seemingly intractable national security resource challenge which has remained on the Government Accountability Office's (GAO) "high-risk" list for two decades now.

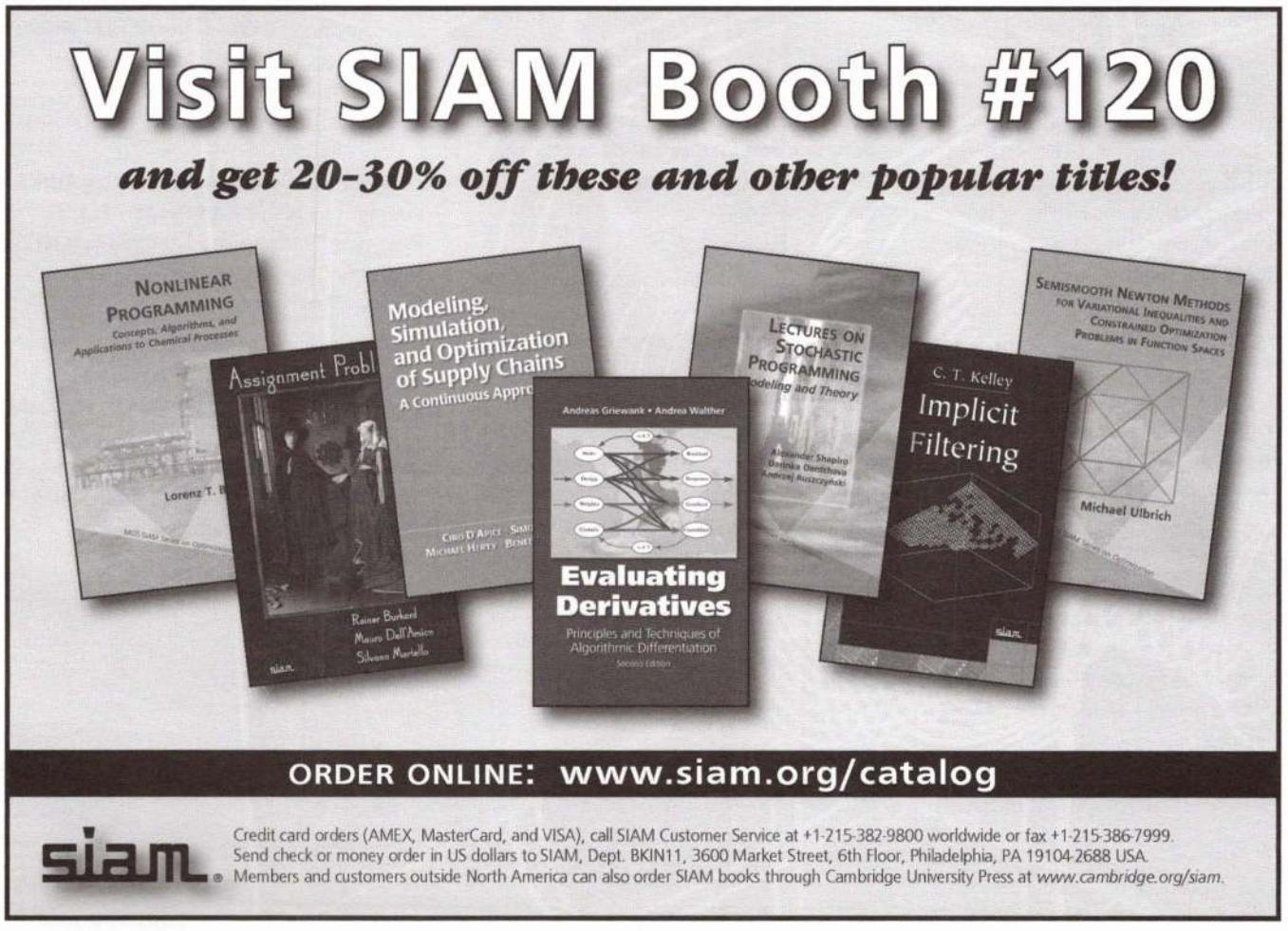
■ TD05 - Center, 203A
4:30pm-6:00pm
Optimizing Cancer Screening Using Partially Observable Markov Decision Processes (POMDPs)
Oguzhan Alagoz, University of Wisconsin-Madison

We show how to apply partially observable Markov decision processes (POMDPs) for optimizing cancer screening decisions. We use a previously developed POMDP model for mammography screening to demonstrate the development and application of a POMDP model for cancer screening. In addition, we describe challenges for applying POMDPs to model other cancer screening problems as well as possible future research directions.

WEDNESDAY

■ WB58 - Westin, Providence II
11:00am-12:30pm
Modern Design of Experiments - Recent Advances in Screening Methods
Tom Donnelly, SAS Institute Inc.

Attendees will be introduced to recently published Design of Experiments for screening factors. Relative to traditional regular fractional-factorial designs, these new designs – non-regular fractional-factorial, definitive screening and alias-optimal designs – allow experimenters to run fewer trials or learn more about interactions or quadratic behavior. Graphical comparisons between these alternative methods and traditional designs will show the new ones to be superior or strong competitors.



All sessions will be held in the Convention Center, Room 206B.

SUNDAY, NOVEMBER 13

■ SA10
8:00am-8:45am
Palisade Corporation - Avoiding Failure: Using @RISK to Identify, Analyze and Manage Risk More Successfully
Thompson Terry, tterry@palisade.com

Projects fail. They often fail for a lack of effective planning, either because of excess optimism in terms of time, cost and performance or because of extra work in the plan in terms of scope, resources and unforeseen events. @RISK employs Monte Carlo based simulation to give insight through sophisticated statistical analysis of the various potential outcomes. Understanding range outcomes facilitates effective risk management, prioritizing critical risks and managing expectations.

8:45am-9:30am
Salford Systems - Introduction to Salford Systems' Data Mining Suite
Mikhail Golovnya, golomi@salford-systems.com

Salford Systems offers a highly accurate, ultra-fast predictive and data mining platform for developing models from databases of any size, complexity or organization. Our technologies span classification, regression, survival analysis, missing value analysis and clustering/segmentation. Core components of our platform include CART®, MARS®, TreeNet® and RandomForests®.

■ SB10
11:00am-11:45am
SAS Institute, JMP Division - Analytics Made Easy
Mia Stephens, mia.stephens@jmp.com

JMP is intuitive and interactive data visualization and analytics software. Providing a complete array of statistical procedures, from basic to advanced, all JMP output is dynamic, visual and integrated. We will demonstrate JMP tools for data visualization, including Graph Builder®, Bubble Plots, the data filter, and our popular mapping tools.

11:45am-12:30pm
Oracle - Crystal Ball in the Classroom and Teaching Resources
Michael Franden, michael.franden@oracle.com

Oracle's Crystal Ball software is a spreadsheet-based software suite for predictive modeling, forecasting, Monte Carlo simulation and optimization. Our software is used in over 800 universities and schools worldwide for teaching risk analysis concepts. Teaching applications for Crystal Ball include financial risk analysis, valuation, engineering, portfolio allocation, cost estimation and project management. Learn about teaching resources available in Crystal Ball and online.

■ SC10
1:30pm-2:15pm
GAMS Development Corporation - GAMS
Steve Dirkse, sdirkse@gams.com

GAMS Development will demonstrate how an application can be built using GAMS. We'll use both fundamental modeling practices, our state-of-the-art solvers and the latest in data access and application integration tools to quickly produce a working application.

2:15pm-3:00pm
Maximal Software - MPL OptiMax 2.0 for Python and .Net: Introducing New Scripting and Library Interfaces for the MPL Modeling Language
Bjarni Kristjansson, bjarni@maximalsoftware.com

MPL has been distributed with a standard GUI interface for development and the object-oriented OptiMax Component library for deployment for many years now. With the advent of scripting language frameworks such as Python that are becoming increasingly popular, there are now new opportunities for integrating optimization into real-world applications. With the new MPL OptiMax 2.0 for Python and .Net, we are introducing a new scripting and component library interfaces for MPL that takes full advantage of the many powerful features of Python, CSharp and VB.Net.

■ SD10
4:30pm-5:15pm
Ziena Optimization LLC - New Developments in the KNITRO 8.0 Optimization Solver
Richard Waltz, waltz@ziena.com

This software demonstration will highlight new features in the 8.0 release of the KNITRO optimization solver. In particular we will focus on the new presolver, new parallel features and improvements in mixed-integer programming and infeasibility detection.

MONDAY, NOVEMBER 14

■ MA10
8:00am-8:45am
Syncopation Software - DPL Even Easier from Excel!
Chris Dalton, cdalton@syncopation.com

DPL 8 features an all new Excel add-in interface – work directly in Excel! Like a head-up display, key modeling and analysis features are right in front of you while you build your spreadsheet. Many of DPL's insightful outputs are now available in Microsoft Office native formats – analyze, format, tweak, copy and paste to create the ultimate PowerPoint presentation!

8:45am-9:30am
LINKS-simulations.com - Exploiting LINKS Simulations Web-Based Resources for Maximum Teaching and Learning Impact
Randall G. Chapman, chapman@chapmanrg.com

How can an instructor teach effectively and efficiently with a large-scale, team-based, competitive supply chain management simulation? By exploiting the simulation's web-based teaching and learning resources! This software demo explores web-based resources for supporting instructors and their students throughout LINKS simulation events.

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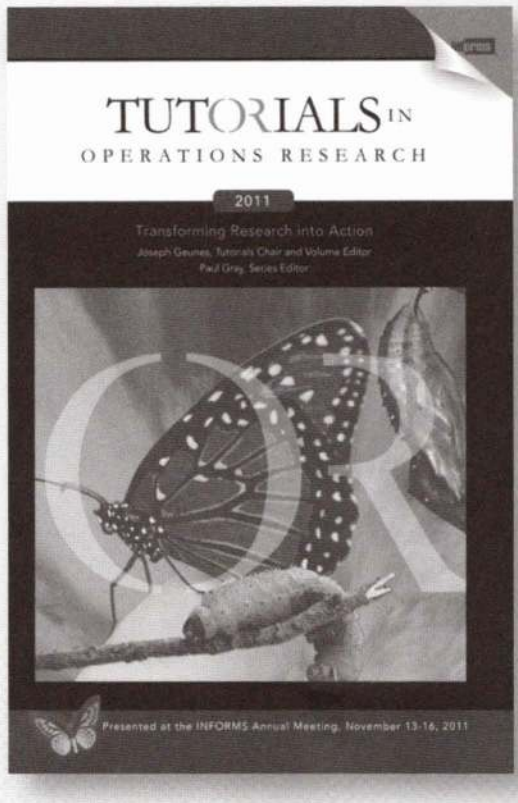
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■ MB10
11:00am-11:45am
LINDO Systems, Inc. - Optimization Modeling Made Easy
Mark Wiley, mwiley@lindo.com
Gautier Laude, glaude@lindo.com

LINDO will demonstrate our optimization software known for exceptional ease of use and comprehensive range of capabilities. We'll show our versatile, intuitive interfaces and demonstrate our powerful solvers for linear, integer, quadratic, general nonlinear, global and stochastic optimization. Come find out why our software is the tool of choice for thousands of OR professionals.

11:45am-12:30pm
SAS - Discrete Event Simulation with SAS Simulation Studio
Ed Hughes, ed.hughes@sas.com
Emily Lada, emily.lada@sas.com

We survey the capabilities of SAS Simulation Studio, an application for discrete-event simulation that integrates with SAS and JMP for data management, distribution fitting and experimental design. Simulation Studio features a hierarchical, entity-based approach to resource modeling that enables extensive control over complicated resource requirements such as scheduling and preemption.

■ MC10
1:30pm-2:15pm
FICO - Building Optimization Applications in FICO Xpress
Oliver Bastert, oliverbastert@fico.com

This tutorial will focus on developing and deploying complete optimization applications using FICO's array of mathematical modeling and optimization tools. These tools can be used for modeling, solving, analyzing and visualizing optimization problems, and integrating them seamlessly in business applications. We will explain how Xpress-Mosel, Xpress-IVE and Xpress-Application Developer can decrease development time for new optimization applications and enable you and your customers to make smarter decisions. The proven technologies offered by FICO can be used in range of applications such as supply chain management, transportation, finance, energy, manufacturing, retail, insurance and manufacturing industries, to name a few.

2:15pm-3:00pm
AIMMS (Paragon Decision Technology) - Constraint Programming in AIMMS
Peter Nieuwesteeg, p.nieuwesteeg@aimms.com
Deanne Zhang, d.zhang@aimms.com

Constraint Programming, a recent addition to the AIMMS modeling platform, is a paradigm useful in formulating and solving highly combinatorial problems where MIP solvers fail. In this session, we will demonstrate AIMMS and the new Constraint Programming functionalities, through a real-life example with various formulations, and analyze the results using the tools in AIMMS.

■ MD10
4:30pm-5:15pm
Responsive Learning Technologies, Inc. - Online Games to Teach Operations and Supply Chain Management
Sam Wood, wood@responsive.net

Learn about online competitive exercises that are used in Operations Management courses and Supply Chain Management courses to teach topics like capacity management, lead time management, inventory control, supply chain design and logistics. These games are typically used as graded assignments.

5:15pm-6:00pm
Forio Online Simulations - How to Convert Your Desktop Simulation into a Sharable Web Simulation using Forio Simulate
Michael Bean, mbean@forio.com

Forio Simulate allows modelers to develop and present simulations on the Web with no programming. During this 45-minute workshop, we will demonstrate how to create web simulations, discuss commonly occurring web simulation design challenges and potential solutions, and show examples of web simulations that have been used by thousands of users. We will also provide a series of guidelines for creating simulations online. Forio Simulate can import models from Any Logic, Excel, Vensim, iThink and other desktop simulation packages.

TUESDAY, NOVEMBER 15

■ TA10
8:00am-8:45am
SAS Global Academic Program - Rapid Predictive Modeler
Tom Bohannon, tom.bohannon@sas.com
Jerry Oglesby

Using SAS Rapid Predictive Modeler, business analysts and subject-matter experts with limited statistical expertise can quickly generate their own predictive models based on their specific needs and business scenarios. This enables a wide range of individuals to use and benefit from predictive analytics without always having to rely on a potentially limited pool of overburdened analytic resources.

8:45am-9:30am
Lumina Decision Systems, Inc. - Analytica: What it Does that Spreadsheets Can't
Paul Sanford, psanford@lumina.com

Experienced analysts prefer Analytica to spreadsheets because of its visual influence diagrams, Intelligent Arrays, fast Monte Carlo and scalability. Users say that they can build, verify and analyze models in a quarter to half the time it takes with a spreadsheet. Because it's designed by expert modelers, it's also an ideal tool for teaching students the art of effective modeling.

■ TB10
11:00am-11:45am
Frontline Systems, Inc. - Integrated Data Mining, Simulation and Optimization in Microsoft Excel
Daniel H. Fylstra, info@solver.com

We'll explain how one integrated toolset in Microsoft Excel can meet your needs for forecasting and sophisticated data mining, Monte Carlo simulation and risk analysis, and conventional and stochastic optimization. We'll show you the fastest way to build your models, build your own analytic expertise, and get real business results.

11:45am-12:30pm

Gurobi Optimization - Solving Large Scale Math Programming Models with the Gurobi Optimizer

Zonghau Gu, gu@gurobi.com

We will examine recent trends in the types and sizes of models that are being solved, focusing on models with up to hundreds of millions of variables or constraints. We will examine several instances that are pushing the envelope on size and difficulty, and talk about technologies and tuning approaches for obtaining good solutions.

■ TC10

1:30pm-2:15pm

IBM ILOG Optimization - IBM ILOG CPLEX Optimization Studio and Advanced Analytics

Ferenc Katai, ferenc.katai@fr.ibm.com

Come learn about the latest developments in IBM ILOG CPLEX Optimization Studio including how you can combine optimization with the predictive analytics of IBM SPSS, bringing you entirely new capabilities as an operations researcher. Recent and upcoming releases will be discussed, with an advance peek at new features and performance advances. A live demo illustrating the combination of SPSS and CPLEX will be presented. You will see the benefits of leveraging the IBM software portfolio, delivered by the undisputed leader in optimization and advanced analytics.

2:15pm-3:00pm

AMPL Optimization - AMPL Models for "Not Linear" Optimization Using Linear Solvers

Robert Fourer, 4er@ampl.com

Popular solvers for mixed-integer linear programming can also be applied effectively to various extensions and generalizations of linearity. We describe features of the AMPL modeling language that encourage modeling with "not linear" features including discrete domains, logical restrictions, and a range of formulations that are equivalent to conic quadratic programs.

■ TD10

4:30pm-5:15pm

American Optimal Decisions - Portfolio Safeguard (PSG): Advanced Nonlinear Mixed-Integer Optimization Package

Stan Uryasev, uryasev@aorda.com

Portfolio Safeguard is an advanced nonlinear mixed-integer optimization package used in risk management, financial engineering, military, medical and other applications. Design and solve complex optimization problems with built-in functions (maximum, StDev, variance, probability, VaR, CVaR, cardinality, fixed-charge, recourse etc.) See real-life case studies in Windows and MATLAB at www.aorda.com/aod/psg.action.

5:15pm-6:00pm

Tableau Software - Stop Wrestling with Your Data-Start Exploring it with Tableau

Chamont Wang, wang@tcnj.edu

Sophia Kan, skan@tableausoftware.com

Tableau Desktop is based on breakthrough technology from Stanford University that lets you drag and drop to analyze data. You can connect to data in a few clicks, then visualize and create interactive dashboards with a few more. Tableau Software transforms stubborn databases and spreadsheets into sources for easy investigations. It's so easy to use that any Excel user can learn it. Answer questions as fast as you can think of them.

WEDNESDAY, NOVEMBER 16

■ WA10

8:00am-8:45am

AnyLogic - Fast Modeling with AnyLogic's Smart Libraries

Andrei Borshchev

George Gonzalez-Rivas, grivas@anylogic.com

Since AnyLogic is the only tool allowing you to build discrete event, agent based, or system dynamics models, it has been the features-leader among simulation software for years. Now, as we add more smart libraries to our palette we also are becoming the speed leader – simply drag and drop smart objects such as pedestrians, vehicles, or trains and take advantage of their pre-coded behavior to create models faster than ever before.

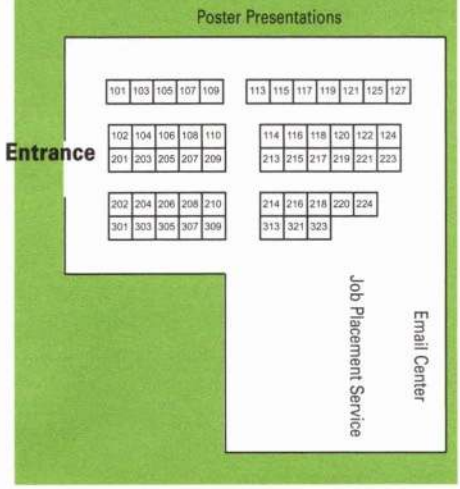


EXHIBITS OPEN

Sunday, Nov. 13	12:00pm-5:00pm 7:30pm-9:00pm (Welcome Reception)
Monday, Nov. 14	9:00am-5:00pm
Tuesday, Nov. 15	9:00am-5:00pm
Wed., Nov. 16	9:00am-1:00pm

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As a winner of the prestigious 2011 Franz Edelman Award, Paragon's AIMMS solver-independent modeling platform distinguishes itself from other optimization software through its advanced modeling concepts, a full interactive graphical user interface as well as the variety of deployment options (including desktop, client-server, and web services). Ask for a personal demo at our exhibit, visit the workshop or software demo, or ask for a trial CD (also available at www.aimms.com/try). Check out our Educational Program, www.aimms.com/edu.

American Optimal Decisions **#103**
5214 SW 91st Way, Ste. 130
Gainesville, FL 32608
www.aorda.com

American Optimal Decisions (AOD) is a privately held company that provides consulting services and software solutions in advanced statistics, optimization and risk management. The main software product is Portfolio Safeguard (PSG), an advanced nonlinear mixed-integer optimization package. Use simple codes for sophisticated optimization problems, calling non-linear functions without additional programming. AOD provides consulting in various engineering areas involving statistics and optimization. See case studies with downloadable data and problem statements: www.aorda.com/aod/psg.action.

AMPL Optimization LLC **#209**
900 Sierra Pl. SE
Albuquerque, NM 87108-3379
www.ampl.com

AMPL Optimization develops and supports the AMPL modeling language, a powerful and natural tool for creating and managing the large, complex optimization problems that arise in numerous applications. AMPL is notable for supporting a broad range of linear and nonlinear problem formulations and a large selection of popular large-scale solvers.

AnyLogic North America **#216, 218**
53 Frontage Rd., Ste. 250
Hampton, NJ 08833
www.anylogic.com

AnyLogic is the premier multi-method simulation application on the market. It supports any combination of: discrete event, system dynamics or agent-based simulation techniques. Stop by the booth for demo of our new features, to review our new tutorials and books, and get a free trial version to use.

ASEE SMART Scholarship Program **#219**
American Society for Engineering Education
1818 N St. N.W., Ste. 600
Washington, DC 20036
http://smart.asee.org

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Cambridge University Press **#204**
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Visit the Computational Infrastructure for Operations Research booth to learn about high-quality, free, open-source tools for OR professionals and students, suitable for commercial, educational and personal use. COIN-OR is the place to go when you need a "white box" for algorithm research and development. COIN-OR is a strategic partner of the INFORMS Computing Society.

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500 Water St.
Jacksonville, FL 32202
www.csx.com

CSX Transportation operates the largest railroad in the eastern United States. Operations research helps achieve its goals, operationally and financially, by using methods like mathematical modeling, statistics and algorithms to arrive at optimal decisions. We will have a PowerPoint presentation showing our analytical and modeling techniques, CSXT information and O.R. employees.

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Dynamic Ideas is a publisher of scientific books that have quality and originality in the areas of operations research and applied mathematics. The key objective of our titles is to educate the next generation. Many of our books are currently being used as the main textbook in academic courses in some of the finest universities and research institutions in the world.

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Elsevier publishes more than 40 high-quality journals covering Operations Research and related disciplines, which are edited by the greatest minds in the field. Visit our booth at INFORMS for free gifts, information on new journal launches and demos of our latest technology.

FICO **#213, 215**
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San Francisco, CA 94107
www.forio.com

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Frontline Systems, Inc. **#214**
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Gurobi Optimization **#110**
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IBM: ILOG Optimization **#113, 115, 117**
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INFORMS Future Meetings **#119**
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LINDO Systems, Inc. **#301**
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LINDO Systems will highlight recent enhancements to our optimization modeling software including updates to the linear, integer and global solvers and stochastic programming capabilities. We will be demonstrating LINDO API, our powerful solver engine; LINGO, our integrated modeling language and solvers; and What'sBest! our large scale Excel solver. Stop by for a free CD with full capacity trial versions.

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Lumina Decision Systems, Inc. **#217**
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Maximal Software, Inc. **#101**
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Arlington, VA 22201
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MPL has been distributed with a standard GUI interface for development and the object-oriented OptiMax Component library for deployment for many years now. With the advent of scripting language frameworks such as Python that are becoming increasingly popular, there are now new opportunities for integrating optimization into real-world applications. With the new MPL OptiMax 2.0 for Python and .Net, we are introducing a new scripting and component library interfaces for MPL that takes full advantage of the many powerful features of Python, CSharp and VB.Net.

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Responsive Learning Technologies **#210**
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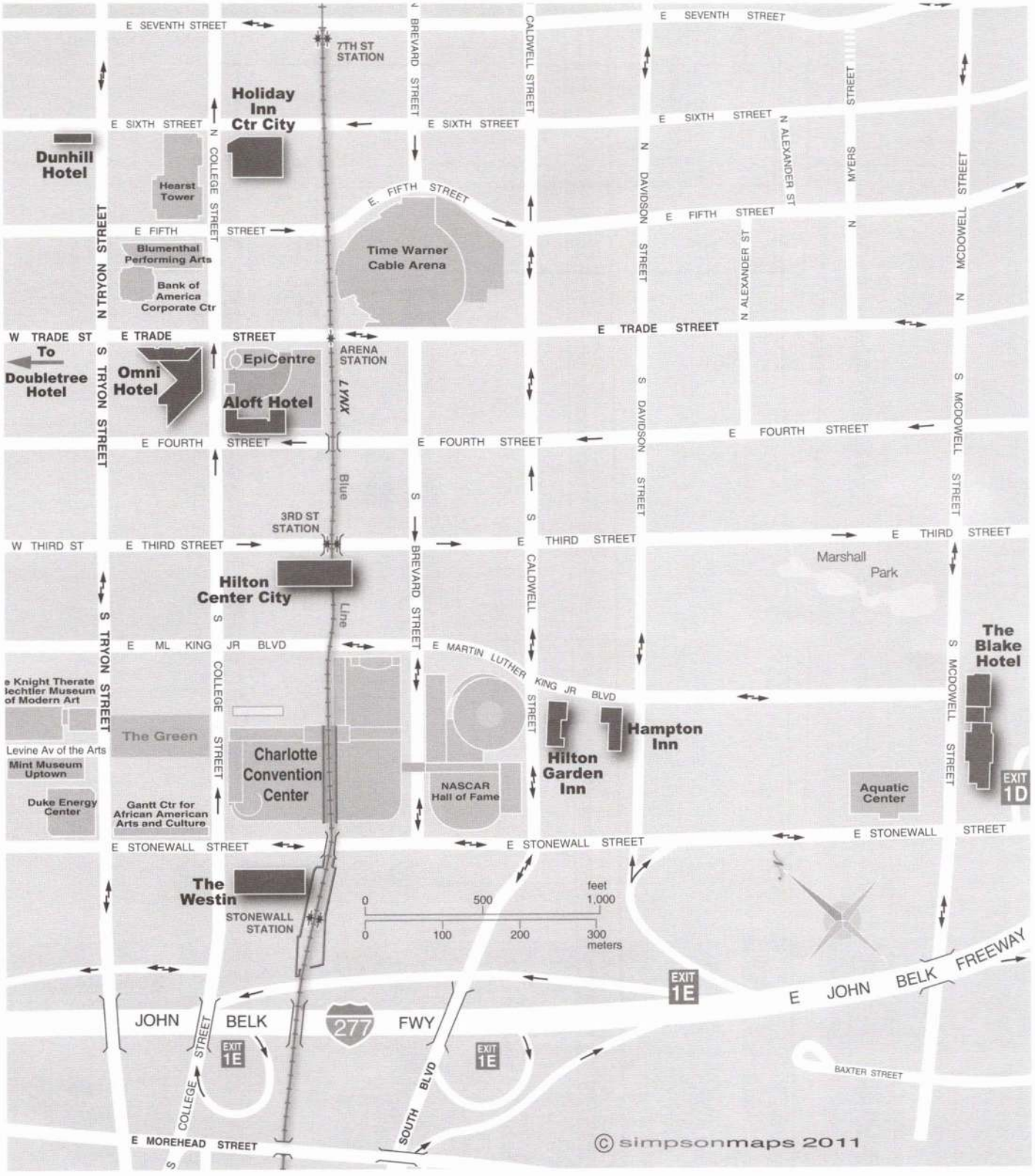
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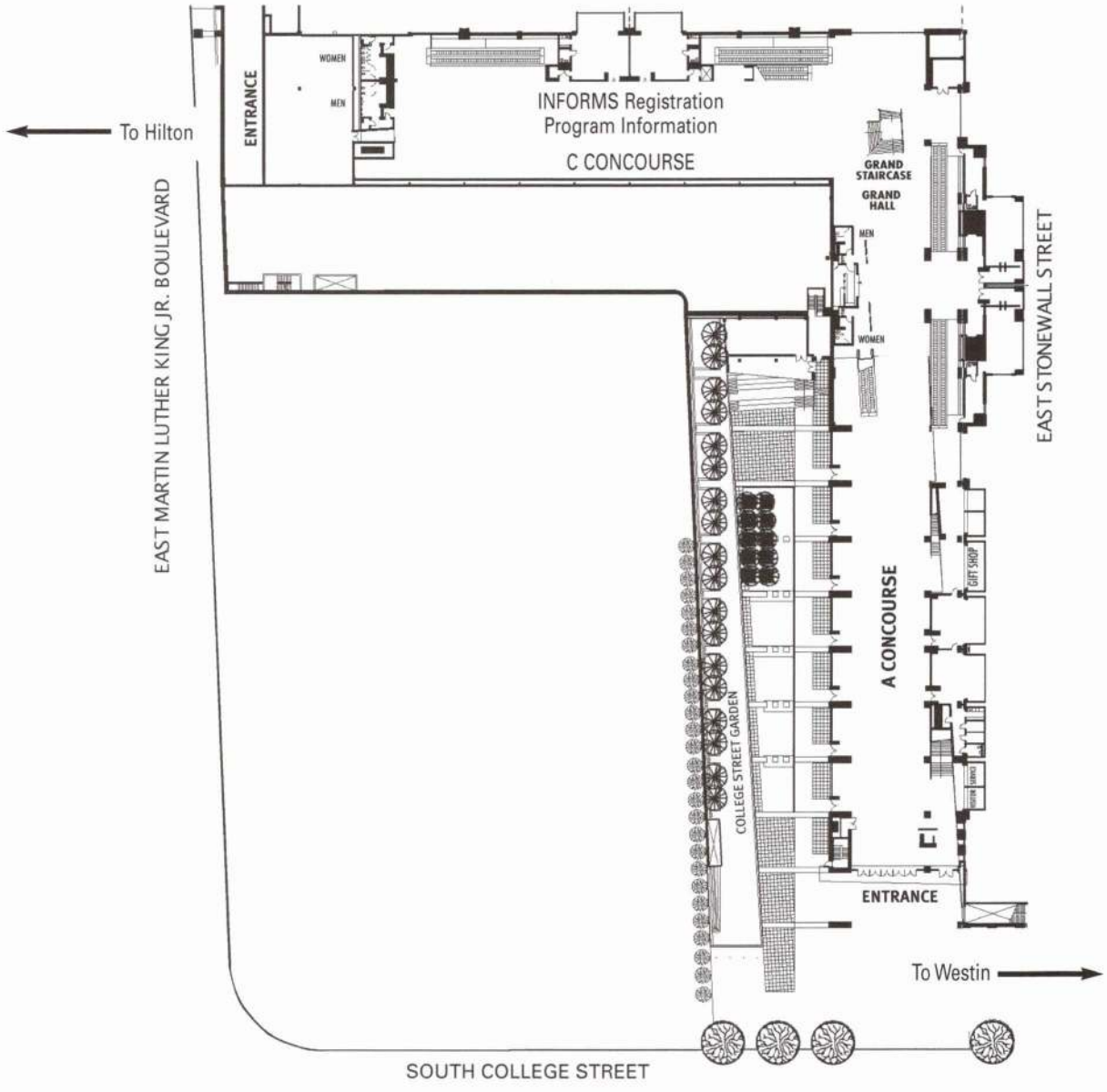
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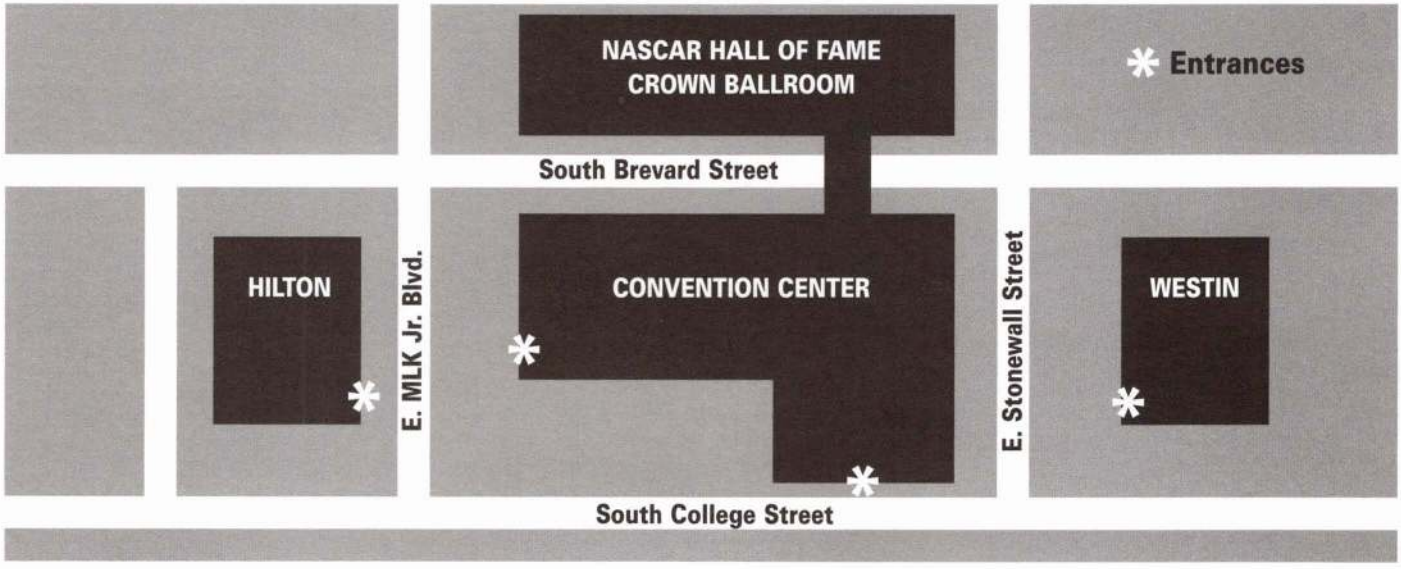
Ziena Optimization LLC **#108**
1801 Maple Ave., Ste. 6320
Evanston, IL 60201
www.ziena.com

Ziena was founded in 2001 by world-renowned scientists to provide robust software tools and responsive, professional technical support for difficult nonlinear optimization problems. Many Fortune 100 customers and hundreds of sites worldwide rely on Ziena's KNITRO solver to deliver optimization excellence in various financial, energy, communications, science and engineering applications.


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STREET-LEVEL CONCOURSE – (ENTRANCE LEVEL)





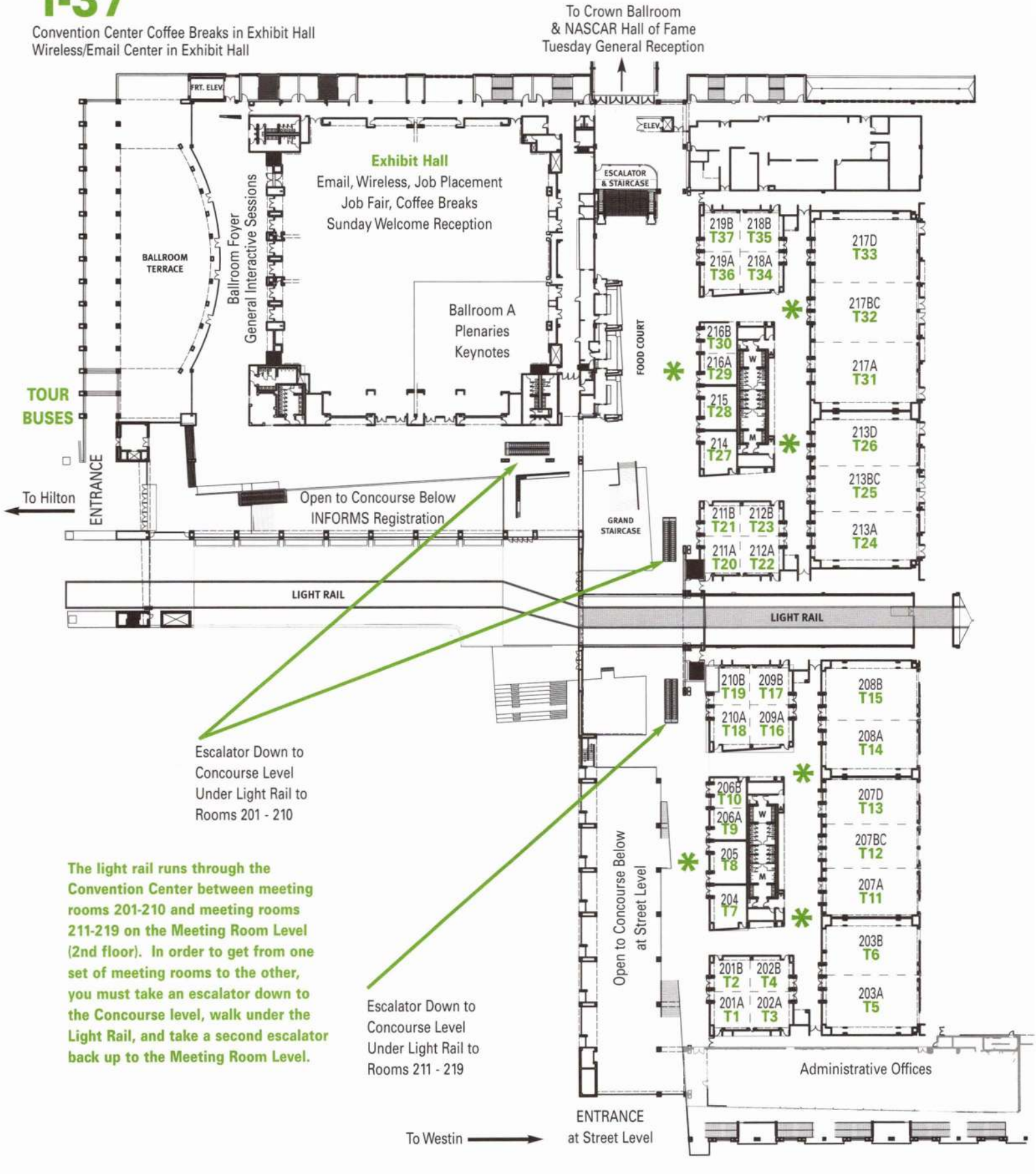
BALLROOM/MEETING ROOM LEVEL – (2ND FLOOR)

TRACKS

1-37

Convention Center Coffee Breaks in Exhibit Hall
Wireless/Email Center in Exhibit Hall

Track numbers shown for Technical Session Rooms



The light rail runs through the Convention Center between meeting rooms 201-210 and meeting rooms 211-219 on the Meeting Room Level (2nd floor). In order to get from one set of meeting rooms to the other, you must take an escalator down to the Concourse level, walk under the Light Rail, and take a second escalator back up to the Meeting Room Level.

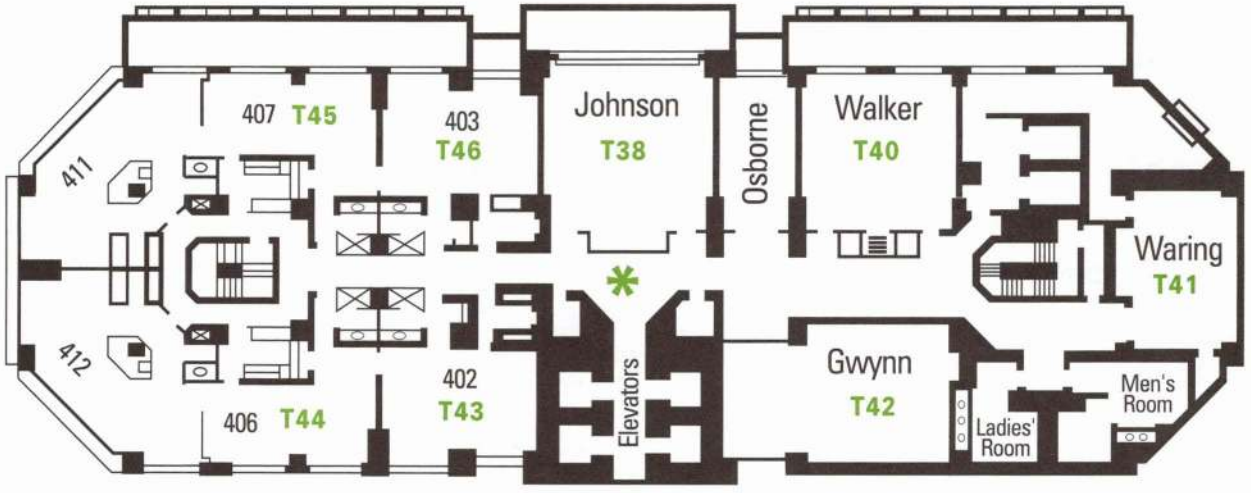
TRACKS

38-56

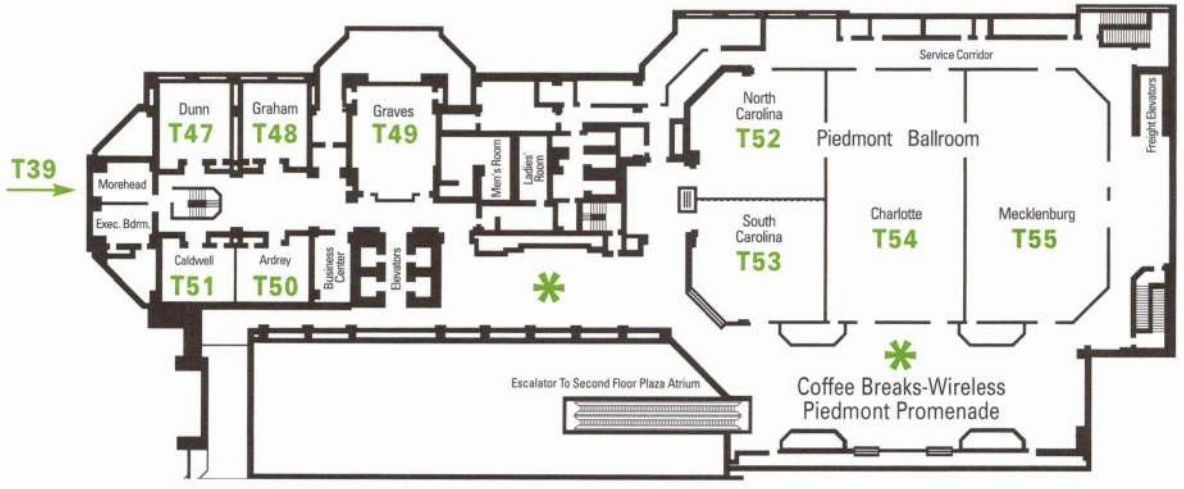
Hilton Coffee Breaks on 3rd Floor
Wireless on 3rd Floor, Piedmont Promenade

Track numbers shown for Technical Session Rooms

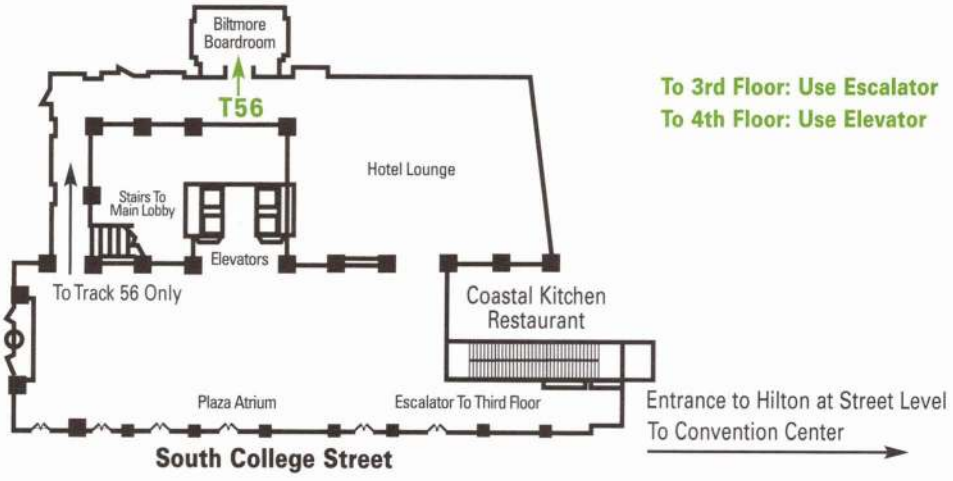
4TH FLOOR - Tracks 38 and 40-46



3RD FLOOR - Tracks 39 and 47-55



2ND FLOOR (ENTRANCE LEVEL) - Track 56



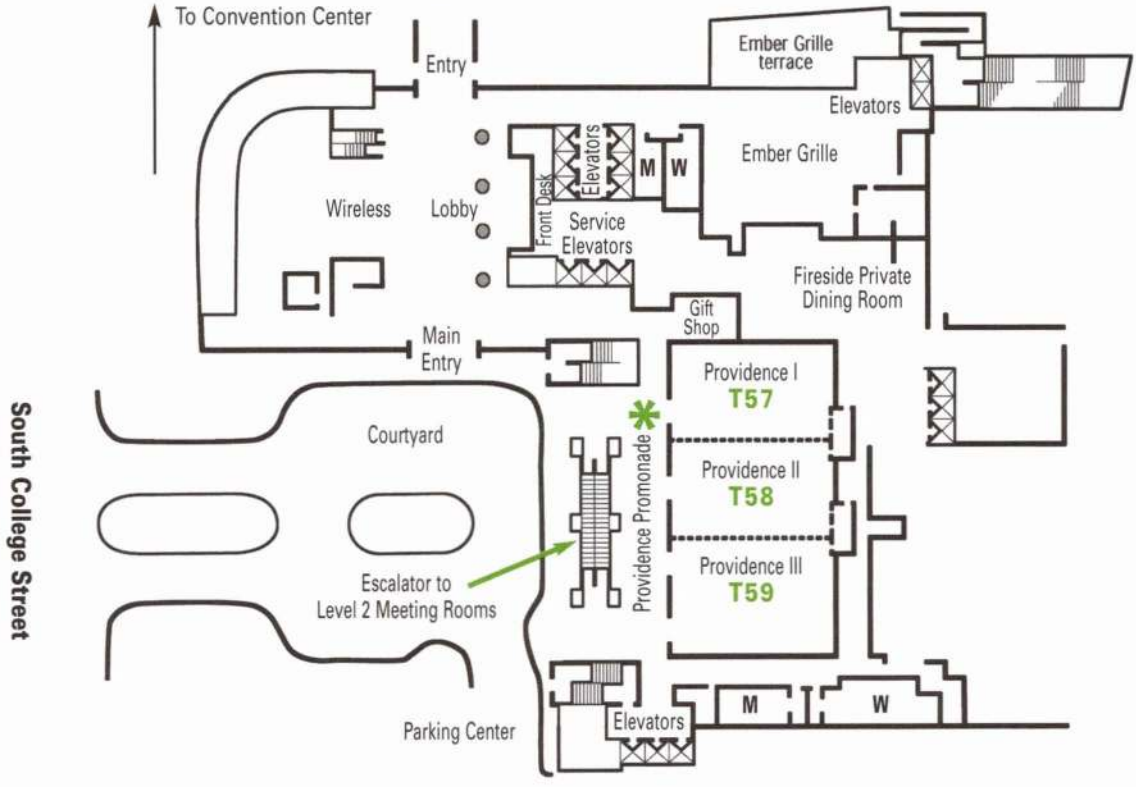
To 3rd Floor: Use Escalator
To 4th Floor: Use Elevator

TRACKS

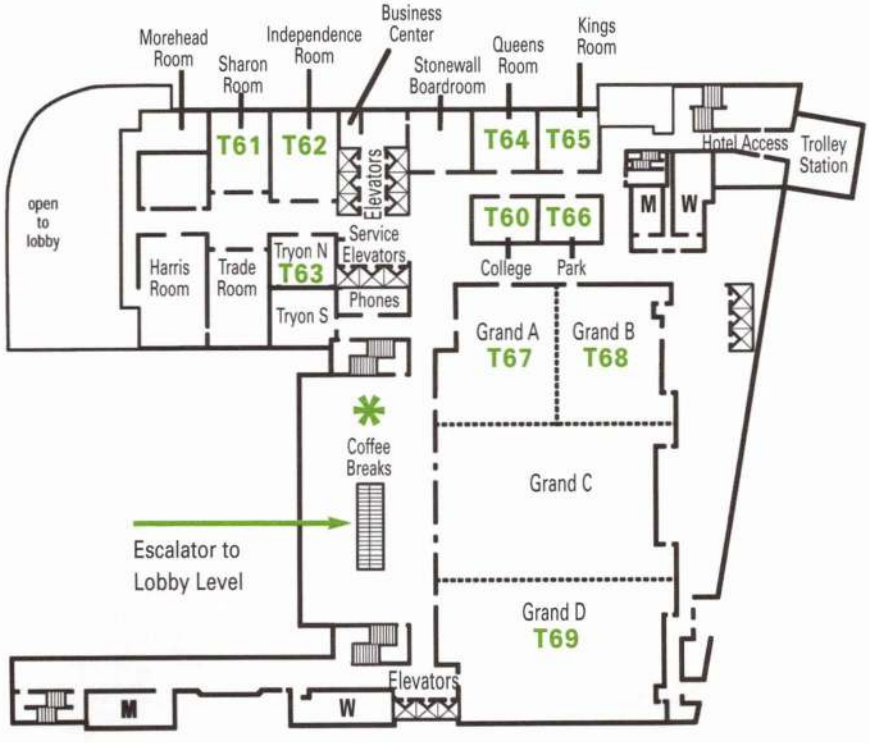
57-69

Westin Coffee Breaks on 2nd Floor
Wireless in Hotel Lobby

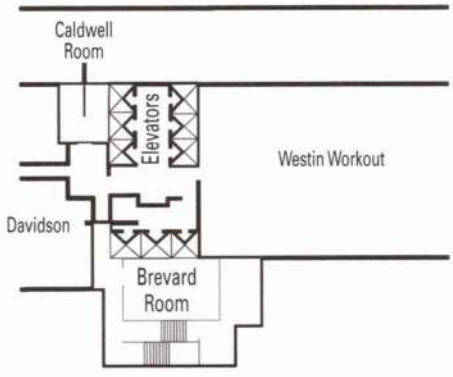
LOBBY LEVEL-Tracks 57-59



LEVEL 2-Tracks 60-69



LEVEL 3



Master Track Schedule – Sunday

C-Convention Center H-Hilton W-Westin

Track	Room	SA 8:00-9:30	Plenary 10:00–10:50	SB 11:00-12:30	SC 1:30-3:00	Plenary 3:10-4:00	SD 4:30-6:00
1	C - Room 201A	Nicholson Student Paper Prize		Nicholson Student Paper Prize	Mfg. & Service Oper Mgt. - SC Ops.		MSOM
2	C - Room 201B	Risk Mgt.		Risk Mgt.	Risk Mgt.		Opt. in Finance
3	C - Room 202A	Computer Science		Opt. - Computational Opt. & Software	Women in OR/MS		Women in OR/MS
4	C - Room 202B	Computing		Computing	Computing		Computing
5	C - Room 203A	Supply Chain		Tutorials	Tutorials		Tutorials
6	C - Room 203B	Quantitative Finance		Quantitative Finance	Tutorials		Tutorials
7	C - Room 204	Applied Probability		Applied Probability	Applied Probability		Applied Probability
8	C - Room 205	Computing – Large Scale Comp.		Computing – Large Scale Comp.	Computing – Large Scale Comp.		Computing – Large Scale Comp.
9	C - Room 206A	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
10	C - Room 206B	Palisade & Salford Systems	**Welcome & Plenary**	SAS-JMP Div. & Oracle	GAMS & Maximal Software	**Plenary**	Ziena Optimization
11	C - Room 207A	Applied Probability	**Salah Elmaghraby**	Applied Probability	Applied Probability	**James Rogers**	Applied Probability
12	C - Room 207BC	Computational Biology	**Studies in Activity**	Computational Biology	Computational Biology	**Electric Industry's**	Computational Biology
13	C - Room 207D	Revenue Mgt. & Pricing	**Networks**	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing	**Coming**	Revenue Mgt. & Pricing
14	C - Room 208A	Energy, Nat'l Resources & Environment – Energy	**C-Ballroom A**	ENRE – Energy	ENRE – Energy	**Transformation**	ENRE – Energy
15	C - Room 208B	Decision Analysis		Decision Analysis	Decision Analysis	**C-Ballroom A**	Decision Analysis
16	C - Room 209A	Railway Applications		Railway Applications	Railway Applications		ENRE – Forestry
17	C - Room 209B	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
18	C - Room 210A	Scheduling & Project Mgt.		Scheduling & Project Mgt.	Scheduling & Project Mgt.		Scheduling & Project Mgt.
19	C - Room 210B	No Session		Junior Faculty Interest Group	JFIG		Financial Services
20	C - Room 211A	Opt. - Global Opt.		Opt. - Global Opt.	Opt. - Global Opt.		Opt. - Global Opt.
21	C - Room 211B	Opt. - Stochastic Programming		Opt. - Stochastic Programming	Opt. - Stochastic Programming		Opt. - Stochastic Programming
22	C - Room 212A	Opt. - Stochastic Programming		Opt. - Stochastic Programming	Opt. - Stochastic Programming		Opt. - Stochastic Programming
23	C - Room 212B	Homeland Security – Emergency Prep		Homeland Security	Homeland Security		Homeland Security
24	C - Room 213A	Opt. - Integer Programming		Opt. - Integer Programming	Opt. - Integer Programming		Opt. - Integer Programming
25	C - Room 213BC	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
26	C - Room 213D	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
27	C - Room 214	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
28	C - Room 215	Mfg. & Service Operations Mgt. – Service Mgt.		MSOM – Service Mgt.	MSOM – Service Mgt.		MSOM – Service Mgt.
29	C - Room 216A	Mfg. & Service Operations Mgt. – Healthcare		MSOM – Healthcare	MSOM – Healthcare		MSOM – Healthcare
30	C - Room 216B	Mfg. & Service Operations Mgt. – iForm		MSOM – iForm	MSOM – iForm		MSOM – iForm
31	C - Room 217A	Health Applications		Health Applications	Health Applications		Health Applications
32	C - Room 217BC	Military Applications		Mfg. & Service Operations Mgt.	Military Applications		Railway Applications
33	C - Room 217D	Quality, Statistics & Reliability		QSR	No Session		QSR
34	C - Room 218A	Health Applications		Health Applications	Health Applications		Health Applications
35	C - Room 218B	Quality, Statistics & Reliability		QSR	QSR		QSR

Track	Room	SA 8:00-9:30	Plenary 10:00–10:50	SB 11:00-12:30	SC 1:30-3:00	Plenary 3:10-4:00	SD 4:30-6:00
36	C - Room 219A	Telecommunications		Telecommunications	Telecommunications		Telecommunications
37	C - Room 219B	Quality, Statistics & Reliability		QSR	QSR		QSR
38	H - Johnson Rm, 4th Fl.	Location Analysis		Location Analysis	Location Analysis		Location Analysis
39	H - Morehead, 3rd Fl.	E-Business		Information Systems	Information Systems		Information Systems
40	H - Walker Rm, 4th Fl.	Technology Mgt.		Technology Mgt.	Technology Mgt.		Technology Mgt.
41	H - Waring Rm,4th Fl.	New Product Development		New Product Development	New Product Development		New Product Development
42	H- Gwynn Rm, 4th Fl.	Information Systems		Information Systems	Information Systems		Information Systems
43	H - Suite 402, 4th Fl.	Energy, Natural Resources & the Environment – Energy		ENRE – Energy	ENRE – Energy		ENRE – Energy
44	H - Suite 406, 4th Fl.	Managing Disruptions in Supply Chains		Managing Disruptions in Supply Chains	Managing Disruptions in Supply Chains		Junior Faculty Interest Group
45	H- Suite 407, 4th Fl.	Auctions		Auctions	Auctions		Auctions
46	H - Suite 403, 4th Fl.	No Session		INFORM-ED	INFORM-ED		INFORM-ED
47	H - Dunn Rm, 3rd Fl.	Transport. Science & Logistics		TSL	TSL		TSL
48	H - Graham Rm, 3rd Fl.	Transport. Science & Logistics		TSL	TSL		TSL
49	H - Graves Rm, 3rd Fl.	Simulation		Simulation	Simulation		Simulation
50	H - Ardrey Rm, 3rd Fl.	Data Mining		Data Mining	Data Mining		Data Mining
51	H - Caldwell Rm, 3rd Fl.	Transport. Science & Logistics		TSL	TSL		TSL
52	H - North Carolina, 3rd Fl.	Organization Science		Organization Science	Organization Science		Organization Science
53	H - South Carolina, 3rd Fl.	Data Mining		Data Mining	Data Mining		Data Mining
54	H - Charlotte Hall, 3rd Fl.	George B. Dantzig Prize		Data Mining	Doing Good with Good O.R. Competition		Doing Good with Good OR
55	H - Mecklenburg Hall, 3rd Fl.	Analytics		Decision Support Systems	CPMS, The Practice Section of INFORMS		CPMS
56	H - Biltmore, 2nd Fl.	Supply Chain		Supply Chain	Supply Chain		Supply Chain
57	W - Providence I, Lobby	Aviation Applications		Aviation Applications	Aviation Applications		Aviation Applications
58	W - Providence II, Lobby	Military Applications		Military Applications	Military Applications		No Session
59	W - Providence III, Lobby	Service Science		No Session	Service Science		Service Science
60	W - College Room, 2nd Fl.	Opt. - Networks		No Session	Opt. - Networks		Opt. - Networks
61	W - Sharon Room, 2nd Fl.	No Session		No Session	No Session		No Session
62	W - Independence Rm, 2nd Fl.	No Session		No Session	No Session		No Session
63	W - Tryon North, 2nd Fl.	Multiple Criteria DM		Multiple Criteria Decision Making	Multiple Criteria Decision Making		Multiple Criteria Decision Making
64	W - Queens Rm, 2nd Fl.	Public Programs		Public Programs	Public Programs		Public Programs
65	W - Kings Rm, 2nd Fl.	Service Science		Service Science	Service Science		Service Science
66	W - Park Rm, 2nd Fl.	Data Envelopment Analysis		Data Envelopment Analysis	Data Envelopment Analysis		Data Envelopment Analysis
67	W - Grand A, 2nd Fl.	No Session		No Session	No Session		No Session
68	W - Grand B, 2nd Fl.	No Session		No Session	No Session		No Session
69	W - Grand D, 2nd Fl.	No Session		No Session	No Session		No Session

General Interactive Session 12:30- 2:30, Convention Center, Ballroom Foyer

Track	Room	MA 8:00-9:30	Plenary 10:00–10:50	MB 11:00-12:30	MC 1:30-3:00	Plenary 3:10-4:00	MD 4:30-6:00
1	C - Room 201A	Mfg. & Service Oper Mgt.		MSOM – SC Operations	MSOM – SC Operations		MSOM-SC Operations
2	C - Room 201B	Opt. in Finance		Opt. in Finance	Opt. in Finance		Opt. in Finance
3	C - Room 202A	Women in OR/MS		Computing – Open Source Software	Computing – Open Source Software		Computing – Open Source Software
4	C - Room 202B	Computing		Computing	Computing - Opt.		Computing - Opt.
5	C - Room 203A	Tutorials		Tutorials	Tutorials		Tutorials
6	C - Room 203B	Tutorials		Tutorials	Tutorials		Tutorials
7	C - Room 204	Applied Probability		Applied Probability	Applied Probability		Applied Probability
8	C - Room 205	Cloud Computing		Cloud Computing	Computing – Constraint Programming		Computing – Constraint Programming
9	C - Room 206A	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
10	C - Room 206B	Syncopation Software & LINKS-simulations	**Plenary Keith Collins Evolution of Analytics C-Ballroom A**	LINDO Systems & SAS	FICO & AIMMS	**Plenary OMEGA RHO Barry Nelson Why Good Simulations Go Bad C-Ballroom A**	Responsive Learning & Forio Simulations
11	C - Room 207A	Applied Probability		Applied Probability	Applied Probability		Applied Probability
12	C - Room 207BC	Computing		Computing	Computing - Comp. Stochastic Opt.		Computing - Comp. Stochastic Opt.
13	C - Room 207D	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
14	C - Room 208A	Energy, Natural Resources & the Environment – Energy		ENRE – Energy	ENRE – Energy		ENRE - Energy
15	C - Room 208B	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
16	C - Room 209A	Energy, Natural Resources & the Environment – Forestry		ENRE – Forestry	ENRE – Forestry		ENRE – Forestry
17	C - Room 209B	Decision Analysis		Decision Analysis	Decision Analysis		Health Applications
18	C - Room 210A	Scheduling & Project Mgt.		Scheduling & Project Mgt.	Scheduling & Project Mgt.		Scheduling & Project Mgt.
19	C - Room 210B	Financial Services		Financial Services	Financial Services		Financial Services
20	C - Room 211A	Opt. – Global Opt.		Opt. – Global Opt.	Opt. – Global Opt.		Opt. – Global Opt.
21	C - Room 211B	Opt. - Stochastic Programming		Opt. - Stochastic Programming	Opt. - Stochastic Programming		Opt. - Stochastic Programming
22	C - Room 212A	Opt. - Stochastic Programming		Opt. - Nonlinear Programming	Opt. - Nonlinear Programming		Opt. - Nonlinear Programming
23	C - Room 212B	Homeland Security - Emergency Prep.		Homeland Security	International Activities Committee		International Activities Committee
24	C - Room 213A	Opt. - Integer Programming		Opt. - Integer Programming	Opt. - Integer Programming		Opt. - Integer Programming
25	C - Room 213BC	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
26	C - Room 213D	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
27	C - Room 214	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
28	C - Room 215	MSOM - Service Mgt.		MSOM - Service Mgt.	MSOM - Service Mgt.		MSOM - Service Mgt.
29	C - Room 216A	Quantitative Finance		Quantitative Finance	Quantitative Finance		Quantitative Finance
30	C - Room 216B	Mfg. & Service Operations Mgt.		MSOM	MSOM - iFORM		MSOM - iFORM
31	C - Room 217A	Health Apps-Interactives		Health Applications	Health Applications		Health Applications
32	C - Room 217BC	Railway Applications		Railway Applications	Railway Applications		Railway Applications
33	C - Room 217D	Quality, Statistics & Reliability		QSR - Interactives	QSR		QSR
34	C - Room 218A	Health Applications		Health Applications	Health Applications		Health Applications
35	C - Room 218B	Quality, Statistics & Reliability		QSR	QSR		QSR

Track	Room	MA 8:00-9:30	Plenary 10:00–10:50	MB 11:00-12:30	MC 1:30-3:00	Plenary 3:10-4:00	MD 4:30-6:00
36	C - Room 219A	Health Applications		Telecommunications	Telecommunications		Health Applications
37	C - Room 219B	Quality, Statistics & Reliability		QSR	QSR		QSR
38	H - Johnson Room, 4th Fl.	Location Analysis		Location Analysis	Location Analysis		Location Analysis
39	H - Morehead, 3rd Fl.	E-Business		Members who Succeed in Media Relations	Spreadsheet Productivity Research		E-Business
40	H - Walker Rm, 4th Fl.	Technology Mgt.		Technology Mgt.	Technology Mgt.		Technology Mgt.
41	H - Waring Rm,4th Fl.	New Product Development		New Product Development	New Product Development		Product Development & Design
42	H- Gwynn Rm, 4th Fl.	Junior Faculty Interest Group		Information Systems Society	Information Systems Society		Information Systems Society
43	H - Suite 402, 4th Fl.	Energy, Natural Resources & the Environment		ENRE – Energy	ENRE – Energy		ENRE – Energy
44	H - Suite 406, 4th Fl.	Undergraduate O.R. Prize		Undergraduate O.R. Prize	Undergraduate O.R. Prize		Undergraduate O.R. Prize
45	H- Suite 407, 4th Fl.	Auctions		Auctions	Auctions		Auctions
46	H - Suite 403, 4th Fl.	INFORM-ED		INFORM-ED	INFORM-ED		INFORM-ED
47	H - Dunn Rm, 3rd Fl.	Transportation Science & Logistics		TSL	TSL		TSL
48	H - Graham Rm, 3rd Fl.	Transportation Science & Logistics		TSL	TSL		TSL
49	H - Graves Rm, 3rd Fl.	Simulation		Simulation	Simulation		Simulation
50	H - Ardrey Rm, 3rd Fl.	Data Mining		Data Mining	Behavioral Operations Mgt.		Behavioral Operations Mgt.
51	H - Caldwell Rm, 3rd Fl.	Transportation Science & Logistics		No Session	TSL		TSL
52	H - North Carolina, 3rd Fl.	Organization Science		SpORts (Sports Analytics)	SpORts (Sports Analytics)		SpORts (Sports Analytics)
53	H - South Carolina, 3rd Fl.	Data Mining		No Session	Data Mining		Data Mining
54	H - Charlotte Hall, 3rd Fl.	2011 INFORMS Prize		Daniel H. Wagner Prize	Daniel H. Wagner Prize		Daniel H. Wagner Prize
55	H - Mecklenburg Hall, 3rd Fl.	Analytics		Analytics	Analytics		Analytics
56	H - Biltmore Boardroom, 2nd Fl.	Modeling Disease		Health Care	Scheduling		Scheduling
57	W - Providence I, Lobby	Aviation Applications		Aviation Applications	Aviation Applications		Aviation Applications
58	W - Providence II, Lobby	Military Applications		Military Applications	Military Applications		Military Applications
59	W - Providence III, Lobby	Service Science		Service Science	Service Science		Service Science
60	W - College Room, 2nd Fl.	Opt - Networks		Opt - Networks	Opt - Networks		Opt - Networks
61	W - Sharon Room, 2nd Fl.	No Session		No Session	No Session		No Session
62	W - Independence Rm, 2nd Fl.	No Session		No Session	No Session		No Session
63	W - Tryon North, 2nd Fl.	Multiple Criteria Decision Making		Multiple Criteria Decision Making	Multiple Criteria Decision Making		Multiple Criteria Decision Making
64	W - Queens Room, 2nd Fl.	Public Programs		Public Programs	Public Programs		Public Programs
65	W - Kings Room, 2nd Fl.	Service Science		Service Science	Service Science		Service Science
66	W - Park Room, 2nd Fl.	No Session		Data Envelopment Analysis	Data Envelopment Analysis		Workforce Engineering & Mgt.
67	W - Grand A, 2nd Fl.	No Session		No Session	No Session		No Session
68	W - Grand B, 2nd Fl.	No Session		No Session	No Session		No Session
69	W - Grand D, 2nd Fl.	Mfg. & Service Operations Mgt.		MSOM - Sustainable Operations	MSOM - Sustainable Operations		MSOM - Sustainable Operations

Master Track Schedule – Tuesday

C-Convention Center H-Hilton W-Westin

General Interactive Session 12:30- 2:30, Convention Center, Ballroom Foyer

Track	Room	TA 8:00-9:30	Plenary 10:00–10:50	TB 11:00-12:30	TC 1:30-3:00	Plenary 3:10-4:00	TD 4:30-6:00
1	C - Room 201A	MSOM - Supply Chain Ops.		MSOM - Supply Chain Ops.	MSOM - Supply Chain Ops.		MSOM - Supply Chain Ops.
2	C - Room 201B	Optimization in Finance		Optimization in Finance	Assortment Planning & Customer Choice		Customers & Retailers
3	C - Room 202A	Computing - Open Source Software		Computing - Open Source Software	Newsvendor & Risk		Substitution & Inventory Characterization
4	C - Room 202B	Computing - Optimization		Computing - Optimization	Computing - Optimization		Computing - Optimization
5	C - Room 203A	Tutorials		Tutorials	Tutorials		Tutorials
6	C - Room 203B	Tutorials		Computing	Multiobjective & Quadratic Objectives in Scheduling		Scheduling Integrated with Other Issues
7	C - Room 204	Applied Probability		Applied Probability	Law, Law Enforcement & Public Policy		Law, Law Enforcement & PP
8	C - Room 205	Computing - Constraint Programming		Computing - Constraint Programming	Computing - Constraint Programming		Computing - Constraint Programming
9	C - Room 206A	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing
10	C - Room 206B	SAS Global & Lumina Decision Systems	**Plenary Susan DeVore Build, Test, Scale: Innovative Strategies that are Transforming the U.S. Healthcare System C-Ballroom A**	Frontline Systems & Gurobi Optimization	IBM ILOG & AMPL	**Keynote Edelman Reprise 2011 Edelman Winner Midwest ISO Application of O.R. to Electricity Markets C-Ballroom A**	Americal Optimal Decisions & Tableau Software
11	C - Room 207A	Applied Probability		Applied Probability	Applied Probability		Applied Probability
12	C - Room 207BC	Computing -Comput. Stochastic Opt.		Computing -Comput. Stochastic Opt.	Computing -Comput. Stochastic Opt.		Computing -Comput. Stochastic Opt.
13	C - Room 207D	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing		Pricing with Inventory or Real Estate
14	C - Room 208A	ENRE - Energy		ENRE - Energy	ENRE - Energy		ENRE - Energy
15	C - Room 208B	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
16	C - Room 209A	ENRE - Environment & Sustainability		ENRE - Environment & Sustainability	ENRE - Environment & Sustainability		ENRE - Environment & Sustainability
17	C - Room 209B	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
18	C - Room 210A	Scheduling & Project Mgt.		Scheduling & Project Mgt.	Scheduling & Project Mgt.		Scheduling & Project Mgt.
19	C - Room 210B	Financial Services		Financial Services	Financial Services		Financial Services
20	C - Room 211A	Optimization - Global Opt.		Optimization - Global Opt.	Optimization - Global Opt.	**Keynote IFORS Lecture Yves Crama Boolean Methods in O.R. C-Room 217A**	Optimization - Global Opt.
21	C - Room 211B	Opt. - Stochastic Programming		Opt. - Stochastic Programming	Opt. - Stochastic Programming		Opt. - Stochastic Programming
22	C - Room 212A	Opt. - Nonlinear Programming		Opt. - Nonlinear Programming	Opt. - Nonlinear Programming		Opt. - Nonlinear Programming
23	C - Room 212B	INFORMS International Activities Comm.		Aviation Applications	Aviation Applications		Aviation Applications
24	C - Room 213A	Opt. - Integer Programming		Opt. - Integer Programming	Opt. - Integer Programming		Opt. - Integer Programming
25	C - Room 213BC	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
26	C - Room 213D	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
27	C - Room 214	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
28	C - Room 215	Mfg. & Service Oper Mgt. - Service Mgt.		MSOM - Service Mgt.	MSOM - Service Mgt.		MSOM - Service Mgt.
29	C - Room 216A	Quantitative Finance		Quantitative Finance	Quantitative Finance		Quantitative Finance
30	C - Room 216B	Mfg. & Service Oper Mgt. - iFORM		MSOM - iFORM	MSOM - iFORM		Risk & Uncertainty in Supply Chain
31	C - Room 217A	Health Applications		Health Applications	Health Applications		Health Applications
32	C - Room 217BC	Railway Applications		Railway Applications	Railway Applications		Railway Applications
33	C - Room 217D	Quality, Statistics & Reliability		QSR	QSR		QSR
34	C - Room 218A	Health Applications		Health Applications	Health Applications		Health Applications
35	C - Room 218B	Quality, Statistics & Reliability		ENRE - Energy	QSR		QSR

Track	Room	TA 8:00-9:30	Plenary 10:00-10:50	TB 11:00-12:30	TC 1:30-3:00	Plenary 3:10-4:00	TD 4:30-6:00
36	C - Room 219A	Health Applications		Health Applications	Health Applications		Health Applications
37	C - Room 219B	Quality, Statistics & Reliability		QSR	QSR		QSR
38	H - Johnson Rm, 4th Fl.	Location Analysis		Location Analysis	Location Analysis		Location Analysis
39	H - Morehead, 3rd Fl.	E-Business		E-Business	E-Business		E-Business
40	H - Walker Rm, 4th Fl.	Technology Mgt.		Technology Mgt.	Technology Mgt.		Technology Mgt.
41	H - Waring Rm,4th Fl.	New Product Development		New Product Development	Analytics for Innovation		No Session
42	H- Gwynn Rm, 4th Fl.	Information Systems Society		Information Systems Society	Information Systems Society		Information Systems Society
43	H - Suite 402, 4th Fl.	ENRE - Energy		ENRE - Energy	ENRE - Energy		ENRE - Energy
44	H - Suite 406, 4th Fl.	Managing Disruptions in SC		Managing Disruptions in SC	Managing Disruptions in SC		Managing Disruptions in SC
45	H- Suite 407, 4th Fl.	Auctions		Auctions	Auctions		Auctions
46	H - Suite 403, 4th Fl.	INFORM-ED		INFORM-ED	INFORM-ED		Organizational Culture
47	H - Dunn Rm, 3rd Fl.	Transportation Science & Logistics		TSL	TSL		TSL
48	H - Graham Rm, 3rd Fl.	Transportation Science & Logistics		TSL	TSL		TSL
49	H - Graves Rm, 3rd Fl.	Simulation		Simulation	Simulation		Simulation
50	H - Ardrey Rm, 3rd Fl.	Behavioral Operations Mgt.		Behavioral Operations Mgt.	Behavioral Operations Mgt.		Behavioral Operations Mgt.
51	H - Caldwell Rm, 3rd Fl.	Transportation Science & Logistics		TSL	TSL		TSL
52	H - North Carolina, 3rd Fl.	TSL - Facility Logistics		TSL - Facility Logistics	TSL - Facility Logistics		TSL - Facility Logistics
53	H - South Carolina, 3rd Fl.	Data Mining		Data Mining	Data Mining		Data Mining
54	H - Charlotte Hall, 3rd Fl.	No Session		Semiconductor Industry	Junior Faculty Interest Group (JFIG)		Free Website Mgt. Tools for Subdivisions
55	H - Mecklenburg Hall, 3rd Fl.	Analytics		Analytics	Analytics		Analytics
56	H - Biltmore Boardrm, 2nd Fl.	Healthcare Topics		Healthcare	O.R. Scheduling		O.R. Scheduling
57	W - Providence I, Lobby	Aviation Applications		Aviation Applications	Aviation Applications		Aviation Applications
58	W - Providence II, Lobbyl	Military Applications		Military Applications	Military Applications		Military Applications
59	W - Providence III, Lobby	Service Science		Service Science	Service Science		Service Science
60	W - College Rm, 2nd Fl.	Optimization - Linear Prog. & Complementarity		Optimization - Linear Prog. & Complementarity	Optimization - Linear Prog. & Complementarity		Optimization - Linear Prog. & Complementarity
61	W - Sharon Room, 2nd Fl.	Maritime Transportation		Sensors, Signals & Flow	Energy Issues in Transportation		Transportation
62	W - Independence Rm, 2nd Fl.	Biofuels & Renewable Sources		Uncertainty in Power Output	Energy Production Forecasting		Energy Pricing
63	W - Tryon North, 2nd Fl.	Multiple Criteria Decision Making		Multiple Criteria Decision Making	Multiple Criteria Decision Making		Multiple Criteria Decision Making
64	W - Queens Rm, 2nd Fl.	Public Programs		Public Programs	Public Programs		Public Programs
65	W - Kings Rm, 2nd Fl	Service Science		Service Science	Industry Specific Service Topics		Planning in Service Industries
66	W - Park Rm, 2nd Fl.	Workforce Engineering & Mgt.		Workforce Engineering & Mgt.	Workforce Engineering & Mgt.		Workforce Engineering & Mgt.
67	W - Grand A, 2nd Fl.	Artificial Intelligence		Artificial Intelligence	Artificial Intelligence		Game Theory
68	W - Grand B, 2nd Fl.	Job Placement Services		Job Placement Services	Competition in Supply Chain		Supply Chain
69	W - Grand D, 2nd Fl.	MSOM - Sustainable Operations		MSOM - Sustainable Operations	MSOM - Sustainable Operations		MSOM - Sustainable Operations

Track	Room	WA 8:00-9:30	Plenary 10:00–10:50	WB 11:00-12:30	WC 12:45-2:15	WD 2:45 - 4:15	WE 4:30-6:00
1	C - Room 201A	MSOM - Supply Chain Ops.		MSOM - Supply Chain Ops.	MSOM - Supply Chain Ops.	Forecasting	Stochastic Optimization
2	C - Room 201B	Pricing		Pricing	No Session	Marketing	Marketing
3	C - Room 202A	Inventory Mgt.		Inventory Mgt.	Inventory Mgt.	Inventory Mgt.	Inventory Mgt.
4	C - Room 202B	Network Optimization		Network Optimization	Network Optimization	No Session	No Session
5	C - Room 203A	Optimization		No Session	No Session	No Session	No Session
6	C - Room 203B	Scheduling		Scheduling	Scheduling	No Session	No Session
7	C - Room 204	Simulation		Simulation	Simulation	Queueing Models	Queueing Models
8	C - Room 205	Dynamic Programming		Disaster & Emergency Mgt.	Integer Optimization	Robust Opt.	Dynamic Programming
9	C - Room 206A	No Session		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing
10	C - Room 206B	AnyLogic	**Plenary 2011 Daniel H. Wagner Prize Presentation C-Ballroom A**	Risk Mgt.	Finance	No Session	No Session
11	C - Room 207A	Applied Probability		Applied Probability	Applied Probability	Applied Probability	Applied Probability
12	C - Room 207BC	Stochastic Optimization		Stochastic Optimization	Stochastic Optimization	Stochastic Optimization	No Session
13	C - Room 207D	Revenue Mgt.		Dynamic Pricing	Revenue Mgt.	No Session	No Session
14	C - Room 208A	ENRE – Energy		ENRE – Energy	ENRE – Energy	ENRE – Energy	ENRE – Energy
15	C - Room 208B	Decision Analysis		Decision Analysis	Decision Analysis	Decision Analysis	No Session
16	C - Room 209A	ENRE - Environment & Sustainability		ENRE - Environment & Sustainability	ENRE - Mining	ENRE - Mining	No Session
17	C - Room 209B	Decision Analysis		Decision Analysis	Decision Analysis	No Session	No Session
18	C - Room 210A	Scheduling & Project Mgt.		Lot-Sizing	Production & Scheduling	Project Mgt.	No Session
19	C - Room 210B	Banking & Insurance		No Session	Economics	Economics	Financial Engineering
20	C - Room 211A	Opt. - Global Opt.		Opt. - Global Opt.	Opt. - Global Opt.	No Session	Combinatorial Opt.
21	C - Room 211B	Opt. - Stochastic Programming		Opt. - Stochastic Programming	Opt. - Stochastic Programming	Opt. - Stochastic Programming	Opt. - Stochastic Programming
22	C - Room 212A	Opt. - Nonlinear Programming		Opt. - Nonlinear Programming	Opt. - Nonlinear Programming	Nonlinear Optimization	Continuous Opt.
23	C - Room 212B	Aviation Applications		Homeland Security	Homeland Security	Disaster & Emergency Mgt.	Disaster & Emergency Mgt.
24	C - Room 213A	Opt. - Integer Programming		Opt. - Integer Programming	Opt. - Integer Programming	Opt. - Integer Programming	Opt. - Integer Programming
25	C - Room 213BC	Mfg. & Service Operations Mgt.		MSOM	MSOM	MSOM	MSOM
26	C - Room 213D	Mfg. & Service Operations Mgt.		MSOM	Outsourcing	Outsourcing	Retail Mgt.
27	C - Room 214	Mfg. & Service Operations Mgt.		MSOM	MSOM	MSOM	No Session
28	C - Room 215	MSOM - Service Mgt.		MSOM - Service Mgt.	Environmental Operations	MSOM - Service Mgt.	Environmental Operations
29	C - Room 216A	Quantitative Finance		Quantitative Finance	Operations/Finance Interface	No Session	No Session
30	C - Room 216B	Supply Chain, Risk Mgt.		No Session	No Session	Supply Chain	Supply Chain
31	C - Room 217A	Health Applications		Health Applications	Health Applications	Health Applications	Health Applications
32	C - Room 217BC	Sustainability		Railway Applications	Sustainability	No Session	No Session
33	C - Room 217D	Quality, Statistics & Reliability		QSR	QSR	QSR	QSR
34	C - Room 218A	Health Applications		Health Applications	Health Applications	Health Applications	Health Applications
35	C - Room 218B	QSR		Quality Mgt.	No Session	No Session	No Session

Track	Room	WA 8:00-9:30	Plenary 10:00–10:50	WB 11:00-12:30	WC 12:45-2:15	WD 2:45 - 4:15	WE 4:30-6:00
36	C - Room 219A	Health Applications		No Session	Data Mining	No Session	No Session
37	C - Room 219B	QSR		QSR	QSR	No Session	No Session
38	H - Johnson Rm, 4th Fl.	Vehicle Routing		Vehicle Routing	Vehicle Routing	No Session	No Session
39	H - Morehead, 3rd Fl.	E-Business		E-Business	E-Business	E-Business	No Session
40	H - Walker Room, 4th Fl.	Technology Mgt.		Technology Mgt.	Technology Mgt.	No Session	No Session
41	H - Warring Room,4th Fl.	Productivity		Research & Development	Corporate Strategy	Strategy	No Session
42	H- Gwynn Room, 4th Fl.	Information Systems		Information Systems	Information Systems	Information Systems	Information Systems
43	H - Suite 402, 4th Fl.	ENRE – Energy		ENRE – Energy	ENRE – Energy	ENRE – Energy	No Session
44	H - Suite 406, 4th Fl.	Supply Chain Mgt.		Supply Chain Mgt.	Opt. Methodology	Energy	Energy
45	H- Suite 407, 4th Fl.	Procurement		Reliability	Reliability	Statistics Quality Control	Statistics Quality Control
46	H - Suite 403, 4th Fl.	No Session		Organization Theory	Organization Theory	Behavioral Operations	No Session
47	H - Dunn Rm, 3rd Fl."	Transportation Science & Logistics		TSL	TSL	TSL	TSL
48	H - Graham Rm, 3rd Fl.	Transportation Science & Logistics		TSL	TSL	Transportation	Transportation
49	H - Graves Room, 3rd Fl.	Simulation		Simulation	Simulation	Simulation	No Session
50	H - Audrey Room, 3rd Fl.	Behavioral Operations Mgt.		Behavioral Operations Mgt.	Data Mining	Data Mining	No Session
51	H - Caldwell Room, 3rd Fl.	Transportation Science & Logistics		TSL	TSL	TSL	No Session
52	H - North Carolina, 3rd Fl.	TSL - Facility Location		TSL - Facility Location	No Session	Facility Location	Facility Location
53	H - South Carolina, 3rd Fl.	Data Mining		Data Mining	Data Mining	No Session	No Session
54	H - Charlotte Hall, 3rd Fl.	Jr. Faculty Interest Group		JFIG	No Session	Analytics	Analytics
55	H - Mecklenburg Hall, 3rd Fl.	Analytics		Analytics	Analytics	Analytics	No Session
56	H - Biltmore Boardroom, 2nd Fl.	Patient Flow		Health Care	Health Care	Health Care	No Session
57	W - Providence I, Lobby	Aviation Applications		Aviation Applications	Aviation Applications	Aviation Applications	Aviation Applications
58	W - Providence II, Lobbyl	Military Applications		Military Applications	Military Applications	Military Applications	Military Applications
59	W - Providence III, Lobby	Service Science		Service Science	Service Science	Service Science	Service Science
60	W - College Room, 2nd Fl.	Opt. - Linear Programming		Opt. - Linear Programming	Opt. - Linear Programming	Linear Optimization	No Session
61	W - Sharon Room, 2nd Fl.	Traffic Planning		Network Planning	Scheduling	Transportation	Transportation
62	W - Independence Room, 2nd Fl.	Energy		Energy	Energy	Energy	Supply Chain
63	W - Tryon North, 2nd Fl.	Multiple Criteria Decision Making		Multiple Criteria Decision Making	Multiple Criteria Decision Making	Multiple Criteria Decision Making	Multiple Criteria Decision Making
64	W - Queens Room, 2nd Fl.	Public Programs		Public Programs	No Session	Health Care	No Session
65	W - Kings Room, 2nd Fl.	Operations & SC		Retailing	Procurement & Pricing	Operations Mgt.	Operations Mgt.
66	W - Park Room, 2nd Fl.	Logistics		Logistics	Logistics	Manufacturing	No Session
67	W - Grand A, 2nd Fl.	Game Theory		Game Theory	Systems Analysis	Business Applications	Business Applications
68	W - Grand B, 2nd Fl.	Game Theory		Supply Chain	Supply Chain	Supply Chain, Green	Remanufacturing
69	W - Grand D, 2nd Fl.	MSOM - Sustainable Ops.		MSOM - Sustainable Ops.	MSOM - Sustainable Ops.	No Session	MSOM - Sustainable Ops.

Invited Cluster Chairs

Auctions
Robert Day
University of Connecticut

Martin Bichler
Technische Universität München

Cloud Computing
Michael Murphy
Coastal Carolina University

Brian Larkins
Coastal Carolina University

Computational Biology (Joint with Computing Society)
Russell Schwartz
Carnegie Mellon University

Ming-Ying Leung
University of Texas at El Paso

Data Envelopment Analysis
Larry Seiford
University of Michigan

Doing Good with Good O.R. Student Competition
Donna Llewellyn
Georgia Institute of Technology

Michael Johnson
University of Massachusetts

George B. Dantzig Dissertation Prize
Stephan Biller
General Motors R & D

Homeland Security/Emergency Preparedness
Les Servi
MITRE Corporation

2011 INFORMS Prize
Michele Fisher
Sasol Technology (Pty) Ltd.

Erica Klampfl
Ford Research & Advanced Engineering

INFORMS International Activities Committee
Judy Jin
University of Michigan

Job Placement Services
Bala Shetty
Texas A&M University

Law, Law Enforcement & Public Policy
Doug Samuelson
InfoLogix, Inc.

Managing Disruptions in Supply Chains
Ed Pohl
University of Arkansas

Chase Rainwater
University of Arkansas

Media Relations
Barry List
INFORMS

New Product Development
Raul Chao
University of Virginia

Cheryl Druehl
George Mason University

Nicholson Student Paper Prize
Mor Armony
New York University

Optimization in Finance
John Beasley
Brunel University

Project Management & Scheduling
Nick Hall
Ohio State University

Marc Posner
Ohio State University

Quantitative Finance
Stathis Tompaidis
University of Texas at Austin

Kumar Muthuraman
University of Texas at Austin

Risk Management
John Birge
University of Chicago

Undergraduate O.R. Prize
David Czerwinski
San Jose State University

Daniel H. Wagner Prize for Excellence in O.R.
Allen Butler
Daniel H. Wagner Associates

Workforce Engineering & Management
Esma Gel
Arizona State University

Yun Fong Lim
Singapore Management University



Analytics
Manoj K. Chari
SAS Institute, Inc.

Michael Gorman
University of Dayton

Doug Samuelson
InfoLogix, Inc.

Applied Probability
Achal Bassamboo
Northwestern University

Hanqin Zhang
National University of Singapore

Artificial Intelligence
Huimin Zhao
University of Wisconsin-Milwaukee

Aviation Applications
Poornima Balakrishna
SENSIS

Behavioral Operations Management
Anton Ovchinnikov
University of Virginia

Computing Society
William Cook
Georgia Institute of Technology

Computational Stochastic Optimization
Warren Powell
Princeton University

Constraint Programming & Integrated Methods
Willem-Jan van Hoeve
Carnegie Mellon University

Louis-Martin Rosseau
École Polytechnique de Montréal

Large-Scale Computation
Ted Ralphs
Lehigh University

Open Source Software
Robin Lougee
IBM

Computing/Optimization (Joint)
Nick Sahinidis
Carnegie Mellon University

Christine Ann Shoemaker
Cornell University

CPMS, The Practice Section of INFORMS
Doug Samuelson
InfoLogix, Inc.

Manoj K. Chari
SAS Institute, Inc.

Data Mining
Jing Li
Arizona State University

Decision Analysis
Canan Ulu
University of Texas-Austin

James C. Felli
Eli Lilly & Company

eBusiness
Terrence August
University of California

Byung Cho Kim
Virginia Tech

Energy, Natural Resources & the Environment
Energy
Ramteen Sioshansi
Ohio State University

Environment & Sustainability
Hayri Onal
University of Illinois

Forestry
Marc McDill
Pennsylvania State University

Mining
Alexandra Newman
Colorado School of Mines

Financial Services
Chanaka Edirisinghe
University of Tennessee

Health Applications
Steven Shechter
University of British Columbia

INFORM-ED
Matt Bailey
Bucknell University

Information Systems
Param Vir Singh
Carnegie Mellon University

Junior Faculty Interest Group
Dionne Aleman
University of Toronto

Location Analysis
Erhan Kutanoglu
University of Texas

Manufacturing & Service Operations Management
Vinayak Deshpande
Purdue University

Gurhan Kok
Duke University

Healthcare Operations
Vivek Farias
Massachusetts Institute of Technology

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Lingxiu Dong
Washington Univ. - St. Louis

Danko Turcic
Washington Univ. - St. Louis

Service Management
Philipp Afeche
University of Toronto

Supply Chain Operations
Felipe Caro
UCLA

Sustainable Operations
Atalay Atasu
Georgia Institute of Technology

Ravi Subramanian
Georgia Institute of Technology

Military Applications Society
Greg Parlier
Institute for Defense Analyses

Multiple Criteria Decision Making
Murat Koksalan
Middle East Technical University

Optimization
Computational Optimization & Software
Steven Dirske
GAMS Development Corp.

Global Optimization
Oleg Prokopyev
University of Pittsburgh

Integer Programming
Oktay Gunluk
IBM TJ Watson Research Center

Linear Programming & Complementarity
Miguel Anjos
École Polytechnique de Montréal

Networks
Mauricio Resende
AT&T Laboratories

Nonlinear Programming
Frank E. Curtis
Lehigh University

Stochastic Programming
Huseying Topaloglu
Cornell University

Organization Science
Mary Zellmer-Bruhn
University of Minnesota

Public Programs, Service & Needs
John Hollywood
Rand Corporation

Jeremie Gallien
London Business School

Karen Smilowitz
Northwestern University

Quality, Statistics & Reliability
Qiang Huang
University of Southern California

Railway Applications
Jagadish Jampani
CSX Transportation

Revenue Management & Pricing
Frederick Harris
Wake Forest University

Shiva Kommareddi
SAS Institute, Inc.

Raj Solanki
SAS Institute, Inc.

Service Science
Ming-Hui Huang
National Taiwan University

Simulation
Bahar Biller
Carnegie Mellon University

SpORts
Joel Oberstone
University of San Francisco

Spreadsheet Productivity Research Interest Group
Tom Groleau
Carthage College

Technology Management
Cheryl Druehl
George Mason University

Telecommunications
Abdullah Konak
Pennsylvania State University

Ivan Guardiola
Missouri University

Transportation Science & Logistics
Tom Van Woensel
Eindhoven Univ. of Technology

Facility Logistics
Sadan Kulturel-Konak
Pennsylvania State University

Women in OR/MS
Eva Regnier
Naval Postgraduate School

Esma Gel
Arizona State University

Sadan Kulturel-Konak
Pennsylvania State University

INFORMS MEETINGS

2012

April 15-17
INFORMS Conference on Business Analytics & Operations Research
Applying Science to the Art of Business
Hyatt Regency Huntington Beach
Huntington Beach, California
Chair: Erica Klampfl, Ford Research & Advanced Engineering
http://meetings2.informs.org/Analytics2012/

June 24-27
INFORMS International Beijing
In conjunction with Operations Research Society of China
China National Convention Center
Beijing, China
Chair: Jian Chen, Tsinghua University
http://meetings2.informs.org/Beijing2012

October 14-17
INFORMS Annual Meeting 2012 Phoenix
Phoenix Convention Center
Phoenix, Arizona
Chair: Ronald G. Askin, Arizona State Univ.
http://meetings2.informs.org/Phoenix2012

2013

April 7-9
INFORMS Conference on Business Analytics & Operations Research
Applying Science to the Art of Business
Grand Hyatt San Antonio
San Antonio, Texas

October 6-9
INFORMS Annual Meeting 2013 Minneapolis
Minneapolis Convention Center & Hilton Minneapolis
Minneapolis, Minnesota
Chair: Robert G. Haight, U.S. Forest Service
rhaight@fs.fed.us

INFORMS COMMUNITIES

2011

December 11-14
Winter Simulation Conference 2011
Arizona Grand
Phoenix, Arizona
Chair: K. Preston White, Jr.
www.wintersim.org

December 12-15
Land Translog II-Joint Workshop on Location & Network Design, Transportation & Logistics
Puerto Varas, Chile
Chair: Andres Weintraub, Universidad de Chile
http://www.land-translog.cl/

2012

February 9-12
INFORMS Organization Science Winter Conference
Sheraton Steamboat Springs
Steamboat Springs, Colorado
Chair: Daniel Levinthal, University of Pennsylvania
www.informs.org/Pubs/OrgSci/News/Organization-Science-Winter-Conference

February 24-26
INFORMS Optimization Society Conference
University of Miami
Coral Gables, Florida
Chair: Tallys Yunes, University of Miami
http://www.bus.miami.edu/ios/

March 15-17
INFORMS Telecommunications Conference
Renaissance Hotel
Boca Raton, Florida
Chair: Eli V. Olinik, Southern Methodist University
olinick@lyle.smu.edu

March 26-28
INFORMS Military Applications Society Conference
Hyatt Monterey
Monterey, CA
Chair: William Fox, Naval Postgraduate School
wpfox@nps.edu

May 20-24
INFORMS Group Decision & Negotiation Conference
Golden Tulip Recife Palace
Recife, Brazil
Chairs: Melvin F Shakun, New York University & Marc Kilgour, Wilfrid Laurier University
http://www.cdsid.org.br/gdn2012/

June 7-9
INFORMS Marketing Science Conference
Westin Copley Place
Boston, Massachusetts
Chairs: Shuba Srinivasan & Patrick Kaufmann, Boston University
http://www.bu.edu/marketingscience2012/

June 17-19
INFORMS MSOM Annual Conference
Columbia School of Engineering and Applied Science & Columbia Business School
New York, New York
Chair: Soulaymane Kachani
Columbia University
kachani@ieor.columbia.edu

June 29-30
INFORMS Revenue Management & Pricing Section Conference
European School of Management and Technology (ESMT)
Berlin, Germany
Chair: Catalina Stefanescu-Cuntze
Catalina.Stefanescu-Cuntze@esmt.org

October 3-5
INFORMS Southeastern Chapter Annual Meeting
Myrtle Beach Hilton Resort
Myrtle Beach, South Carolina
http://www.roanoke.edu/business/SEINFORMS.HTM

December 9-12
Winter Simulation Conference 2012
InterContinental Berlin
Berlin, Germany
Chair: Oliver Rose
www.wintersim.com

How to Navigate the Technical Sessions

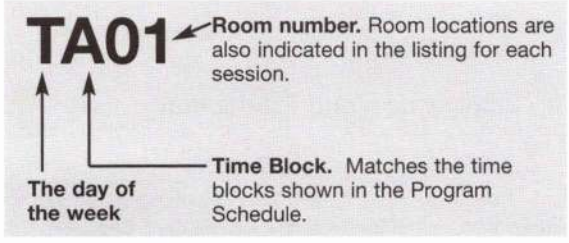
There are four primary resources to help you understand and navigate the Technical Sessions:

- This Technical Session listing, which provides the most detailed information. The listing is presented chronologically by day/time, showing each session and the papers/abstracts/authors within each session.
- The Author and Session indices provide cross-reference assistance (pages 448-483).
- The floor plans on pages 40-43 show you where technical session tracks are located.
- The Program Schedule is on pages 44-51.

Quickest Way to Find Your Own Session

Use the Author Index (page 448) — the session code for your presentation will be shown along with the room location. You can also refer to the full session listing for the room location of your session.

The Session Codes



Time Blocks

Sunday - Tuesday

A — 8:00am - 9:30am
B — 11:00am - 12:30pm
C — 1:30pm - 3:00pm
D — 4:30pm - 6:00pm

Wednesday

A — 8:00am - 9:30am
B — 11:00am - 12:30pm
C — 12:45pm - 2:15pm
D — 2:45pm - 4:15pm
D — 4:30pm - 6:00pm

Room Locations /Tracks

All tracks and technical sessions will be held in the Charlotte Convention Center, Westin Hotel, and Hilton Center City Hotel. Room numbers are shown on the Track Schedule and in the technical session listing.

Sunday, 8:00am - 9:30am

■ SA01

C - Room 201A

Nicholson Student Paper Prize I

Cluster: Nicholson Student Paper Prize

Invited Session

Chair: Mor Armony, Associate Professor, New York University, 44 West 4th Street, New York, NY, 10012, United States of America, marmony@stern.nyu.edu

1 - The Gomory-Chvátal Closure of a Non-Rational Polytope is a Rational Polytope

Juliane Dunkel, PhD, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, juliane@mit.edu, Andreas Schulz

The question as to whether the Gomory-Chvátal closure of a non-rational polytope is a polytope has been a longstanding open problem in integer programming. In this paper, we answer this question in the affirmative. Our proof is geometrically motivated and makes use of classic results from polyhedral theory and the geometry of numbers. In particular, integer lattices and reduced lattice bases play a crucial role.

2 - Fast Multiple Splitting Algorithms for Convex Optimization

Shiqian Ma, Columbia University, 500 W 120th Street, Mudd, Room 313, New York, NY, 10027, United States of America, sm2756@columbia.edu, Donald Goldfarb

We present two different classes of multiple-splitting algorithms for solving convex optimization problems. The basic and accelerated versions of our algorithms need respectively O(1/eps) and O(1/sqrt(eps)) iterations to obtain an eps-optimal solution. To the best of our knowledge, these complexity results are the first ones of this type that have been given for splitting and alternating direction type methods.

3 - Understanding the Performance of the Long Chain and Sparse Designs in Process Flexibility

Yehua Wei, Massachusetts Insitute of Technology, 235 Albany Street 5113C, Cambridge, MA, 02139, United States of America, y4wei@mit.edu, David Simchi-Levi

This presentation aims to provide better theoretical understanding of long chain designs. We uncover a fundamental property, supermodularity, that serves as an important building block in the analysis. Then, we apply the supermodularity property as a key lemma to show that the performance of the long chain can be characterized by the difference between the performances of two open chains. Finally, we will present several interesting applications of this characterization of the long chain.

■ SA02

C - Room 201B

Risk Management in Portfolio Optimization

Cluster: Risk Management

Invited Session

Chair: John Birge, Professor, University of Chicago, Booth School of Business, Chicago, IL, United States of America, john.birge@chicagobooth.edu

1 - Inverse Optimization: A New Perspective on the Black-Litterman Model

Vishal Gupta, Massachusetts Institute of Technology, Operations Research Center, 77 Massachusetts Avenue, E40-139, Cambridge, MA, 02139, United States of America, vgupta1@mit.edu, Dimitris Bertsimas, Ioannis C. Paschalidis

The Black-Litterman (BL) model is a widely-used estimation procedure in finance. By replacing its statistical framework with inverse optimization techniques, we extend the scope of this model to include information on volatility and market dynamics. We also construct estimators for general convex risk measures beyond variance. Historical backtesting shows these estimators are more robust and efficient than BL counterparts.

2 - Linear Solution Schemes for the Mean-semivariance Portfolio Allocation Model

Jorge A. Sefair, University of Florida, 303 Weil Hall, Industrial and Systems Engineering, Gainesville, FL, 32611-6595, United States of America, j.sefair@ufl.edu, Andrés L. Medaglia, Carlos Y. Méndez, Luis F. Zuluaga

We propose two linear solution schemes for the mean-semivariance model, which are particularly useful when the size of the problem, the available optimization solver, or expertise do not allow the solution of the nonlinear formulation. We illustrate the solution schemes by solving real instances with liquid assets and go/no-go projects

3 - Estimation and Optimization of Portfolio Allocations

John Birge, Professor, University of Chicago, Booth School of Business, Chicago, IL, United States of America, john.birge@chicagobooth.edu

A variety of methods have been proposed to incorporate the consideration of estimation errors into portfolio optimization. This talk will summarize those approaches, describe a general form of Bayesian updating similar to the Black-Litterman model, and compare the various procedures on sets of example portfolios.

■ SA03

C - Room 202A

Computer Science / OR Interface

Contributed Session

Chair: Merav Aharoni, IBM Research, Haifa University Campus, Haifa, 31905, Israel, MERAV@il.ibm.com

1 - GPU Accelerating MIP Solvers

David Nehme, Operations Research Analyst, Abremod, LLC, 2412 W. 12th Street, Austin, TX, 78703, United States of America, nehme@abremod.com

GPUs on a typical computer have more raw processing power than the CPUs but most MIP solvers use the CPUs exclusively. The current trend is for GPUs to grow in processing power and energy efficiency faster than CPUs and recent advances in development tools make it practical to perform more complex operations on the GPUs. This talk presents methods to make use of the otherwise-idle GPUs to complement the CPU-based algorithms for finding solutions to mixed-integer programs.

2 - GPU-Based Parallel Algorithm for IMRT Beam Angle Optimization

Likang Ma, University of Houston, 5805 Gulfton St., Apt. 2914, Houston, TX, 77081, United States of America, leonddr@gmail.com, Gino J. Lim

We discuss design and implementation of GPU-based parallel solvers for optimizing beam angle selection and fluence maps in Intensity Modulated Radiation Therapy. The first implementation is GPU-based linear programming (LP) solver that optimizes fluence maps. We discuss parallel neighborhood search technique using our GPU-based LP solver for the beam angle selection problem. Numerical experiments are made to show the performance of our approach against CPU-based algorithms using CPLEX solver.

3 - Test-driven MIP Modeling

Lars Beckmann, University of Paderborn, Uhlenstr. 10, Paderborn, 33098, Germany, lars.beckmann@gmail.com, Dirk Schumacher

Test-driven development (TDD) is a well-known methodology which requires developers to define tests prior to implementation. We propose to adapt this paradigm to MIP modeling and present a number of test categories. Each of these categories has a focus on a different aspect of the MIP modeling process and its surrounding decision support system. The ultimate goal is to specify and validate MIP models in a structured manner.

4 - Constraint Programming for Cloud Computing

Merav Aharoni, IBM Research, Haifa University Campus, Haifa, 31905, Israel, MERAV@il.ibm.com, Erez Hadad, Yosef Moatti, Odellia Boni

One of the major problems in the field of cloud computing is the problem of placing virtual machines on the physical machines (hosts), while satisfying constraints stemming from resources, security and efficiency, and optimizing various objective functions corresponding to the working mode of the cloud. The problem was modeled as a CSP problem and solved by a systematic search solver. Results show the solution to be scalable as well as flexible.

■ SA04

C - Room 202B

Vehicle Routing

Sponsor: Computing Society

Sponsored Session

Chair: Bruce Golden, University of Maryland, College Park, MD, United States of America, bgolden@rhsmith.umd.edu

1 - A New Approach for Solving Truck and Trailer Routing Problems

Ulrich Derigs, University of Cologne, Cologne, Germany, derigs@informatik.uni-koeln.de

The truck and trailer routing problem (TTRP) is an extension of the classical VRP, where vehicles are trucks and trailers, combined. Due to road limitations, a subset of customers can only be served by a truck. A vehicle route starts and ends at a depot, but the trailer can be detached at any customer with the truck continuing to serve customers on a truck subtour without the trailer before returning and reattaching the trailer. We present a heuristic; the computational results are encouraging.

2 - A New Variant of the Windy Postman Problem

Benjamin Dussault, University of Maryland, Department of Mathematics, College Park, MD, United States of America, ben.dussault@gmail.com, Bruce Golden, Chris Groer, Edward Wasil

The windy postman problem (WPP) is a generalization of the traditional Chinese postman problem. In the WPP, the cost of traversing an edge depends on the direction of traversal. In this paper, we propose, model, and solve a variant of the WPP based on real-world considerations.

3 - The Hierarchical Traveling Salesman Problem

Kiran Panchamgam, University of Maryland, College Park, MD, United States of America, kpanch@gmail.com, Yupei Xiong, Bruce Golden, Edward Wasil

In this paper, we describe a simple model for humanitarian relief routing, the hierarchical traveling salesman problem (HTSP). We formulate this model as a mixed integer program. Next, we compare the HTSP and the classical TSP in terms of worst-case behavior. Finally, we solve a set of small HTSP instances.

■ SA05

C - Room 203A

Topics in Supply Chain and Production

Contributed Session

Chair: Houcai Shen, Professor, Nanjing University, Department of Mgmt Sci and Eng., Nanjing, 210093, China, hcshen@nju.edu.cn

1 - Challenges in Handling the Pharmaceutical Cold Chains

Niranjan Kulkarni, Niranjan.Kulkarni@crbusa.com, Suman Niranjan, Vishnu Kesaraju

In the pharmaceutical and medical domain, certain raw material or products have to be handled, stored and transported in a controlled environment to ensure that quality is not compromised. It is very crucial that the temperature is controlled below ambient, and in some cases, below freezing. Furthermore, temperature constraint dictates the equipment that should be used, e.g. products which require storage between 2∞C and 8∞C will be stored in refrigerators and not freezers, etc. Such conditions create particularly challenging situations within the supply chains. Some of the key concerns that are required to be addressed include container selection, use of temperature monitoring and sensing devices, choosing suitable packing material, designing appropriate cold storage units/warehouses, and security. It is recommended to perform risk analysis before setting up a facility, storage units, and designing the supply chain for such products. This paper discusses some of the challenges encountered within pharmaceutical cold supply chains and outlines few industrial engineering techniques that can be used to analyze and design the same.

2 - Just-In-Time vs. Just-In-Case for Capital Projects Supply Chain Management

Poyraz Kayabas, Graduate Research Assistant, North Dakota State University, Room 212, CJPP Building,, P.O. Box 6050, NDSU, Fargo, ND, 58108, United States of America, Poyraz.Kayabas@ndsu.edu, Joseph Szmerekovsky

Supply chain management tactics used in capital projects management are related to minimizing uncertainty and mitigating risk to improve overall project performance. The presentation will include a process-based and hybrid project management framework between just-in-time (JIT) and just-in-case (JIC) strategies for analyzing opportunities and threats in a stochastic business environment.

3 - Fresh-Product Supply Chain Optimization Involving Three Parties: Producer, Distributor, and 3PL Provider

Jian Chen, School of Economics and Management, Tsinghua University, Beijing, 100084, China, chenj@sem.tsinghua.edu.cn, Q.X. Cai, Y.B. Xiao, X.L. Xu

We consider a supply chain in which a producer supplies a fresh product, via a third-party logistics (3PL) provider, to a distributor in a distant export market. The optimal decisions faced by the three parties in the decentralized system, the fully centralized system, and the partially centralized systems, are studied and characterized respectively. To facilitate coordination of the three parties, we propose an incentive scheme that can make the decentralized supply chain coordinated, and eliminate the two sources of "double marginalization" that exist in the three-level decentralized system.

4 - Estimating Clearing Functions for Multistage Production Systems with Alternative Machines

Reha Uzsoy, Professor, North Carolina State University, 300 Daniels Hall, College of Engineering, Raleigh, 27695-7906, United States of America, ruzsoy@ncsu.edu, Erinc Albey, Umit Bilge

We examine the problem of estimating nonlinear clearing functions to describe therelationship between throughput and WIP levels for multistage production systems withalternative machines. We develop clearing functions using different levels ofaggregation and explore the performance of the resulting production planning models incomputational experiments.

5 - Joint Control of Component Production and Inventory Allocation in M-Type Assemble-to-Order Systems

Houcai Shen, Professor, Nanjing University, Department of Mgmt. Sci. and Eng., Nanjing, 210093, China, hcshen@nju.edu.cn

This paper considers a joint control problem of combined component production and inventory allocation in an assemble-to-order system which consists of two components and three demand classes with lost sales. Each demand class arrives according to a Poisson process, and the production times of each component follow an exponential distribution. By formulating the system as a Markov decision process under the expected total discounted cost criterion, we obtain the optimality equation following the Lippman transformation, from which we derive the structural properties of the optimal control policy.

■ SA06

C - Room 203B

Credit Risk

Cluster: Quantitative Finance

Invited Session

Chair: Antje Berndt, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue GSIA 335, Pittsburgh, PA, 15213, United States of America, aberndt@andrew.cmu.edu

1 - Time Variation in Default Risk Premia

Antje Berndt, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue GSIA 335, Pittsburgh, PA, 15213, United States of America, aberndt@andrew.cmu.edu, Mark Ferguson, Darrell Duffie, Rohan Douglas

We document and explain the time variation in default risk premia between 2001 and 2010.

2 - Short Horizon Expansions for Portfolio Credit Risk

Kay Giesecke, Assistant Professor, Stanford University, Huang Engineering Center, 475 Via Ortega 307, Stanford, CA, 94305, United States of America, giesecke@stanford.edu, Vibhav Bukkapatanam

We provide an approximation to the distribution of losses from defaults and its sensitivities. The approximation is based on an expansion of a transform of the portfolio loss in small time. It is valid for any reduced-form model of correlated default risk. Numerical experiments illustrate its accuracy and computational efficiency.

3 - Explaining Credit Spreads and Volatility Smirk: A Unified Framework

Redouane Elkamhi, University of Iowa, Ames, IA, United States of America, redouane-elkamhi@uiowa.edu, Du Du

This paper shows that non-linear external habit model, when augmented with a peso component in the economic fundamental, is able to jointly price defaultable bonds and equity index options. Time-varying risk aversion induced by habit formation reacts negatively to changes in aggregate consumption by which economic disasters lead to extra jumps in both the pricing kernel and the aggreate equity price. Defaults tend to cluster during disaster times which induces large bond price jumps.

■ SA07

C - Room 204

Information Sharing in Service Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Gad Allon, Northwestern University, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu

1 - Teaching Your Customers to Play Nash

Gad Allon, Northwestern University, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Achal Bassamboo, Ruomeng Cui

Delay announcements informing customers about anticipated delays are prevalent in service-oriented systems. We study a myopic learning scheme that allows the firms and the customers to update their beliefs about the "meaning" of the messages, based on their delay experience. We show how the true meaning of message emerges when there is an equilibrium.

2 - Pricing, Capacity, and Financing Decisions in Two-tier Service Systems

Pengfei Guo, Hong Kong Polytechnic University, Hung Hom, Hong Kong, Hong Kong - PRC, Pengfei.Guo@inet.polyu.edu.hk, George Zhang

We consider a two-tier service system with both free and pay service options. We model such a system with two parallel M/M/1 queues with the mixed goals of profit and social welfare maximization and investigate the pricing, capacity, and financing issues. We develop the conditions under which a two-tier system outperforms a one-tier system. We also find that, in certain situations, regulation issues can be resolved by simple rules.

3 - Call Centers with Delay Information: Models and Insights

Oualid Jouini, Assistant Professor, Ecole Centrale Paris, Grande Voie des Vignes, Chatenay-Malabry, 92290, France, oualid.jouini@ecp.fr, Zeynep Aksin, Yves Dallery

We analyze a call center with impatient customers. We study how informing customers about their anticipated delays affects performance. Customers react by balking upon hearing the delay announcement, and may subsequently renege, particularly if the realized waiting time exceeds the delay that has originally been announced to them. We explore when informing customers about delays is beneficial, and what the optimal coverage should be in these announcements.

■ SA08

C - Room 205

MIPLIB2010 - Selection, Evaluation, and Parallelization

Sponsor: Computing Society/ Large-Scale Computation

Sponsored Session

Chair: Hans Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States of America, Mittelmann@asu.edu

1 - MIPLIB 2010 - Features and Characteristics

Gerald Gamrath, PhD Student, Zuse Institute Berlin, Takustrasse 7, Berlin, 14195, Germany, gamrath@zib.de, Stefan Heinz, Thorsten Koch, Hans Mittelmann, Ted Ralphs, Timo Berthold, Oliver Bastert, Ambros Gleixner, Erling Andersen, Robert E. Bixby, Emilie Danna, Domenico Salvagnin, Tobias Achterberg, Kati Wolter, Daniel E. Steffy, Andrea Lodi

In this talk, we report on the fifth version of the Mixed Integer Programming Library (MIPLIB 2010). We present the eight different test sets that are included in MIPLIB, each of them dedicated to a certain aspect of computational integer programming. MIPLIB further includes tools to run automated tests and to check the accuracy of provided solutions. We finish with the discussion of observations made during the selection process, e.g., concerning performance variability.

2 - Solution Status and Benchmark Results for MIPLIB2010

Hans Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States of America, Mittelmann@asu.edu

We will report on the solution status of all MIPLIB2010 problems as well as on benchmark results for current versions of leading commercial and non-commercial software for the benchmark subset of the library.

3 - UG[SCIP]: Computational Experiments with a Parallel MIP Solver
Yuji Shinano, Zuse Institute Berlin, Takustrasse 7, 14195 Berlin-Dahlem, Berlin, Germany, shinano@zib.de, Michael Wittland, Tobias Achterberg, Timo Berthold, Stefan Heinz, Thorsten Koch

The Ubiquity Generator (UG) framework enables MIP solvers to be run in parallel from the outside of the solver on different target computing environments. This presentation shows computational results for UG[SCIP], a parallel version of the solver SCIP. Our experiments were conducted on a wide range of computing environments, starting from a desktop machine and reaching up to a 7,168 cores supercomputer. In our computational results, we concentrate on instances from MIPLIB2010.

4 - Computational Approaches to Parallel Integer Programming
Ted Ralphs, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, United States of America, ted@lehigh.edu

In this talk, we compare and contrast several different approaches to solving integer programs in parallel using several different open source solvers. We analyze the tradeoffs inherent in the different approaches with respect to modern computer architectures.

■ SA09

C - Room 206A

Retail Pricing

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Goker Aydin, Associate Professor, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States of America, ayding@indiana.edu

1 - Conditional Promotions and Over-spending
Thunyarat Amornpetchkul, University of Michigan, Ann Arbor, MI, United States of America, thunyara@umich.edu, Hyun-Soo Ahn, Ozge Sahin

Conditional promotions (e.g., spend $50 get 30% off, spend $50 get $15 off) are widely used in retail settings. They are effective when some consumers are deal-prone (obtain transaction utility from meeting the condition for the discount). We compare two most common discount schemes (percent off and dollar off) and show that both schemes can lead to consumer over-spending. We also show, depending on the nature of the product, one discount scheme can perform better than the other.

2 - Dynamic Nonlinear Pricing of Perishable Items
Yuri Levin, Queen's University, Goodes Hall, Kingston, ON, Canada, YLevin@business.queensu.ca, Mikhail Nediak

We study the problem of optimal dynamic nonlinear pricing of perishable items under uncertain demand. This problem is faced, for example, by retail outlets planning quantity discounts as well as airlines and hotels employing dynamic pricing in the presence of group bookings. We discuss the structural properties of the pricing policies, implications for the firms, and contrast the policy properties in airline and retail settings.

3 - Designing Price Subsidies for "Green" Products
Stephen Smith, Professor, Santa Clara University, OMIS Department, 500 El Camino Real, Santa Clara, CA, 95053-0382, United States of America, SSmith@scu.edu

Price subsidies are currently offered by governments and public utilities for "green" products such as insulation, solar panels, electric cars, etc. This talk investigates three types of questions regarding these subsidies or rebates: How will a profit maximizing retailer adjust prices in response to these rebates? What are the most cost effective rebate designs, assuming that retailers price to maximize profits? Under what circumstances are some rebate forms better than others?

4 - Early Sales of Seasonal Products with Weather-conditional Rebates
Ozgun Caliskan Demirag, Assistant Professor, Pennsylvania State University-Erie, 5101 Jordan Road Burke 259, School of Business, Erie, PA, 15563, United States of America, ozc1@psu.edu, Fei Gao, Frank Chen

Some retailers of seasonal products adopt weather-conditional rebate programs to induce early sales. In such promotions, early buyers are offered a rebate if a specified weather condition is realized in the later normal season. We show that conditional rebates can increase sales by price discriminating among a customer's post-purchase states. Taking advantage of the early sales, it can also reduce the inventory holding cost and ordering cost; hence can increase the retailer's expected profits.

■ SA10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - Palisade Corporation - Avoiding Failure: Using @RISK to Identify, Analyze and Manage Risk More Successfully
Thompson Terry, Senior Risk Analyst,Trainer, Consultant, Palisade Corporation, 798 Cascadilla Street, Ithaca, NY, 14850, United States of America, tterry@palisade.com

Projects fail. They often fail for a lack of effective planning, either because of excess optimism in terms of time, cost and performance or because of extra work in the plan in terms of scope, resources and unforeseen events. @RISK employs Monte Carlo based simulation to give insight through sophisticated statistical analysis of the various potential outcomes. Understanding range outcomes facilitates effective risk management, prioritizing critical risks and managing expectations.

2 - Salford Systems - Introduction to Salford Systems' Data Mining Suite
Mikhail Golovnya, Senior Scientist, Salford Systems, 9685 Via Excelencia, Ste. 208, San Diego, CA, 92126, United States of America, nancyb@salford-systems.com

Salford Systems offers a highly accurate, ultra-fast predictive and data mining platform for developing models from databases of any size, complexity or organization. Our technologies span classification, regression, survival analysis, missing value analysis and clustering/segmentation. Core components of our platform include CART®, MARS®, TreeNet® and RandomForests®.

■ SA11

C - Room 207A

Large-scale Service Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Itai Gurvich, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60201, United States of America, i-gurvich@kellogg.northwestern.edu

1 - On the Accuracy of Announcing the Delay of the Last Customer to Enter Service in Large Call Centers
Rouba Ibrahim, McGill University, Montreal, QC, Canada, rouba.ibrahim@mail.mcgill.ca, Achal Bassamboo, Mor Armony

We study ways of predicting customer delay in a service system, such as a call center, based on the recent history of delays in that system. A main predictor is the delay of the last customer to enter service (LES) at the time of a new arrival. We prove the asymptotic accuracy of LES in many-server single-class queues with announcement-dependent abandonment. We consider both the Quality-and-Efficiency-Driven (QED) and the Efficiency-Driven (ED) many-server asymptotic regimes.

2 - List-based Routing
Petar Momcilovic, University of Florida, 479 Weil Hall, Gainesville, FL, United States of America, momcilovic@ufl.edu, Avishai Mandelbaum

Routing of customers in a heterogeneous multi-server system is considered. When server service rates are unknown and/or time varying, implementing the fastest server first (FSF) policy is not straightforward. A low-complexity algorithm that approximates FSF routing and does not utilize server rates is proposed. Asymptotic (as the number of servers increases) performance of the algorithm is studied.

3 - The Impact of Dependent Service Times in Large-scale Service Systems
Guodong Pang, Assistant Professor, Pennsylvania State University, Industrial Engineering, University Park, PA, 16802, United States of America, gup3@engr.psu.edu, Ward Whitt

To understand the performance of a large-scale service system, we can employ an infinite-server queueing model with time-varying arrival rate. In that context, we investigate the impact of dependence among successive service times. Our new Gaussian approximation of the number of customers in the system shows that the time-varying mean is unaffected, while the time-varying variance can be affected significantly by the dependence.

4 - Centralized vs. Decentralized Ambulance Diversion: A Network Perspective

Itai Gurvich, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60201, United States of America, i-gurvich@kellogg.northwestern.edu

When crowded, an emergency department (ED) can request diversion of incoming ambulances to neighboring EDs. We study a queueing game in a network of EDs, where each ED decides on a diversion threshold to minimize its average waiting time. We find the existence of an equilibrium that "de-pools" the network and undermines potential benefits of pooling. For the centralized problem, we propose a solution that is approximately optimal and also Pareto improving relative to the equilibrium.

■ SA12

C - Room 207BC

Visualization in Bioinformatics and Computational Biology

Cluster: Computational Biology (Joint cluster ICS)

Invited Session

Chair: Cynthia Gibas, Associate Professor of Bioinformatics and Genomics, University of North Carolina at Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, cgibas@uncc.edu

1 - WaveMap: Feature Discovery Using Visual Analytics

Dennis Livesay, Associate Professor, University of North Carolina Charlotte, 9201 University City Blvd, Charlotte, NC, 28262, United States of America, drlivesa@uncc.edu, Donald Jacobs, Jing Yang, Scott Barlowe

A complete description of protein structure requires knowledge of dynamics, but such descriptions are generally too complex for analysis by traditional methods. In this work, we present a novel visual analytics approach called WaveMap to explore data generated by a protein flexibility model. WaveMap integrates wavelet analysis, visualization, and interactions to facilitate browsing, feature identification and comparison of dynamical quantities.

3 - Visualizing Data Patterns with Micromaps

Daniel Carr, Professor, George Mason University, Statistics Department MS4A7, George Mason University, Fairfax, VA, 22030, United States of America, dcarr@gmu.edu, Linda Pickle

Micromaps are graphics that represent statistical information using an organized set of small maps. Their forms vary to serve different pattern visualization tasks. These forms include partitioned maps linked to statistical graphics such as boxplots, maps conditioned using predictor variable sliders and comparative map sequences augmented to address change blindness.

■ SA13

C - Room 207D

Cargo Revenue and Pricing Management

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Setareh Mardan, Scientist, PROS, 3100 Main Street, Houston, TX, 77002, United States of America, smardan@prosrm.com

1 - Bringing B2B Pricing Optimization to the Cargo Industry

Neil Biehn, Sr Director Science & Research, PROS, 3100 Main Street, Houston, TX, 77002, United States of America, nbiehn@prospricing.com

While the Cargo industry exhibits many characteristics that demand a yield management approach to maximizing revenue, the revenue optimization problem differs from classical passenger revenue management in a fundamental way: Cargo is B2B. We'll leverage examples from other B2B industries including Manufacturing, Distribution and Services and describe how B2B companies around the world are using analytics and operations research to increase revenues and profits.

2 - Dynamic Cargo Revenue Management with Contract and Spot Customers

Lama Moussawi-Haidar, American University of Beirut, Beirut, Lebanon, lm34@aub.edu.lb, Hussein Rida

We consider a cargo revenue management problem in which cargo capacity is sold on a contracted basis or in the spot market. We first solve the static problem of determining how much of the capacity to sell on a contracted basis. The remaining capacity is then dynamically sold to ad hoc customers and may be overbooked. A decision is made regarding which spot requests to accept. We formulate this problem as a Markov decision process and propose several heuristics which we numerically test.

3 - Air Cargo Revenue Management Challenges

Setareh Mardan, Scientist, PROS, 3100 Main Street, Houston, TX, 77002, United States of America, smardan@prosrm.com

We describe the major challenges in air cargo revenue management. We focus on what differentiates air cargo industry from the peer industries. We also discuss some solutions and success factors in this field.

■ SA14

C - Room 208A

Benefits of Modeling Power System Flexibility

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Kory Hedman, Assistant Professor, Arizona State University, P.O. Box 875706, School of ECEE, GWC 206, Tempe, AZ, 85287, United States of America, kory.hedman@asu.edu

1 - Flexibility in Electricity Markets

Eric Krall, Operations Research Analyst, Federal Energy Regulatory Commission, 888 1st St NE, Washington, DC, 20426, United States of America, krall.eric@gmail.com, Kory Hedman, Richard O'Neill, Michael Higgins, Thomas Dautel

Greater flexibility is especially important in the context of a smarter electric grid. In this talk we examine the flexibility of electric assets in electric network optimization models, specifically the unit commitment and economic dispatch problems.

2 - Improving Reserve Requirements

Kory Hedman, Assistant Professor, Arizona State University, P.O. Box 875706, School of ECEE, GWC 206, Tempe, AZ, 85287, United States of America, kory.hedman@asu.edu, Fengyu Wang, Muhong Zhang, Joshua Lyon

Today, operators determine reserve requirements based on using historical data or identifying key transmission lines. With future uncertainties in load, the integration of new resources (wind, solar), and price responsive demand, new methods to determine optimal reserve requirements are needed. This research develops new approaches to determine reserve zones and reserve levels in order to improve reliability and economic efficiency.

3 - Modeling Challenges for Future Electric Power Systems

Jeremy Bloom, Sr. Product Marketing Manager, ILOG Optimization, IBM, San Jose, CA, 95134, United States of America, bloomj@us.ibm.com

Many planning and policy questions in power systems need to represent power system operations under varying configurations and planning assumptions. Detailed operations models often require too much data and computation to be feasible in this context. Yet critical features of operational constraints must be simulated to capture essential limitations of the system. We discuss approaches to creating compact yet realistic production simulations for use in power system planning and policy studies.

4 - Integration of Contracted Renewable Energy and Spot Market Supply to Serve Flexible Loads

Anthony Papavasiliou, University of California-Berkeley, IEOR Department, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States of America, tonypap@berkeley.edu, Shmuel Oren

We present a contract for integrating renewable energy supply and spot markets for serving deferrable loads in order to mitigate renewable supply intermittency. We present a recombinant lattice model for spot price and renewable supply uncertainty and use dynamic programming to solve the resulting optimal control problem. We integrate the deferrable demand model in a stochastic unit commitment model of California and quantify the impact of coupling on operating costs and reserve requirements.

■ SA15

C - Room 208B

Panel: The ROI of DA-DQ - Convincing Evidence of the Benefit of Decision Analysis

Sponsor: Decision Analysis

Sponsored Session

Chair: Carl Spetzler, CEO, Strategic Decisions Group, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

1 - Collecting Compelling Evidence - The Return on Investment in Decision Quality

Moderator: Carl Spetzler, CEO, Strategic Decisions Group, 745 Emerson Street, Palo Alto, CA, 94301, United States of America, cspetzler@sdg.com

One of the major goals of the Society of Decision Professionals (SDP) is to create greater awareness and appreciation of DA among influential decision makers. In support of this goal, the SDP is assembling a portfolio of evidence of "the ROI of DQ". We will present the evidence that we have collected so far. A panel will discuss the challenges that decision professionals face in convincing decision makers of the importance and value of professional DQ support.

■ SA16

C - Room 209A

RAS Student Paper Research Contest

Sponsor: Railway Applications

Sponsored Session

Chair: Juan Morales, BNSF Railway, 2400 Western Center Blvd., Fort Worth, TX, 76131, United States of America, Juan.Morales@BNSF.com

1 - RAS Student Paper Research Contest

Juan Morales, BNSF Railway, 2400 Western Center Blvd., Fort Worth, TX, 76131, United States of America, Juan.Morales@BNSF.com

Finalists of the 2011 RAS Student Paper Research Contest will present their work in this session. Finalists were not determined prior to the abstract submission deadline of the printed program.

■ SA17

C - Room 209B

Group Decision Making

Sponsor: Decision Analysis

Sponsored Session

Chair: Matthias Seifert, Assistant Professor of Quantitative Methods, IE Business School (Instituto de Empresa), Operations & Technology Area, Maria de Molina 12, 5th Floor, Madrid, 28006, Spain, Matthias.Seifert@ie.edu

1 - Group Decision Making under Ambiguity

Steffen Keck, INSEAD, Boulevard de Constance, Fontainebleau, France, Steffen.KECK@insead.edu, Enrico Diecidue

Our study explores the effects of discussing decisions with others and aggregating individual preferences into a group decision in the presence of either simple risk or ambiguity. We find that groups make ambiguity neutral decisions significantly more often than individuals. Moreover, individuals make ambiguity neutral decisions more often after discussing their decisions with others compared to a setting without social interaction.

2 - The Effectiveness of Group Heuristics in Multiattribute Choice Environments

Matthias Seifert, Assistant Professor of Quantitative Methods, IE Business School (Instituto de Empresa), Operations & Technology Area, Maria de Molina 12, 5th Floor, Madrid, 28006, Spain, Matthias.Seifert@ie.edu, Manel Baucells

We use reduced ordered binary decision diagrams (ROBDDs) to study the impact of uncertainty on the effectiveness of the majority voting rule. Exploiting the concept of cumulative dominance in multiattribute choice contexts, we analyze the likelihood that individuals select the objectively best alternative if the correct attribute order may be only partially known. We then focus on group contexts to study the performance of majority voting in various conditions of uncertainty among members.

3 - Group-decision Making: The Incomplete Ranking Case

Erick Moreno-Centeno, Texas A&M University, 3131 TAMU, College Station, TX, United States of America, e.moreno@tamu.edu, Dorit Hochbaum

Aggregating individual rankings/ratings into a group consensus, when each judge ranks all objects, has been extensively studied. We extend some results to the incomplete-rank aggregation problem, where each judge only ranks a subset of the objects. Our group-decision-making method that has several advantages: applies to both complete and incomplete rankings; is based on efficient network-flow techniques; and uses both cardinal and ordinal information (allowing to detect manipulation attempts).

■ SA18

C - Room 210A

Scheduling in Semiconductor Manufacturing

Cluster: Scheduling and Project Management

Invited Session

Chair: Stephane Dauzere-Peres, Professor, Ecole des Mines de Saint-Etienne, CMP - Site Georges Charpak, 880 avenue de Mimet, Gardanne, F-13541, France, Dauzere-Peres@emse.fr

1 - A Parallel Shifting Bottleneck Heuristic for Scheduling Semiconductor Wafer Fabrication Facilities

Lars Moench, Professor, University of Hagen, Universitaetsstrasse 1, Hagen, 58097, Germany, lars.moench@FernUni-Hagen.de, Wolfram Schiffmann, Andrew Bilyk, Holger Weber, Udo Hoenig

The shifting bottleneck heuristic (SBH) decomposes the overall scheduling problem for wafer fabs into a series of scheduling problems related to machine groups. In this talk, we present a parallel implementation of the SBH on a cluster computer. We show that this implementation is much faster than its sequential counterpart. We analyze the parallel SBH for a small and large number of processors and present computational results for large-scaled wafer fabs using a rolling horizon setting.

2 - Algorithmic Parallelization in Multi-Criteria Semiconductor Scheduling

Scott J. Mason, Professor and Endowed Chair, Clemson University, 124 Freeman Hall, Clemson, SC, 29634, United States of America, mason@clemson.edu, Lars Moench, John Fowler, Chase Rainwater

Most semiconductor manufacturers do not schedule their fabs—dispatching decisions are used, even though they do not comprehend multiple, competing performance measures. Our overarching research agenda is to exploit the power of parallel computing technologies to develop new solution methods and algorithms for analyzing challenging, multi-level, multi-criteria scheduling problems of practical and economic importance. We focus will be on both factory- and toolset-level scheduling decisions.

3 - Multi-Criteria Scheduling of Semiconductor Wafer Fabrication Facilities

John Fowler, Professor, Arizona State University,, Computing, Informatics & Dec. Sys. Eng., Tempe, AZ 85287, United States of America, john.fowler@asu.edu, Michele Pfund, Scott J. Mason, Hari Balasubramanian

Semiconductor wafer fabrication is modeled as a complex job shop. A Modified Shifting Bottleneck Heuristic (MSBH) is used in an attempt to optimize a desirability function that considers makespan, cycle time, and total weighted tardiness. The desirability function is implemented at two different levels of the MSBH: the subproblem solution procedure level and the machine criticality measure level. Results demonstrate the ability of the approach to simultaneously minimize all three objectives.

4 - Scheduling on Non-identical Parallel Machines with Setup Times and Advanced Process Control

Stephane Dauzere-Peres, Professor, Ecole des Mines de Saint-Etienne, CMP - Site Georges Charpak, 880 avenue de Mimet, Gardanne, F-13541, France, Dauzere-Peres@emse.fr, Ali Obeid, Claude Yugma

This talk presents novel scheduling problems of job families on parallel machines encountered in semiconductor manufacturing, and some of the approaches we proposed to solve these problems. Two types of APC constraints are considered. The first type corresponds to maximal time constraints that must be satisfied between the start of two jobs of a family to maintain the qualification of the family on machines. In the second type of APC constraints, health indexes are associated to machines.

■ SA20

C - Room 211A

Nonconvex Optimization: Theory and Algorithms

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Evrim Dalkiran, Assistant Professor, Wayne State University, Department of Industrial & Systems Eng., Detroit, MI, 48202, United States of America, evrimd@wayne.edu

1 - Globally Solving Nonconvex Quadratic Programming Problems via Completely Positive Programming

Jieqiu Chen, Argonne Scholar, Argonne National Lab, 9700 S. Cass Avenue, Argonne, IL, 60439, United States of America, jieqchen@mcs.anl.gov, Sam Burer

This talk introduces a new global optimization algorithm for nonconvex quadratic programming problem (QP), which combines two ideas from the literature-finite branching based on the first-order KKT conditions and polyhedral-semidefinite relaxations of copositive programs. Through computational experiments comparing the new algorithm with existing codes on a diverse set of test instances, we demonstrate that the new algorithm is an attractive method for globally solving nonconvex QP.

2 - Generalized McCormick Relaxations

Joseph K. Scott, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 66-363, Cambridge, MA, 02139, United States of America, jkscott@mit.edu, Paul I. Barton

It is often desirable to optimize a function which is defined as the solution of a system of equations or the output of an algorithm. Most relaxation methods apply only to functions known in closed form. Conforming to this paradigm then requires either closed form solutions or the introduction of a large number of intermediate variables as decisions. We discuss the direct relaxation of algorithms and model solutions, which is beneficial when worst-case exponential time algorithms are applied.

3 - Strong Inequalities for Polynomial Covering Sets via Orthogonal Disjunctions

Mohit Tawarmalani, Purdue University, Krannert School of Management, West Lafayette, IN, 47907, United States of America, mtawarma@purdue.edu, Jean-Philippe Richard

We show that orthogonal disjunctive sets can be convexified in the space of the original problem variables under mild technical assumptions. We use this result to derive the convex hull of many polynomial covering inequalities over the nonnegative orthant. Finally, when variables are bounded from above, we show that the above decomposition provides insights that help develop relaxations that are significantly tighter than the factorable counterparts.

4 - Theoretical Filtering of RLT Bound-factor Constraints for Solving Polynomial Programming Problems

Evrim Dalkiran, Assistant Professor, Wayne State University, Department of Industrial & Systems Eng., Detroit, MI, 48202, United States of America, evrimd@wayne.edu, Hanif Sherali

We propose two sets of theoretically filtered bound-factor constraints for constructing Reformulation Linearization Technique (RLT)-based relaxations for solving polynomial programs. We establish related theoretical results for convergence to a global optimum. Computational results are provided to demonstrate the effectiveness of the proposed theoretical filtering strategies in comparison to the standard RLT and a prior heuristic filtering technique.

■ SA21

C - Room 211B

Connections Between Stochastic Programming, Dynamic Programming and Benders Decomposition

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Suvrajeet Sen, Professor, Department of Integrated Systems Engineering, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States of America, sen.22@osu.edu

1 - What is Common and What is Not between Differential DP, Nested Benders and Stochastic Decomposition

Suvrajeet Sen, Professor, Department of Integrated Systems Engineering, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States of America, sen.22@osu.edu

This talk will explore both common themes and differences between classes of DP algorithms with a class of Benders'-based SP algorithms. In both cases, we will be mainly interested in continuous decision and state spaces.

2 - Using Dualization to Solve a Stochastic Optimal Control Problem with Chained Subsystems

Pierre Girardeau, Dr., EDF and Auckland University, 70, Symonds Street, Auckland, New Zealand, pierre.girardeau@ensta.org

We consider a dynamical system which can be influenced by exogenous noise. In the Dynamic Programming framework, we look for policies as functions of a state variable that characterizes the system. On some flower-shaped structured systems, a Lagrangian dualization-type algorithm, called Dual Approximate Dynamic Programming (DADP), has been successfully proposed and applied to get round the curse of dimensionality. We present ideas on how DADP may be applied to the more general settings.

3 - Adaptive Multicut Aggregation Applied to the Nested L-shaped Method

Christian Wolf, University of Paderborn Faculty of Business and Economics, Warburger Str. 100, Paderborn, Germany, kalmar@uni-paderborn.de, Achim Koberstein

It was recently shown that multicut aggregation in the L-shaped method for two-stage stochastic linear programms is advantageous compared with the single or multicut method. We extend these results by applying multicut aggregation to the general multistage case and present a parallelized nested L-shaped solver, allowing integer variables in the first stage. We investigate several strategies for dynamic cut (dis-)aggregation and show computational results for instances from the literature.

■ SA22

C - Room 212A

Applications of Stochastic Programming in Energy Systems

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Neng Fan, Sandia National Laboratories, P.O. Box 5800, MS 1316, Albuquerque, NM, United States of America, nnfan@sandia.gov

1 - Online Dynamic Scheduling for Charging PHEVs in V2G

Feng Pan, fpan@lanl.gov

Plug-in (hybrid) electric vehicles (PHEVs) reduce greenhouse gas emissions but derive much of their energy from the power grid. PHEVs will put additional loads onto existing power grids. It has been proposed that appropriately scheduling of PHEV charging can reduce this stress. The scheduling problem is modeled as a multi-stage online decision problem. We present three polynomial algorithms: consensus, expectation and regret and discuss simulation results.

2 - Multi-period Hybrid Power System Design for Remote Areas

Ludwig Kuznia, University of South Florida, 4202 E. Fowler Avenue ENB118, Tampa, FL, 33620, United States of America, lkuznia@mail.usf.edu, Bo Zeng, Grisselle Centeno

A hybrid power system consists of a traditional energy generation facility, a renewable energy generation facility, and a storage device. To incorporate the random nature of renewable energy and daily power demand, we develop a stochastic mixed integer programming model. This model addresses the higher level capacity decisions along with the lower level daily operating decisions. To the best of our knowledge, this is the first model for comprehensive multi-period hybrid power system design.

3 - Transportation Energy Portfolio Design under Uncertainty

Yuche Chen, Department of Civil and Environmental Engineering, University of California Davis, One Shield Avenue, Davis, CA, 95616, United States of America, ychchen@ucdavis.edu, Yueyue Fan

This research establishes modeling and computational methods for multi-period energy portfolio design used for transportation energy system planning. The new strategic planning approach focuses on renewable energy infrastructure expansion given uncertainties in technology development and environmental regulation, such as LCFS in California, and technology development. The model can be served as a tool to evaluate energy policies and provide information for policy makers.

4 - Robust Security Constrained Generation Scheduling with Wind Power and Pumped Storage Hydro

Ruiwei Jiang, University of Florida, 303 Weil Hall, University of Florida, Gainesville, FL, 32608, United States of America, rwjiang@ufl.edu, Yongpei Guan, Jianhui Wang

As renewable energy, such as wind energy, increasingly penetrates into power grid systems, new challenges arise for system operators (such as ISOs) to keep the systems reliable under uncertain circumstances. In this talk, we propose a robust optimization approach to accommodate wind output uncertainty in a power grid containing pumped storage hydro, with the objective of minimizing the total cost under the worst-case wind farm output scenarios.

5 - Stochastic Optimized Restoration of Interdicted Power Grids by Mobile Generators

Neng Fan, Sandia National Laboratories, P.O. Box 5800, MS 1316, Albuquerque, NM, United States of America, nnfan@sandia.gov, Feng Pan

This talk presents a two-stage stochastic programming model for restoration of an interdicted power grid by mobile generators. In case of different disruptive terrorist attack plans, we propose an optimized plan by mobile generators to recover the power grid. We assume the attack plans are randomly distributed with different probabilities, and the available resources for recovery are limited. Several decomposition methods are used to solve this two-stage stochastic program.

■ SA23

C - Room 212B

Joint Session Homeland/MAS/Law: Advances in Risk Analysis at the Local, State and Federal Level I

Cluster: Homeland Security – Emergency Prep/Military Applications Society/Law, Law Enforcement and Public Policy

Invited Session

Chair: Barry Ezell, Associate Research Professor, Old Dominion University's VMASC, 1030 University Blvd., Suffolk, VA, 23435, United States of America, bezell@odu.edu

1 - The Role of Near-misses in Risk Modeling

Robin Dillon-Merrill, Georgetown University, 517 Hariri Bldg, McDonough School of Business, Washington, DC, 20057, United States of America, rld9@georgetown.edu

There exists an inherent challenge for how to validate risk models for low probability, high consequence events. But if we pay attention to near-misses (the unremarkable small failures that do no harm), we can improve our models to better predict and prevent crises.

2 - Tailored Strategic Risk Analysis Using a Bayesian Network

Debra Elkins, Section Chief, Risk Assessments & Analysis, U.S. Department of Homeland Security, Office of Risk Management and Analysis, Washington, DC, United States of America, Debra.Elkins@hq.dhs.gov, Tony Cheesebrough

The Office of Risk Mgmt. and Analysis (RMA) at the U.S. Department of Homeland Security (DHS) will discuss building a tailored analysis using a Bayesian Network model and Monte Carlo simulation to support policy decisions related to managing Inbound Nuclear Threats. The approach supports the ability to quickly and visually analyze the current threat information, and interactively assessing policy options and resource allocation decisions, particularly in a rapidly changing threat environment.

3 - Impact of Decision Times and Response Capabilities on Mitigating a Bioterrorism Attack

Jason Middleton, Senior Research Scientist, Battelle, 505 King Avenue, Columbus, OH, 43201, United States of America, middletonj@battelle.org, David Guistino, Cheryl Dingus, Jennifer Wightman

A timely and effective response is essential to mitigating illnesses and fatalities potentially resulting from a bioterrorism attack. However, there are negative impacts to a premature response that local authorities must consider when deciding how to respond to initial evidence. To inform planning, the Department of Homeland Security Bioterrorism Risk Assessment Public Health Response model was used to estimate the impact of decision times and response capabilities on mitigation activities.

4 - A Risk Quadruplet for Homeland Security

Kara Norman Hill, Booz Allen Hamilton, 205 Westover Avenue #302, Norfolk, VA, 23507, United States of America, hill_kara@bah.com, Barry Ezell

Risk in homeland security is often considered to be a function of threat, vulnerability, and consequence. But risk is also a function of our perceptions. Rather than ignore our intuitions when conducting supposedly objective assessments, we should embrace that subjectivity. A risk quadruplet is proposed to systematically integrate risk perceptions with assessments of threat, vulnerability, and consequence.

■ SA24

C - Room 213A

Advances In Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Kiavash Kianfar, Assistant Professor, Texas A&M University, TAMU 3131, College Station, TX, 77843-3131, United States of America, kianfar@tamu.edu

1 - A (k+1)-Slope Theorem for the Infinite Group Relaxation

Marco Molinaro, Carnegie Mellon University, 630 Clyde St, Apt 302, Pittsburgh, PA, United States of America, molinaro@cmu.edu, Amitabh Basu, Robert Hildebrand, Matthias Koeppe

In the 1-d infinite group relaxation, the celebrated 2-Slope Theorem gives a sufficient condition for a minimal function to be extreme. This is an important tool for building and analyzing valid inequalities. Extending this result, and a recent generalization by Cornuejols and Molinaro, we show that in the k-d case, minimal piecewise linear functions with k+1 slopes (satisfying a necessary regularity condition) are extreme. This is practically motivated by increasing interest in multi-row cuts.

2 - Strong Dual for Conic Mixed-Integer Programs

Diego Moran, PhD student, H. Milton Stewart School of Industrial and Systems Engineering Georgia Institute of Technology, 755 Ferst Drive NW, Atlanta, GA, 30332, United States of America, dmoran@gatech.edu, Santanu S. Dey, Juan Pablo Vielma

Mixed-integer conic programming is a generalization of mixed-integer linear programming. In this paper, we present an extension of the duality theory for mixed-integer linear programming to the case of mixed-integer conic programming. In particular, we construct a subadditive dual to mixed-integer conic programming problems. Under a simple condition on the primal problem, we are able to prove strong duality.

3 - A Polyhedral Study of Multi-Echelon Lot Sizing with Intermediate Demands

Minjiao Zhang, Graduate Research Associate, The Ohio State University, Integrated and Systems Engineering, 210 Baker Systems Bldg, 1971 Neil Avenue, Columbus, OH, 43202, United States of America, zhang.769@osu.edu, Simge Kucukyavuz, Hande Yaman

We study a multi-echelon uncapacitated lot-sizing problem in series with intermediate demands. We give a polynomial-time dynamic program and a tight, compact extended formulation for two echelon case. We present a class of valid inequalities for multi-echelon case, show its strength and give a polynomial-time separation algorithm. We also propose alternative formulations for two echelon case. Computational results show the effectiveness of the extended formulations and the proposed inequalities.

4 - Integer Linear Programming Reformulations for the TV Commercial Breaks Scheduling Problem

Houyuan Jiang, University Senior Lecturer, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, h.jiang@jbs.cam.ac.uk, Giovanni Giallombardo, Giovana Gmiglionico

The conflict-resolution problem is to schedule advertisements into TV commercial breaks so that the total conflict weight between advertisements scheduled to the same commercial break is minimized. We present several integer linear programming reformulations. We propose valid cuts and a Benders decomposition approach for solving these reformulations. Encouraging computational results are reported.

■ SA25

C - Room 213BC

Emerging Topics in Healthcare Operations and Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Vinayak Deshpande, Purdue University, West Lafayette, IN, United States of America, vinayak@purdue.edu

1 - Health Provider Competition with Heterogeneous, Wait-sensitive Customers

Aaron Ratcliffe, University of North Carolina at Chapel Hill, McColl Building CB 3490, Chapel Hill, NC, 27599, United States of America, Aaron_Ratcliffe@kenan-flagler.unc.edu, Wendell Gilland, Ann Marucheck

We develop a competitive queueing model where consumers choose a health service provider to maximize utility. Utility is a function of random quality-dependent service valuation, consumer co-payment, and expected wait time which depends on choices of all consumers. Providers maximize expected profits by setting quality level, service rate, and full service price. We analyze the impact of competition on optimal quality, price, wait, and welfare, and investigate quality and speed dependencies.

2 - Capacity Planning for Healthcare Services with Series Patients

Vinayak Deshpande, Purdue University, West Lafayette, IN, United States of America, vinayak@purdue.edu, Heejong Lim, George Shanthikumar

Motivated by a project with a community hospital in Indiana, we analyze a capacity planning problem for healthcare services with 'series' patients, i.e., patients who are scheduled for a series of appointments. We formulate an admission control problem to the service facility to match supply and demand. We test several capacity control policies using real data obtained from the hospital.

3 - Optimal Commodity Inventory Control with Swing Contracts and Spot Markets

Hung Do, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States of America, hdo@purdue.edu, Ananth Iyer, George Shanthikumar

Motivated by a manufacturer of finished products that uses, as raw material, commodity metals, we study the optimal procurement and inventory control policies for a manufacturer purchasing raw material from swing contracts and spot markets to satisfy stochastic demand. Using stochastic DP, we provide optimal policies under supermartingale, martingale or submartingale spot prices. We use the manufacturer's data to show the impact of the optimal policies compared with those implemented currently.

4 - Supply Diversification with Correlated Suppliers and Responsive Pricing

Tao Li, PhD Student, University of Texas-Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, txl071000@utdallas.edu, Suresh P. Sethi, Jun Zhang

We obtain the optimal sourcing and pricing decisions of a firm with unreliable suppliers having correlated random capacities. We show that the insight — cost is the order qualifier while reliability is the order winner — derived in the literature for uncorrelated suppliers no longer holds when the suppliers are correlated. We also show that supplier diversification and responsive pricing strategies are not necessarily substitutes as one's intuition might suggest.

■ SA26

C - Room 213D

Incentives Issues in Operations Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Georgia Perakis, Massachusetts Institute of Technology, Cambridge, MA, United States of America, georgiap@mit.edu

1 - Optimal Contract Design for Joint-ventures in the Healthcare Industry

Retsef Levi, Massachusetts Institute of Technology, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, retsef@mit.edu, Georgia Perakis, Wei Sun, Cong Shi

Motivated by the growing popularity of joint ventures among healthcare providers, we study the performance of business partners in a Generalized Nash Equilibrium to that of a system optimum which maximizes the collective benefit. In particular, we compare the investment level and the profit of the joint venture attained in the two settings. Our model incorporates asymmetry and considers several common cost structures such as quadratic and exponential cost functions.

2 - OrganJet: overcoming Geographical Disparities in Access to Deceased (kidney) Donors in the US

Baris Ata, Professor, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, b-ata@kellogg.northwestern.edu, Anton Skaro, Sridhar Tayur

There are over 80,000 patients in the US waiting for a kidney transplant. Currently, the organs are first allocated locally. This causes significant disparities across geographical regions in terms of waiting times for transplant and access to organs. We propose an operational solution (OrganJet), which allows patients to multiple-list at a transplant center in different (and possible very distant) donor service areas of their choosing and alleviates the inequity significantly.

3 - Consumer Subsidies and Industry Response Dynamics under Multi-period Stochastic Demand

Ruben Lobel, Massachusetts Institute of Technology, ORC, Cambridge, MA, United States of America, rlobel@mit.edu, Maxime Cohen, Georgia Perakis

Governments use consumer incentives to promote new technologies and stimulate investments from the private sector (eg. solar panels). We model the interaction between government and industry players in a multi-period setting under uncertain demand. We show how the market structure and timing will affect the outcome of the technological development.

4 - A Cournot-Nash Oligopolisic Market Equilibrium in Productivity Analysis

Andy Johnson, Assistant Professor, Texas A&M University, Department of I&SE, College Station, TX, 77843-3131, United States of America, ajohnson@tamu.edu, Chia-Yen Lee

Previously most work in the productivity and efficiency analysis literature assumes perfect competition and exogenous prices, thus a profit maximizing firm, using a given level of input resources, will expand their output level to improve productivity and profits. Under imperfect competition the concept of Nash equilibrium will be used to identify improvement targets extending productivity and efficiency analysis to consider endogenously determined prices in an oligopolistic market.

■ SA27

C - Room 214

Global Health Commodity Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Terry Taylor, Associate Professor, University of California-Berkeley, Haas School of Business, Berkeley, CA, United States of America, taylor@haas.berkeley.edu

Co-Chair: Sarang Deo, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, 500032, India, sarang_deo@isb.edu

1 - Donor Subsidies for Supply Chains: Improving the Availability of Products with Benefit Externalities

Terry Taylor, Associate Professor, University of California-Berkeley, Haas School of Business, Berkeley, CA, United States of America, taylor@haas.berkeley.edu, Prashant Yadav

Faced with the poor availability of essential medicines in countries where diseases are endemic, donors such as the The Global Fund and The Gates Foundation are committed to devoting substantial financial resources towards the goal of improving this availability. We explore how donors ought to best deploy their resources to encourage improved availability in private-sector supply chains.

2 - Using a Model to Improve Donor Coordination in Sierra Leone

Ananth Iyer, Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47909, United States of America, aiyer@purdue.edu, Santiago Kraiselburd, Joseph Edem-Hotah

In Sierra Leone, international donors (countries and NGOs) are involved independently in the funding and delivery of health care. We model the funds availability, supply chain constraints, diseases targeted, populations targeted etc using a mathematical programming model. The model optimizes deployment of constrained funds to maximize health care outcomes. It enables quanitication of the impact of constraints, changes in funds use etc. Data from field contexts are used to provide insights

3 - Network Externality in Allocation of Point-of-care Diagnostic Tests in Developing Countries

Sarang Deo, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, 500032, India, sarang_deo@isb.edu, Milind Sohoni

POC diagnostic devices aim to eliminate diagnostic delays and improve patient retention in developing countries. We develop an optimization model for the allocation of a limited number of devices over a network of clinics. We study the impact of network externality – allocation to one clinic changes the delay experienced at other clinics – which is not accounted for in simple thumb rules used in practice. We apply our results to an infant HIV diagnosis program in a sub-Saharan country.

■ SA28

C - Room 215

Consumer Driven Service OM Models

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Muge Yayla-Kullu, Assistant Professor, Rensselaer Polytechnic Institute, Lally School, 110 8th Street, Troy, NY, 12180, United States of America, YAYLAH@rpi.edu

1 - Impact of National Culture on Quality of Services: A Case of Airline Industry

Praowpan Tansitpong, Rensselaer Polytechnic Institute, 110 8th street, Troy, 12180, United States of America, tansip@rpi.edu, Jeffrey F. Durgee, Muge Yayla-Kullu

The national characteristics will impact the organizational culture that determines the mindset behind services. We utilize Hofstede's cultural indices (Power distance, Individualism, Masculinity, and Uncertainty avoidance) to measure the differences in cultures. We investigate how these national characteristics might have an impact specifically on the service delivery and the overall image of the company.

2 - To Pool or Not to Pool: Delivery System Choice for Vertically Segmented Product Line

Aditya Jain, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, India, aditya_jain@isb.edu, Ram Bala, Sandeep Rath

We analyze delivery system choice – flexible or dedicated, for a firm that sells vertically differentiated make-to-order physical goods and/or services to a segmented market. We characterize the optimal choice as a function of performance deterioration that may result from mix variability. Our research highlights the effect of market cannibalization on the operations strategy decision of delivery systems.

3 - Retailer Bundling or Manufacturer Bundling in a Supply Chain

Qingning Cao, University of Texas at Dallas, 800 West Campbell Rd, SM30, Richardson, TX, 75080, United States of America, qingning.cao@utdallas.edu, Kathryn Stecke, Xianjun Geng, Jun Zhang

We examine a supply chain where a manufacturer has the option of bundling products. Comparing both the manufacturer's and retailer's profits to profits in supply chains where either no supply chain member or only the retailer or only the manufacturer has a bundling option, respectively, this paper provides a number of interesting managerial insights.

4 - Vertical Integration Strategies for Fashion Products

Yen-Ting Lin, University of North Carolina at Chapel Hill, McColl Building, Chapel Hill, NC, United States of America, Yen-Ting_Lin@unc.edu, Jayashankar Swaminathan, Ali Parlakturk

We study manufacturers' vertical integration decisions in fashion retailing. We consider two competing supply chains, each consisting of a supplier, a manufacturer and a retailer. The supplier controls the product quality, and the retailer sets the retail price. A manufacturer chooses to (1) forward integrate, (2) backward integrate, or (3) not integrate. We analyze the equilibrium channel structure, and examine the effect of vertical integration on the product price and quality.

5 - Inventory Policies and Cyclical Cleanups under Customer Initiated Misplacements

Vidya Mani, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, vidya_mani@unc.edu, Jayashankar Swaminathan

In this paper, we concentrate on inventory misplacement, a form of inventory inaccuracy, explore how it affects the operations of a firm and seek methods to mitigate its effect through changes in inventory and cleanup policies. Under the scenario of deterministic demand and random misplacements, we formulate simple heuristics that can be easily implemented, study their effectiveness and derive managerial insights from them.

■ SA29

C - Room 216A

Healthcare Operations

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations

Sponsored Session

Chair: Nikolaos Trichakis, Harvard Business School, 15 Harvard Way, Morgan 493, Boston, MA, 02163, United States of America, ntrichakis@hbs.edu

1 - Robust Appointment Scheduling

Shashi Mittal, Massachusetts Institute of Technology, 77 Massachusetts Avenue Bldg. E40-130, Cambridge, MA, 02139, United States of America, mshashi@mit.edu, Sebastian Stiller

We construct robust appointment schedules for jobs with uncertain length in a high cost health care facility avoiding extreme costs due to both idle time and delay. Given the order of the jobs during the day and for each job its maximum and minimal possible length, arbitrary overage cost, and (during the day non-decreasing) underage cost we give a closed form for the unique robust optimum. We achieve broad insights into the structure of the optimum and characterize its worst case scenarios.

2 - The Fairness, Efficiency and Flexibility in the Organ Allocation for Kidney Transplantation

Nikolaos Trichakis, Harvard Business School, 15 Harvard Way, Morgan 493, Boston, MA, 02163, United States of America, ntrichakis@hbs.edu, Dimitris Bertsimas, Vivek Farias

We propose a method for designing point systems for the allocation of kidneys to patients on a waitlist. Our method does not presume any fairness principle or priority criterion, but rather offers the flexibility to the designer to make her own selection. We design a point system that is based on the same criteria as the one recently proposed by policymakers, but delivers an 8% increase in extra life years, while preserving the same fairness properties.

3 - Estimating the NIH Efficient Frontier

Dimitrios Bisias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, dbisias@mit.edu, James Watkins, Andrew Lo

Based on an empirical relationship between burden-of-disease as measured by years-of-life-lost (YLL) and funding levels from the National Institutes of Health (NIH) from 1980 to 2006, financial portfolio theory is used to estimate the risk/reward trade-offs of NIH funding allocations by treating appropriation as an investment, changes in YLL as investment returns, and estimating the means, variances, and covariance matrix of such disease-category returns using historical data.

■ SA30

C - Room 216B

Operations-Corporate Finance Interface

Sponsor: Manufacturing & Service Oper Mgmt/ iFORM SIG

Sponsored Session

Chair: Vishal Gaur, Cornell University, The Johnson School, 321 Sage Hall, Ithaca, NY, 14853, United States of America, vg77@cornell.edu

1 - Signaling to Capital Providers in the Newsvendor Model

William Schmidt, Harvard Business School, Wyss Hall, Boston, MA, 02163, United States of America, wschmidt@hbs.edu, Richard Lai, Ananth Raman, Vishal Gaur

We investigate a puzzling phenomenon in which firms make investment decisions that purposefully do not maximize expected profits. Using an extension to the newsvendor model and Perfect Bayesian equilibrium solution concepts, we confirm that multiple equilibria may exist, including a counterintuitive equilibrium in which a firm with a high quality investment opportunity finds it attractive to underinvest, thereby behaving as if it faces a lower quality investment opportunity.

2 - Risk Propagation in a Supply Chain: Is There a Financial Bullwhip Effect?

Alejandro Serrano, Zaragoza Logistics Center, Bari 55 Plaza, Zaragoza, Spain, aserrano@zlc.edu.es, Santiago Kraiselburd, Rogelio Oliva

We study how risk, as measured by the payments variability, propagates upstream in a supply chain when firms have limited access to external funds and unilaterally exceed trade credit agreements. We model a serial supply chain

where the downstream player faces random demand. Using numerical Markov chains, we analyze under which conditions payments variability and amplification occur, and if the observed behavior can be described as a generalization of the bullwhip effect in the financial space.

3 - Global Sourcing Decisions and Tax-credit Planning For a Multi-national Firm

Joice Hu, Visiting Assistant Professor, Washington University at St. Louis, 1 Brookings Drive, St. Louis, MO, 63130, United States of America, qhu@wustl.edu, Vernon Hsu

This paper studies a U.S.-based multinational firm's global sourcing decisions at two subsidiaries located in low-tax and high-tax countries respectively, with an objective of maximizing its expected worldwide after-tax profits. We characterize the optimal sourcing decisions under various decentralized and centralized after-tax profit-maximizing performance measures.

4 - Managing Growth and Bankruptcy Risk for a Cash Constrained Firm

Yasin Alan, Cornell University, The Johnson School, 201J Sage Hall, Ithaca, NY, 14853, United States of America, ya47@cornell.edu, Vishal Gaur

A cash constrained firm has to balance growth and bankruptcy risk when making operational decisions. We study the implications of different inventory policies, including an aggressive and a conservative policy for the growth rate and bankruptcy risk of such a firm by setting up a finite horizon cash-constrained inventory model with non-stationary demand. We address questions such as whether growth requires investing more than the myopic optimal and whether it increases bankruptcy risk.

■ SA31

C - Room 217A

Game-Theoretic Healthcare Applications I

Sponsor: Health Applications

Sponsored Session

Chair: Murat Kurt, Assistant Professor, University at Buffalo, SUNY, 415 Bell Hall, Buffalo, NY, 14260, United States of America, muratkur@buffalo.edu

1 - On Improving the Quality of Care of Profit-Maximizing Dialysis Facilities

Anicham Kumarasamy, PhD Candidate, Stanford University, Graduate School of Business, Stanford, United States of America, anichamk@stanford.edu, Stefanos Zenios

The number of freestanding for-profit dialysis facilities in the United States has more than tripled over the last two decades. Concerned by profit-maximizing behavior from these facilities, Medicare recently changed its reimbursement system and publicly released data on facility performance measures. We analyze how these changes and other possible policy adjustments could influence the quality of care of profit-maximizing dialysis facilities.

2 - Vaccine Market: Operational Issues and Externality Effects

Hamed Mamani, Foster School of Business, University of Washington, Seattle, WA, 98195-3226, United States of America, hmamani@uw.edu, Elodie Adida, Debrabata Dey

Prevention of infectious diseases is an important concern for managing public health. Although vaccines are the most effective means for preventing infectious diseases, negative consumption externality often makes it difficult for vaccine coverage to reach a level that is socially optimal. In this research, we consider how a subsidy program can induce a socially optimal vaccine coverage, both for a perfect and an imperfect vaccine, when vaccine producers form a competitive oligopoly market.

3 - A Game-Theoretic Model of a Credit Point System for Walk-in Clinic Access

Yung-wen Liu, Assistant Professor, University of Michigan-Dearborn, 4901 Evergreen Rd., 2250 HPEC, IMSE,, University of Michigan-Dearborn, Dearborn, MI, 48128, United States of America, ywliu@umich.edu, Tilman Börgers

To regulate access to walk-in clinics, health care providers may charge extra fees from patients who attend such clinics. If some patients aren't able to pay the extra fee, equity considerations may suggest the use of a credit point system, where each patient may visit a walk-in clinic a certain number of times without extra charge. We develop a game-theoretic model of patient behavior under a credit point system, and evaluate the system's performance from efficiency and equity viewpoints.

4 - Refining Pay-for-Performance: A Dynamic and Risk-Adjusted Payment Model for Preventive Healthcare

Reza Yaesoubi, Post-Doctoral Research Staff, IBM Watson Research Center, 19 Skyline Dr., Hawthorne, NY, 10532, United States of America, reza.yaesoubi@gmail.com, Mona Sharifi

We consider a preventive health care system in which a primary-care physician (PCP) identifies and refers those at risk of developing a disease to a preventive intervention. Patient compliance with the referral is affected by her risk factors, intervention price, and the PCP's effort in promoting the procedure. We characterize a dynamic payment model in which the healthcare institution is incentivized to select the price and risk-adjusted effort level that maximize social welfare.

■ SA32

C - Room 217BC

National Security Research

Sponsor: Military Applications Society

Sponsored Session

Chair: Ronald McGarvey, Senior Operations Researcher, RAND, 4570 Fifth Avenue, Pittsburgh, PA, 15208, United States of America, ronm@rand.org

1 - Assessing the Accuracy of TDOA/FDOA Geolocation

Kimberly Hale, RAND, 1776 Main St, Santa Monica, CA, 90407, United States of America, khale@rand.org, Brien Alkire

Time-and-frequency-difference-of-arrival (TDOA/FDOA) techniques are effective for geolocating the source of radio frequency emissions that are low frequency, low power, or short duration. The accuracy of TDOA/FDOA geolocation is a complex function of geometry, signal characteristics, and measurement precision. We present a simulation-based approach to estimating geolocation accuracy for TDOA/FDOA. We then compare TDOA/FDOA geolocation with the traditional technique used, direction finding.

2 - Identifying and Measuring the Cost of Poor Quality

Elvira Loredo, Researcher, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90404, United States of America, loredo@rand.org, Shawn McKay, Amber Jaycocks

This research focuses on using existing maintenance data to detect parts with degrading reliability or with substandard performance when compared to similar parts. We examine several approaches to detecting poor quality parts, including Crow-AMSAA plots and use clustering to group like parts. The initial work is intended to lead to a cost of quality criteria to prioritize efforts to improve the reliability of legacy systems.

3 - Combining Colonel Blotto Games with Lanchester Equations

Patrick Hester, Old Dominion University, Department of Eng. Mgmt. & Sys. Eng., Kaufman Hall, Room 242C, Norfolk, VA, 23508, United States of America, pthester@odu.edu, Andrew Collins

Military analysts use a variety of techniques to determine the best strategies against adversarial forces. Game theory has been used extensively in the military domain using Colonel Blotto games to analyze troop and resource allocation across multiple fronts. Lanchester equations are a set of differential equations used to determine the outcome of a particular battle. This presentation demonstrates a novel combination of game theory and Lanchester equations using Colonel Blotto games.

■ SA33

C - Room 217D

Journal of Quality Technology Invited Session

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Dan Apley, Associate Professor, Northwestern University, Evanston, IL, United States of America, apley@northwestern.edu

1 - A Review and Perspective on Control Charting with Image Data

Fadel M. Megahed, PhD Candidate, Virginia Tech, 250 Durham Hall, Blacksburg, 24061, United States of America, fmegahed@vt.edu, William H. Woodall, Jaime A. Camelio

Machine vision systems are increasingly being used in industrial applications due to their ability to provide information on product geometry, surface defects, surface finish, and other product and process characteristics. There are a number of applications of control charts for image data to detect changes in process performance. In this presentation we provide a review of these charts, highlight some future application opportunities, and provide some advice to practitioners.

2 - System Monitoring with Real-Time Contrasts
George Runger, Professor, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, George.Runger@asu.edu, Houtao Deng, Eugene Tuv

Monitoring real-time data streams challenges traditional techniques with increasingly complex data (high-dimensional, mixed, non-normal, nonlinear data). Here real-time contrasts (RTC) between reference and current data transform monitoring to a dynamic series of classification problems. Re-learned classifiers distinguish this work from one-time model training. Monitoring statistics and diagnostics are considered and unbalanced data needs to be handled. Experiments illustrate advantages.

3 - Monitoring Batch Processes with Multiple On-Off Steps in Semiconductor Manufacturing
David Shan Hill Wong, Professor, National Tsing Hus University, 101 Section 2 Guang Fu Road, Hsinchu, Taiwan - ROC, dshwong@che.nthu.edu.tw, Shui-Pin Lee, Sheng-Tsiang Tseng, An-kuo Chao, Shi-Shang Jang, Fugee Tsung

Monitoring of batch processes in semiconductor manufacturing is complicated by drastic within profile changes due to on-off actions and sample-to-sample variations due to tool aging and lot cycle. A simple model is proposed consisting of a reference profile that describes the on-off actions and profile level shifts that capture long and short term trends. The residuals can then be used to formulate a health index which can monitor the health of the equipment and diagnose fault efficiently.

■ SA34

C - Room 218A

Logistics Applications in Health Care

Sponsor: Health Applications

Sponsored Session

Chair: Ali Ekici, Assistant Professor, University of Houston, Department of Industrial Engineering, Houston, TX, 77204, United States of America, aekici@central.uh.edu

1 - Logistics of Clinical Testing: Heuristics for Routing and Scheduling of Specimen Collection
Esma Gel, Associate Professor, Arizona State University, SCIDSE, Tempe, AZ, 85281, United States of America, esma.gel@asu.edu, Sibel Salman, Lerzan Ormeci, Eda Yucel

We study the logistics of specimen collection for a clinical testing laboratory that serves clients dispersed in an urban area, motivated by a U.S.-based clinical laboratory. The specimens accumulate by time at the clients throughout a day. We design tours to collect all the specimens with two hierarchical objectives: maximizing the number of specimens processed by the next morning as the first priority, and minimizing the total routing costs as the second.

2 - Integrated Collection and Appointment Scheduling for Blood Collection
Azadeh Mobasher, PhD Candidate, University of Houston, 4800 Calhoun Rd, Houston, TX, 77204, United States of America, azadeh.mobasher@gmail.com, Ali Ekici, Orsan Ozener

In this project, considering the perishability of the blood, we develop a model to schedule the appointments and collect donated blood at each donation site. We consider different aspects of the problem such as flexibility, total amount of blood collected and transportation cost. We propose an insertion/savings heuristic algorithm to find good solutions and develop an adaptive large neighborhood search algorithm to improve the solutions further.

3 - Optimizing Delivery of Antibiotics in Response to an Anthrax Attack
Adam Montjoy, University of Maryland, Institute for Systems Research, College Park, MD, 20742, United States of America, amontjoy@umd.edu, Jeffrey Herrmann

Following the deliberate release of anthrax spores into a largely populated area, state or county health officials will coordinate deliveries to Points of Dispensing from a central depot that receives shipments in waves from the Strategic National Stockpile. We formulate the problem as a unique capacitated vehicle routing problem that focuses on a novel objective that seeks to keep inventory levels equitable at the dispensing sites. Solution techniques and numerical results are presented.

■ SA35

C - Room 218B

Joint Session QSR/DAS: Panel Discussion: Research Trends in Homeland Security

Sponsor: Quality, Statistics and Reliability/Decision Analysis

Sponsored Session

Chair: Abhishek Shrivastava, Assistant Professor, City University of Hong Kong, Department of MEEM, 83 Tat Chee Avenue, Kowloon, Hong Kong - PRC, abhishek.shrivastava@cityu.edu.hk

1 - Panel Discussion: Research Trends in Homeland Security
Moderator: Abhishek Shrivastava, Assistant Professor, City University of Hong Kong, Department of MEEM, 83 Tat Chee Avenue, Kowloon, Hong Kong - PRC, abhishek.shrivastava@cityu.edu.hk, Panelists: Vicki Bier, Fred S. Roberts, Rajan Batta

The panel brings together leading academics in the field of Homeland Security. They will share their observations on recent progress made in homeland security research and highlight research problems that need to be addressed in future, both, near and long-term.

■ SA36

C - Room 219A

Telecommunications

Contributed Session

Chair: Hui Wang, PhD Student, North Carolina State University, 3607 Helix Ct. Apt. 302, Raleigh, NC, 27606, United States of America, hwang4@ncsu.edu

1 - A Genetic Algorithm for Dynamic MANET Optimization
Orhan Dengiz, General Manager, DND, Golbasi, Ankara, 06830, Turkey, orhan.dengiz@gmail.com, Abdullah Konak, Alice E. Smith

This paper presents a dynamic Mobile Ad hoc Network optimizer system to manage network connectivity by using controlled network nodes, called agents. Agents have predefined wireless communication capabilities similar to the other nodes in the MANET, however their movements and thus their locations are dynamically determined to maintain and optimize network connectivity. In this paper the non-deterministic binary decoding genetic algorithm is proposed as solution method.

2 - A Mathematical Programming Approach for Topology Construction Modeling in Wireless Sensor Networks
Aldo Fabregas, Research Associate, CUTR-USF, Fowler Avenue, Tampa, FL, 33620, United States of America, fabregas@cutr.usf.edu, Pedro Wightman, Miguel Labrador

Topology Construction (TC) is a very well-known technique to save energy and extend the lifetime of wireless sensor networks. One way to solve the topology construction problem is by solving the underlying Minimum Connected Dominating Set Problem (MCDS). This work presents a Mixed Integer Programming formulation that finds the optimal solution to this problem. The formulation is proposed as a benchmarking tool to compare the performance of existing topology construction protocols.

3 - Design Outsourcing, Product Clockspeed, and Channel Management
Li Zhu, Director of Testing Department, Shanghai Sprocomm Technologies CO.,Ltd, 103 Cao Bao Road,, Building # 14, Room 708, Shanghai, 200233, China, li.zhu@sprocomm.com

Design outsourcing is becoming more popular in the telecommnucation industry in recent years. The manufacturer needs to decide when it is optimal to outsource the design. We first study the impact of design outsourcing on the product speedclock and product variety. Then we determine the conditions for the manufacturer to outsource the design.

4 - Decomposition Methods of Traffic Grooming Problems in Ring Optical Networks
Hui Wang, PhD Student, North Carolina State University, 3607 Helix Ct. Apt. 302, Raleigh, NC, 27606, United States of America, hwang4@ncsu.edu, George Rouskas

As the MILP formulated traffic grooming problems on ring optical networks cannot be solved to optimality even for 24 hours for large number of nodes, we need efficiently approximate methods to give guidelines for lightpaths constructing due to real time traffic demands. In this work, we compare the results of the 4 ring-to-path decomposition methods together with the baseline - the original traffic grooming problem, and give suggestion on how the decomposition methods could be used in reality.

■ SA37

C - Room 219B

Maintenance Optimization

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Anahita Khojandi, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, 15261, United States of America, anahitakhojandi@gmail.com

1 - Optimal Maintenance and Replacement Investment under Technological Uncertainty

Thomas Yeung, Associate Professor, Ecole des Mines de Nantes, 4 rue Alfred Kastler BP 20722, Nantes, 44000, France, thomas.yeung@mines-nantes.fr, Phuong Khanh Nguyen Thi, Bruno Castanier

We investigate the maintenance and replacement investment strategy of a stochastically deteriorating asset under technological uncertainty. New technology is modeled by a non-stationary probability of appearance and a stochastic acquisition cost. We use a stationary and non-stationary Markov decision process to formulate the two stages of the problem and an efficient approach to optimize the forecast horizon is proposed. Analytical structure of the policy and numerical results are provided.

2 - Optimal Inspection Policies for a Vital Component Needed Upon Emergency

Alireza Sabouri, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, V6T 1Z2, Canada, Alireza.Sabouri@sauder.ubc.ca, Steven Shechter, Woonghee Tim Huh

We consider a stochastically failing component that will be needed at a random future time when an emergency occurs. If the component is not operational at that time, the system incurs a large penalty, which we want to avoid through periodic inspections. We propose a model and solution algorithm for finding an inspection policy that minimizes the expected penalty and inspection costs. We also discuss structural properties of the solution, as well as insights based on numerical results.

3 - Decision Dependent Stochastic Processes

Thomas Kirschenmann, Graduate Research Assistant, University of Texas at Austin, 1 University Station C0200, Austin, TX, 78712, United States of America, thk3421@ices.utexas.edu, Paul Damien, Tim Hanson, Elmira Popova

Managers often make decisions affecting a stochastic process with incomplete knowledge of their impact on the process. We present a new Bayesian inferencing technique to estimate the decision dependency and make better informed decisions. Our technique uses an MCMC method to obtain estimates of the dependency on maintenance decisions for a system at a nuclear power plant. We use estimates of the dependence in the failure time distribution as inputs to form an optimal maintenance schedule.

4 - Optimal Policies for Life-Depleting Maintenance Activities over a Finite Planning Horizon

Anahita Khojandi, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, 15261, United States of America, anahitakhojandi@gmail.com, Oleg A. Prokopyev, Lisa M. Maillart

Motivated in part by remote monitoring of battery powered devices, we consider a system with a deterministic initial lifetime that generates reward at a decreasing rate as its virtual age increases. Maintenance (MX) can be performed to reduce the virtual age of the system; however, MX also shortens the system's remaining lifetime. Given this tradeoff, we analyze various lifetime-reward-maximizing MX policies under perfect and imperfect MX for failure- and non-failure-prone systems.

■ SA38

H- Johnson Room - 4th Floor

Joint Session Location Analysis/SPPSN: Community-Based Operations Research

Sponsor: Location Analysis/Public Programs, Service and Needs

Sponsored Session

Chair: Michael Johnson, Associate Professor, University of Massachusetts Boston, 100 Morrissey Boulevard, McCormack Hall, Room 3-428A, Boston, MA, 02125-3393, United States of America, Michael.Johnson@umb.edu

1 - Dynamic and Stochastic Knapsack-type Models for Foreclosed Housing Acquisition and Redevelopment

Armagan Bayram, Doctoral Student, University of Massachusetts Amherst, Isenberg School of Management, Amherst, MA, 01003, United States of America, abayram@som.umass.edu, Senay Solak, Michael Johnson, David Turcotte

Community Development Corporations (CDCs) are key actors in preventing the effect of the foreclosures by acquiring, redeveloping and selling foreclosed units in their service areas. We develop dynamic and stochastic knapsack-type models to assist CDCs in managing their housing acquisition and redevelopment decisions. We perform analytical and numerical analyses of the corresponding models, and describe some policy related results.

2 - Mitigating the Impact of Reductions in USPS Infrastructure and Services

Baris Hasdemir, Doctoral student, University of Massachusetts Amherst, Department of Fin. and Operations Mgmt, Amherst, MA 01003, Amherst, MA, 01003, United States of America, hasdemir@som.umass.edu, Agha Iqbal Ali

In response to the GAO reports of the viability and sustainability of the current business and operations model of the USPS, the nation's second largest civilian employer, changes in infrastructure for USPS operations are under review. Proposals include elimination of some of its 27K post offices and reduction of the 260 P&DC with redefinition of the work-force. In this paper we propose a new location model that brings visibility to the impact on the US population's access to postal services.

3 - Operations Research for Family Violence Needs Assessment in the State of Georgia

Christina Scherrer, Associate Professor, Southern Polytechnic State University, 1100 S. Marietta Pkwy, Marietta, GA, 30060, United States of America, cscherre@spsu.edu, Natalie Towns, Paul Griffin, Angela Snyder

We detail the background, OR methodology, and practical results from a needs assessment of domestic violence services completed for Georgia's Family Violence Unit (FVU). We created a mixed-integer optimization model to balance the geographic distribution of shelters and supply of shelter beds with the demand for services. The impact of various distance constraints and capacity restrictions were studied. Results from the model, and application of the results within the FVU, will be discussed.

4 - Decision Models for Residential Housing Planning in an Era of Municipal Shrinkage

Michael Johnson, Associate Professor, University of Massachusetts Boston, 100 Morrissey Boulevard, McCormack Hall, Room 3-428A, Boston, MA, 02125-3393, United States of America, Michael.Johnson@umb.edu, Justin Hollander

Planners must set investment priorities for neighborhoods facing long-term challenges to population and economic growth. We present two multi-objective decision models that optimize objectives related to economic efficiency, equity and social impacts of diverse land uses. The first determines neighborhood-level investments to promote residential or new non-residential uses; the second determines which parcels should be targeted for continued occupancy or allow to become or remain vacant.

■ SA39

H - Morehead Boardroom -3rd Floor

Online Community and Social Network

Sponsor: E-Business

Sponsored Session

Chair: Peng Huang, University of Maryland, 4350 Van Munching Hall, College Park, MD, 20742, United States of America, huang@umd.edu

1 - A Structural Model of Segregation in Social Networks

Angelo Mele, PhD Student, University of Illinois at Urbana-Champaign, 214 David Kinley Hall, 1407 W Gregory Dr, Urbana, IL, 61801, United States of America, amele2@illinois.edu

I develop and estimate a dynamic model of strategic network formation with heterogeneous agents. I prove existence of a unique stationary equilibrium, characterizing the likelihood of observing a specific network in the data. I propose a Bayesian MCMC algorithm that drastically reduces the computational burden of estimating the posterior distribution and allows inference in high dimensional models.

2 - Lattice or Ladder: Evidence of Intra-organizational Virtual Collaboration Using Longitudinal Data
Zhongju Zhang, University of Connecticut, 2100 Hillside Rd, Storrs, CT, United States of America, John.Zhang@business.uconn.edu

We examine intra-organizational collaboration within a Fortune 20 company in which company employees around the globe use an IT-enabled online system to communicate and collaborate with company subject-matter experts. Using longitudinal data on user requests/questions and corresponding responses, we study the efficiency (in terms of response time and number of links to reach expert) of virtual collaboration and implications on organizational structure.

3 - How Social Influence Is Developed Online: The Case of User Reviews
Kexin Zhao, University of North Carolina-Charlotte, 9201 University City Blvd., Charlotte, NC, 28269, United States of America, kzhao2@uncc.edu, Yiming Zheng, Antonis Stylianou

User reviewers play an increasingly important role in e-commerce. While prior research reveals that user reviews can create strong social influence on consumers' decision-making process, the formation process of social influence is still unclear. In this research, we develop a model to examine how different types of social influence are developed from online reviews.

4 - Networking Online for a New Job
Rajiv Garg, Carnegie Mellon University, 4800 Forbes Avenue, Suite 3030, Pittsburgh, PA, 15213, United States of America, rgarg@Andrew.cmu.edu, Rahul Telang

In this paper we empirically investigate the role of online social networks (like LinkedIn) on job outcomes (like job leads, interview calls, or offers). We also compare the returns of online social networks with the other job search modes (like career fairs and agencies, newspapers and magazines, internet, and close friends and family) and find that the online social networks are most effective in converting job search effort into outcomes.

■ SA40

H - Walker Room - 4th Floor

Innovation and Entrepreneurship I: Financing

Sponsor: Technology Management

Sponsored Session

Chair: Sinan Erzurumlu, Assistant Professor, Babson College, 231 Forest Street, Wellesley, MA, 02457, United States of America, serzurumlu@babson.edu

1 - The Relationship of Entrepreneurial Capability, Experience and Traits to Receiving Funding
Andrew Maxwell, University of Waterloo, 200 University Avenue West, Waterloo, Canada, a2maxwel@engmail.uwaterloo.ca, Moren Levesque

We observe business angel investors make actual investment decisions to formulate and test three hypotheses on how manifestations of entrepreneurial characteristics affect investors' risk perception and their likelihood of making an investment offer. We support an increasing linear relationship between that likelihood and capability or experience. For traits, however, we find an inverted U-shaped relationship.

2 - Value of Reversed Factoring in Multi-stage Supply Chains
Fehmi Tanrisever, Technische Universiteit Eindhoven, Eindhoven, Netherlands, f.tanrisever@tue.nl, Hande Cetinay, Matthew Reindorp

Informational asymmetries may create a significant wedge between the costs of internal and external funds for small- and medium-sized enterprises (SMEs). This can have negative repercussions further along in a supply chain, since an SME may be a key supplier to a large corporation. We examine a recent development that promises to address such problems: so-called "reversed factoring" arrangements, which facilitate information revelation and thus trigger affordable financing.

3 - Properties of the Venture Capital Deal Space under Private Information
Meyyappan Narayanan, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, mnarayanan@uwaterloo.ca, Brian Cozzarin

We simulate the venture capital deal process under private information and use regressions to analyze the resulting synthetic data. We find teamwork between the entrepreneur and the venture capitalist to be crucial for the entrepreneur to receive an investment, and that the venture capitalist's confidence in the entrepreneur's performance works to the entrepreneur's advantage. We also find that a higher base salary for the entrepreneur can be detrimental or beneficial to either party.

4 - The Impact of the Venture Capitalist on the Entrepreneurial Innovation Process
Sinan Erzurumlu, Assistant Professor, Babson College, 231 Forest Street, Wellesley, MA, 02457, United States of America, serzurumlu@babson.edu, Fehmi Tanrisever, Nitin Joglekar

In the relationship between a Venture Capitalist(VC) and the startup, as much as the entrepreneur seeks funds, VC should provide sufficient level of advising. We study the impact of the characteristics of the VC as well as financing on the entrepreneurial venture to determine the right type of investor for the startup. Depending on the financier's level of advising and the stage of the project, the startup is better off working with different types of investors.

■ SA41

H - Waring Room - 4th Floor

Collaboration in Innovation and Product Development Processes

Cluster: New Product Development

Invited Session

Chair: Sanjiv Erat, Assistant Professor, University of California-San Diego, Rady School, San Diego, CA, United States of America, serat@ucsd.edu

1 - Managing Product Transition under Technology Uncertainty
Sreekumar Bhaskaran, Assistant Professor, Cox School of Business, Dallas, TX, 75230, United States of America, sbhaskar@mail.cox.smu.edu, Ankur Goel, Karthik Ramachandran

Sequential innovation creates several logistical challenges for innovating firms. Often, the end-of-life inventory decision for an existing product must be made before the technology uncertainty surrounding the new product is resolved. We jointly model these decisions, and consider the effects of product architecture, development capability, operational flexibility and competition on the inventory decision.

2 - The Effect of Correlated Information on the Negotiation Process of Licensing Agreements
Jerry He, Judge Business School, Cambridge University, Trumpington Street, Cambridge, United Kingdom, xh232@cam.ac.uk, Nektarios Oraiopoulos

The vast majority of prior work on licensing agreements between pharmaceutical and biotech companies relies on the assumption of asymmetric information. In light of the remarkably high uncertainty that characterizes the drug development process, we argue that such information may not be available to either party. Instead, we study the efficiency of the licensing process when both parties receive imperfect, yet correlated, signals regarding the value of the drug candidate.

3 - The Bargaining Nature of Product Development: Implications from Cross-Functionality
Stelios Kavadias, Associate Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree St NW, Atlanta, GA, United States of America, Stylianos.Kavadias@mgt.gatech.edu, Jeremy Kovach

We explore how functional stakeholder interactions shape the outcomes of NPD projects. We focus on the milestone points during development, where product specifications are debated between marketing and engineering. Instead of the standard assumption of central project coordinators, we posit that NPD processes rely on the strategic interactions among the stakeholders. We develop a bargaining model to understand how organizational power, uncertainty, and performance metrics affect such decisions.

■ SA42

H - Gwynn Room - 4th Floor

Digital Channel and IT Usage

Sponsor: Information Systems Society

Sponsored Session

Chair: Mohammad Rahman, Assistant Professor, University of Calgary, Haskayne School of Business, 2500 University Drive NW, Calgary, AB, T2N 1N4, Canada, rahman@ucalgary.ca

1 - Sunk Cost Effect: The Impact of Delegating Decision Making to IT
Philipp Herrmann, University of Paderborn, Warburger Strafle 100, Paderborn, 33106, Germany, Philipp.Herrmann@wiwi.uni-paderborn.de, Dennis Kundisch, Mohammad Rahman

We investigate the impact of delegating decision making to IT on the sunk cost effect. We analyze direct buy decisions of participants in pay-per-bid auctions who did not plan to exercise the direct buy option, but who, after failing to win the auction, did buy the product directly. A higher monetary investment increases the occurrence of the sunk cost effect. Participants who delegate their decision making to bidding agents are less prone to the sunk cost effect.

2 - Social Media, Traditional Media and Music Sales: A Panel VAR Approach

Jui Ramaprasad, McGill University, Montreal, QC, Canada, jui.ramaprasad@mcgill.ca, Sanjeev Dewan

Motivated by the growing importance of social media, especially in the context of music, this paper examines the inter-relationship between social media buzz, radio play and music sales, at both the album and song levels of analysis. To examine these relationships, we employ Panel Vector Autoregression (PVAR) methodology, an extension of vector auto-regression to be used with panel data. Our initial results indicate interesting differences in the relationships at the song-level and album level.

3 - Max Headroom and Bob Dylan Walk Into a Bundle: Digital Distribution in the Post Napster Era

Il-Horn Hann, University of Maryland, 4332R Van Munching Hall, University of Maryland, College Park, United States of America, ihann@rhsmith.umd.edu, Anna Devlin, Brad Greenwood

The advent of Napster had a profound impact on the music industry. While most work has focused on the effect of piracy on physical CD sales, we investigate how firms should optimally react to the introduction of a digital channel. Our model suggests that the size, price, and profitability of physical albums should decrease. The number of hit songs per album remains the same, while the number of individuals consuming music should increase. We subsequently verify the model against data.

4 - The Impact of eBook Distribution on Print Sales: Analysis of a Natural Experiment

Yu Hu, Assistant Professor, Purdue University, West Lafayette, IN, United States of America, yuhu@purdue.edu, Michael Smith

We analyze the impact of digital channels on physical sales using a natural experiment that occurred between April and June 2010. We find that delaying the release of ebooks causes in an insignificant change in hardcover sales but a significant decrease in ebook sales, total sales, and likely total revenue and profit to the publisher. Together our results suggest that channel (platform) choice is more important than product choice in the minds of the majority of ebook consumers.

■ SA43

H - Suite 402 - 4th Floor

Real Options in the Energy Sector

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Afzal Siddiqui, University College London, Gower Street, London, United Kingdom, afzal@stats.ucl.ac.uk

1 - Parameter Estimation for Two-factor Commodity Price Models

Joe Hahn, Assistant Professor of Decision Sciences, Pepperdine University, 24255 Pacific Coast Highway, Malibu, CA, 90263, United States of America, Joe.Hahn@pepperdine.edu, James Dyer, Jim DiLellio

Stochastic models of commodity prices are important inputs in long-term energy planning problems. Schwartz and Smith (2000) developed one such model which decomposes price into unobservable factors for the long-term mean, specified with a GBM process, and short-term deviation from the long-term mean, modeled as a mean-reverting process. In this paper, we develop a Kalman filtering with maximum likelihood approach to determine the parameters and demonstrate its utility using empirical data.

2 - Discounting in Multi-asset Real Options Analysis

Reinhard Madlener, Institute for Future Energy Consumer Needs and Behavior (FCN), E.ON Energy Research Center, Mathieustrasse 6, Aachen, 52074, Germany, rmadlener@eonerc.rwth-aachen.de, Wilko Rohlfs

Investment decisions in the energy sector are influenced by several factors, e.g. electricity, fuel and CO2 prices as well as investment cost. The overall cash flow and its volatility in each period is given by the combination of the assets. An adequate risk-adjusted discount rate of the cash flow has to account for this fact. Based on an NPV model, we present a multi-asset real options model, including time-dependent discounting and simulation results of carbon capture and storage technology.

3 - Reversibility, Operating Flexibility, and Asset Returns in Competitive Equilibrium

Ryuta Takashima, Chiba Institute of Technology, 2-17-1 Tsudanuma, Narashino-shi, Chiba, Japan, takashima@sun.it-chiba.ac.jp

Firm in the deregulated infrastructure industries as energy sector must make decisions taking into account uncertain market prices, and competitor's decision. Moreover, the firm's exposure to systematic risk is dependent on its decision. We model the equilibrium investment strategy of firm to analyze firm's decisions in competitive industries. Especially, we how the strategic behaviors of firms such as investment, disinvestment, and operating flexibility affect their asset returns dynamics.

4 - Technology Adoption under Rivalry and Uncertainty

Afzal Siddiqui, University College London, Gower Street, London, United Kingdom, afzal@stats.ucl.ac.uk

Tackling climate change requires developing alternative energy technologies along with adaptation measures. In order to maximise the benefits of such R&D programmes, a timely migration strategy from existing technologies is necessary. Competition from other countries magnifies the importance of the timing and sequencing. We analyse adoption strategies with repeated technology options under rivalry, market uncertainty, and random technological improvement.

■ SA44

H - Suite 406 - 4th Floor

Design and Analysis of Supply Chains Under Risk of Disruption

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Chase Rainwater, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, cer@uark.edu

1 - The Capacitated Facility Location Problem for Emergency Response - A Multi-objective Approach

Ivan Hernandez, Research Assistant, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, ihernand@stevens.edu, Jose Emmanuel Ramirez-Marquez, David Starr, Ryan McKay

Were a biological disaster to occur, response agencies will open Temporary Emergency Units (TEUs) to provide medication in order contain the spread of the disease. Through an evolutionary optimization approach, we provide response agencies the option of choosing from a range of solutions that best meets their criteria among competing objectives such as the minimization of: 1)total travel distance between TEUs and neighborhoods, 2) number of TEUs deployed and 3) the distribution of TEU load.

2 - Designing a Robust Pharmaceutical Supply Chain Network Against Disruptions

Mustafa Sir, Assistant Professor, University of Missouri, Lafferre Hall, Columbia, MO, 65211, United States of America, sirm@missouri.edu, Kevin Taaffe, Scott J. Mason, Mahmood Pariazar, Sarah Root, Edward Pohl, Mary Beth Kurz

We develop a two-stage stochastic programming model to explore the tradeoffs between costs and risk in the healthcare supply chain. The first-stage decisions represent strategic decisions such as location and capacity of suppliers while in the second stage, operational decisions related to transportation and inspection are determined. We consider scenarios where the failures of the suppliers are correlated and examine their effect on supplier selection, transportation, and inspection strategies.

3 - Assessing Vulnerabilities in the Coal Supply Chain

Ridvan Gedik, Graduate Research Assistant, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rgedik@uark.edu, Hugh Medal, Chase Rainwater, Edward Pohl, Scott J. Mason

Due to critical roles of rail transportation in the coal supply chain, vulnerable infrastructure elements of the system must be identified to minimize the impacts of rail network disruptions. In order to maintain the functionality of the coal transportation, we present a 2-stage interdiction mathematical model with an integer time-indexed second stage. Our model seeks to identify the most critical elements of the rail network under disruptions caused by deterministic interdiction.

■ SA45

H - Suite 407 - 4th Floor

Combinatorial Auction Design and Applications I

Cluster: Auctions

Invited Session

Chair: Dries Goossens, K.U.Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Dries.Goossens@econ.kuleuven.be

1 - An Experimental Analysis of the Combinatorial Clock Auction
Martin Bichler, TU München, Boltzmannstr. 3, Garching, 85748, Germany, bichler@in.tum.de, Pasha Shabalin, Jürgen Wolf

There has been a long discussion on appropriate auction mechanisms for the sale of spectrum rights. The Simultaneous Multi-Round Auction (SMRA) has been used worldwide for more than 15 years. In the recent years, the Combinatorial Clock Auction (CCA) has been used in several countries world-wide to sell spectrum. We will present the results of laboratory experiments comparing the CCA and SMRA and analyze bidder behavior of both experienced and unexperienced bidders.

2 - Network Bargaining: A Search-theoretic Approach
Thanh Nguyen, Northwestern University, Kellogg School of Management, 2001 Sheridan Rd, Evanston, IL, 60208, United States of America, t-nguyen@kellogg.northwestern.edu

We examine variations of non-cooperative network bargaining models, where trade opportunities arise according to a stationary stochastic process, and a randomly selected agent makes a take-it-or-leave-it offer. We give a characterization of stationary equilibrium via a convex program. We contrast our prediction with the Core of a TU game and study the emergence of an unstable market.

3 - Enabling Spectrum Sharing in Secondary Market Auctions
Ian Kash, Harvard University, 33 Oxford St, Cambridge, MA, 02138, United States of America, kash@seas.harvard.edu, David Parkes, Rohan Murty

Wireless spectrum is a scare resource, but much of it is under-used by current owners. To enable better use of this spectrum, we propose an auction approach to dynamically allocate the spectrum in a secondary market. Unlike previous auction approaches, we seek to take advantage of the ability to share spectrum among some bidders while respecting the needs of others for exclusive use. A key challenge for our auction design is handling the externalities created by sharing.

4 - Solids - A Combinatorial Auction for a Housing Corporation
Dries Goossens, K.U.Leuven, Naamsestraat 69, Leuven, 3000, Belgium, Dries.Goossens@econ.kuleuven.be, Frits Spieksma

We describe a combinatorial auction for real estate in Amsterdam (The Netherlands). The auction is scheduled for May 7, 2011, when hundreds of bidders will bid for housing space in a newly erected building. We sketch our collaboration with the housing corporation that resulted in choices with respect to the auction design. We show how a various condition can be included in a MIP formulation used to compute the allocation. Computational experiments illustrate the tractability of this model.

■ SA47

H - Dunn Room - 3rd Floor

Freight Transportation and Logistics

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Rodrigo Mesa Arango, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47907, United States of America, rmesaa@gmail.com

1 - A Multi-commodity Capacitated Pickup and Delivery Problem: The Single and Two-vehicle Cases
Harilaos N Psaraftis, National Technical University of Athens, Athens, 10682, Greece, hnpsar@mail.ntua.gr

We consider a multi-commodity capacitated pickup and delivery problem with cargo flows among all node pairs given by a general O/D matrix. Objective is to minimize a combination of vehicle trip costs and cargo delay/inventory costs. This problem is a generalization of several problems that have appeared in the literature. Dynamic programming approaches are developed for the single-vehicle and two-vehicle cases. Some examples are presented to illustrate the method.

2 - Multi-scenario Heuristics for a Dynamic Traveling Salesman Problem with Fixed Appointment Times
Yu-Shiu Lin, Georgia Institute of Technology, 15 Habersham Rd., Unit G06, Atlanta, GA, 30305, United States of America, phil.lin82@gmail.com, Ashlea Bennett, Alan Erera

This paper emphasizes a dynamic single vehicle, single depot routing problem with fixed appointment times. First, we introduce an exact algorithm for the static problem to maximize number of customer served with customers on the real line. For the dynamic problem, we present a multi-scenario heuristic. Our computation studies show that our heuristic can efficiently provide a high quality solution for 1) customers on the real line and 2) customers in two-dimensional space.

3 - A Bidding Advisory Model for Combinatorial Auctions Incorporating Less-than-Truckload Schemes
Rodrigo Mesa Arango, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47907, United States of America, rmesaa@gmail.com, Satish Ukkusuri

In this paper we present a bidding technique that can be used by a Less-Than-Truckload (LTL) company in order to submit optimal quotes in a combinatorial auction. The objective is to minimize the unused capacity per-mile. This problem is solved using a Branch-and-Price technique. Numerical results show the implications of using LTL strategies over the usual Truck-Load (TL) strategies reported in previous literature.

4 - Employee Scheduling at Maritime Container Terminals
F. Jordan Srour, The American University of Beirut, P.O. Box 11-036, Riad El-Solh, Beirut, 1107 2020, Lebanon, fjsrour@gmail.com, George Turkiyyah, Omar Rifai, Francisco Franco

While numerous references exist on the topics of terminal design, container logistics, and vessel scheduling, only a limited number of papers address the need for a workforce management system tailored to the highly dynamic container terminal environment. Our research, motivated by the Beirut Container Terminal Consortium (BCTC), seeks to design and test a system for producing yard staff schedules that minimize costs while also promoting fairness across employees in the scheduling of overtime.

5 - Vehicle Routing for Snow Plowing Operations
Hang Li, University of Illinois Urbana-Champaign, Department Civil & Enviro Engineering, Urbana, IL, United States of America, hangli1@illinois.edu

The paper develops a mathematical programming model for the routing of snow plowing vehicles, and the goal is to minimize the total service time needed to serve all road segments while satisfying a set of operational constraints. The problem is formulated into a multi-depot traveling salesman problem. The model generates a feasible snow truck routing plan to maximize snow removal efficiency.

■ SA48

H - Graham Room - 3rd Floor

Innovations in Pricing and Financing of Transportation Systems: I

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Yafeng Yin, University of Florida, 365 Weil Hall, Gainesville, FL, 32611, United States of America, yafeng@ce.ufl.edu

1 - Urban Delivery Industry Response to Pricing and Incentives: The NYC Off-Hour Delivery Project
Jose Holguin-Veras, Rensselaer Polytechnic Institute, 110 8th St Room JEC 4030, Troy, NY, 12180, United States of America, jhv@rpi.edu

This presentation discusses the analytical formulations developed to analyze the urban delivery industry response to pricing and financial incentives. In the second part of the presentation, the author presents the key results of a path breaking pilot test conducted in NYC that confirmed the results anticipated by theory.

2 - Robust and Dynamic Congestion Pricing
Tao Yao, Assistant Professor, The Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Byung Do Chung, Terry Friesz

We formulate robust dynamic congestion pricing problem under demand uncertainty as a mathematical programming with equilibrium constraints (MPEC) and propose a new solution approach to solve the problem.

3 - Equity Effect of Tradable Driving Credit Scheme
Di Wu, University of Florida, 518C Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, wudi@ufl.edu, Yafeng Yin, Hai Yang

This paper analyzes the equity effect of a tradable driving credit scheme in a general multimodal transportation network. Under the scheme, the transportation authority distributes credits to travellers and then charges certain credits for driving. The credits can be traded freely among travelers at a market-determined price. By optimally designing the initial credit distribution and a credit charging scheme, this paper attempts to reduce congestion and simultaneously improve social equity.

4 - Differentiated Congestion Pricing of Urban Transportation Networks
Mahmood Zangui, PhD Student, University of Florida, 518-B Weil Hall, Gainesville, FL, 32608, United States of America, mzangui@ufl.edu, Yafeng Yin, Siriphong (Toi) Lawphongpanich

In the literature, the focus on congestion pricing has been on anonymous schemes, i.e., ones that charge every user the same amount of toll regardless of his or her travel or social characteristics. This paper explores a new type of non-anonymous scheme that differentiates users with respect to their travel characteristics and charges them different amount of toll accordingly. The scheme can reduce the financial burden of travelers or lead to more substantial reduction of traffic congestion.

■ SA49

H - Graves Room - 3rd Floor

Agent-based Modeling and Simulation – Overview and Tutorial

Sponsor: Simulation

Sponsored Session

Chair: Charles Macal, Senior Systems Engineer, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439, United States of America, macal@anl.gov

1 - Agent-based Modeling and Simulation – overview and Tutorial
Charles Macal, Senior Systems Engineer, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439, United States of America, macal@anl.gov, Michael North

Agent-based modeling and simulation (ABMS) is a new approach to modeling systems comprised of autonomous, interacting agents. Applications are growing rapidly in fields ranging from modeling the stock market to predicting the spread of epidemics. Complex adaptive systems, emergent behavior, and self-organization are a few of the notions from ABMS This tutorial covers the foundations of ABMS, development toolkits and methods, practical aspects, and the relationship of ABMS to conventional OR.

■ SA50

H - Ardrey Room - 3rd Floor

Multivariate Methods in Data Mining

Sponsor: Data Mining

Sponsored Session

Chair: Kobi Abayomi, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, ISYE Department, Atlanta, GA, 30332, United States of America, kabayomi3@isye.gatech.edu

1 - Efficient Methods for Anomalous Pattern Detection in General Datasets
Edward McFowland, Graduate Student, Carnegie Mellon University, Pittsburgh, PA, United States of America, mcfowland@cmu.edu, Daniel Neill

Fast Generalized Subset Scan (FGSS) is a novel method for detecting anomalous patterns in general datasets. We frame the pattern detection problem as a search over subsets of records and attributes, and exploit a novel property of the nonparametric scan statistic allowing for efficient optimization over subsets. We have recently extended FGSS to discover anomalous patterns given multiple models of known patterns as well as utilizing an ensemble of independent "local" anomaly detectors.

2 - Statistics for Sorting Multivariate Prognostic Data
Fang Cao, Graduate Student, Georgia Institute of Technology, ISYE, Atlanta, GA, United States of America, fcao6@gatech.edu, Kobi Abayomi, Nagi Gebraeel

We consider probabilistic representations of algorithms for sorting multiple component (multivariate) units (observations) generating prognostic reliability data. Specifically we offer non-deterministic versions of the Thresholding and Minimal Program Algorithms and demonstrate their almost sure convergence to the deterministic programs under more relaxed unit 'scoring'.

3 - Theory and Methodology for Exoneration Data
Kobi Abayomi, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, ISYE Department, Atlanta, GA, 30332, United States of America, kabayomi3@isye.gatech.edu, Jessica Gabel, Otis Jennings

Since 1992, the Innocence Projects have helped over 250 wrongly convicted persons prove their innocence. These are likely a miniscule sample of the number of wrongly convicted persons: research suggests that the number may be greater than 28,500. Many of these cases slip through the cracks: DNA evidence is unavailable or insufficient for exoneration. We suggest methodology for the possible determinants of exoneration using a case-control setup on discrete multivariate dependent data.

4 - Embedding Methods for Finding Meaningful Associations of Key Words in IIE Transactions
Seoung Bum Kim, Associate Professor, Korea University, Seoul, Korea, Republic of, sbkim1@korea.ac.kr, Sugon Cho

Various embedding methods have been introduced to facilitate the visualization of high-dimension data and to extract their meaningful patterns. In the present study we crawled the abstracts of IIE Transactions from 1969 to 2011 and applied low-dimensional embedding methods to find meaningful associations of key words frequently appeared in the paper.

■ SA51

H - Caldwell Room - 3rd Floor

Shared Mobility Systems I

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Tal Raviv, Tel Aviv University, Ramat Aviv, Tel Aviv, 69978, Israel, talraviv@eng.tau.ac.il

1 - Anticipating Usage Patterns in the Design of Bike-sharing Systems
Patrick Vogel, University of Braunschweig, Decision Support Group, Muehlenpfordtstrafle 23, Braunschweig, Germany, p.vogel@tu-bs.de, Dirk C. Mattfeld

A common issue observed in Bike-Sharing systems is imbalances in the distribution of bikes. We refer to Data Mining to gain insight into typical usage patterns of Bike-Sharing systems. Alleviating imbalances by means of bike repositioning is expensive. Our aim is to support design decisions with regard to the corresponding infrastructure, considering costs due to a certain service level. Operational usage patterns are anticipated and incorporated in a strategic location planning model.

2 - The Right Size of Bike Rental Stations
Tal Raviv, Tel Aviv University, Ramat Aviv, Tel Aviv, 69978, Israel, talraviv@eng.tau.ac.il, Edison Avraham, Ofer Kolka

A method to decide upon the size of a station in a bike sharing system based on forecasted demand pattern and assuming a static repositioning policy is presented. It can be used to determine the minimal number of stalls required so as to meet some pre-specified service level or, alternately, to determine the optimal allocation of stalls among the stations in the system assuming a given budget. A case study that is based on data collected from Capital Bikeshare, Washington DC is reported.

3 - Bicycle-sharing System: Deployment, Utilization and the Value of Re-distribution
I-Lin Wang, Associate Professor, National Cheng Kung University, Dept. of Industrial & Information Mgmt., Tainan 701, Taiwan - ROC, ilinwang@mail.ncku.edu.tw, Mabel Chou, Qizhang Liu, Jia Shu, Chung Piaw Teo

We develop practical OR models to support decision making in the design and management of bicycle sharing systems. Using estimates of demand for bicycles between stations in each time period, we develop a model to predict the bike flow, estimate the number of trips supported by the system given an initial allocation of bicycles at each station, the number of docks needed in each station, and also examine the viability of periodic re-distribution of bicycles in the network to support more flows.

4 - Sizing, Incentives and Regulations in Bike-sharing Systems
Christine Fricker, INRIA, Domaine de Voluceau, Rocquencourt, Le Chesnay, 78153, France, christine.fricker@inria.fr, Nicolas Gast

A model including the rental station size in homogeneous bike sharing systems is proposed. Closed form results are obtained for the large system behavior. The influence of the parameters and some load balancing strategies on the proportion of problematic stations is discussed. Simple incentives to choose the station to return the bike may improve dramatically the performance. An non-homogeneous scenario is also investigated, where incentives are insufficient and regulation mechanisms are needed.

■ SA52

H - North Carolina - 3rd Floor

Organizational Learning: A Walk on the Dark Side

Sponsor: Organization Science

Sponsored Session

Chair: Natalya Vinokurova, Stern School of Business, NYU, 44 W. 4th Street, 7-156, New York, NY, 10003, United States of America, ndv209@stern.nyu.edu

1 - 2008 Mortgage Crisis as a Failure of Analogical Reasoning
Natalya Vinokurova, Stern School of Business, NYU, 44 W. 4th Street, 7-156, New York, NY, 10003, United States of America, ndv209@stern.nyu.edu

Drawing on scholarship in organizational learning, diffusion of innovation and sociology of disasters, this paper explores the role played by the 'mortgage-backed securities as bonds' analogy in the diffusion of mortgage-backed securities (MBS) between 1968 and 2008 in the U.S. as well as the subsequent contraction of the market in which more than 3 million families lost their homes.

2 - Geographical Diffusion of Corporate Fraud: How Backdating Spread between U.S. Corporations
Aharon Cohen Mohliver, PhD Candidate, Graduate School of Business, Columbia University, Uris Hall, New York, 10027, United States of America, acohenmohliver14@gsb.columbia.edu

This study examines the diffusion of backdating of stock option grants in the U.S. We find distinct geographical clusters in which backdating was prominent and that these are significant over and above industry clusters. We find that this clustering is driven by the transfer of information and legitimacy through local offices of external auditors as the likelihood of adoption of backdating increases significantly when auditor's local office has been exposed to this practice in the past.

3 - Bell Curve Bias and the Failure to Envision, or Learn from, Merely Unusual Events
Shellwyn Weston, PhD Candidate, Stern School of Business, NYU, 44 W. 4th Street, New York, NY, 10003, United States of America, sweston@stern.nyu.edu

My empirical studies of the distributional assumptions individuals make regarding heavy-tailed phenomena (e.g. asset prices), demonstrate a bias, leading to the underweighting of rare events. Most subjects assume underlying random processes are bell curved, exhibit superstitious learning, and readily dismiss merely unusual events as rare outliers. I introduce a new method, using preferences for skewed derivatives payoffs, to elicit distributional assumptions and estimates of tail-risk.

4 - Learning from Advisers: A Study of Management Consulting
Isaac Waisberg, Stanford University, Huang Engineering Center, 475 Via Ortega, Suite 212R, Stanford, CA, 94305, United States of America, waisberg@stanford.edu

Advisers tend to copy-and-paste old solutions, almost irrespective of the problems they face. As a consequence, organizations are likely to get advice that is ill-suited to their particular needs. Under certain conditions, however, the interaction between organizations and advisers may lead to positive learning outcomes. I discuss these conditions in the context of a management consulting project in one of the largest hospital systems in the US.

■ SA53

H - South Carolina - 3rd Floor

Data-Integrated Simulation Modeling

Sponsor: Data Mining

Sponsored Session

Chair: Durai Sundaramoorthi, Lecturer, Washington University in St. Louis, Olin School of Business, St. Louis, MO, United States of America, dsundaramoorthi@gmail.com

1 - Simulation-based Assessment of Change Propagation Effect in an Aircraft Design Process
Dong Xu, University of Arizona, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, dongxu@email.arizona.edu, Young-Jun Son, Sai Srinivas Nageshwaraniyer

In this talk, a simulation-based approach is proposed for assessing the effect of change propagation in an aircraft design process. The proposed method is a good supplement to the traditional approach by considering 1) logistics factor; 2) manufacturing system flexibility factor; 3) uncertainty conditions. The goal of the proposed approach is to assign the design effort to the change propagation path, which tends to be easily implemented and also involves lower uncertainties and estimated risk.

2 - A Data-integrated Simulation Model to Forecast Ozone Concentration
Durai Sundaramoorthi, Lecturer, Washington University in St. Louis, Olin School of Business, St. Louis, MO, United States of America, dsundaramoorthi@gmail.com

Elevated levels of ground-level ozone are hazardous to the health of people and destructive to the environment. This research develops a novel data-integrated simulation to forecast ground-level ozone (SIMGO) concentration based on a real data set collected from seven monitoring sites in the Dallas-Fort Worth area between January 1, 2005 and December 31, 2007. Tree-based models and kernel density estimation (KDE) were utilized to extract important knowledge from the data for the simulation.

3 - Correlating Random Variables in Monte Carlo Simulation
Samik Raychaudhuri, Oracle Americas, 500 Eldorado Blvd, Broomfield, CO, 80026, United States of America, samikr@gmail.com

In this talk, we will discuss about using correlated random variables in Monte Carlo simulation. The talk will cover algorithms for imparting correlations on random variables, the steps of which includes, grouping random variables, preparing a valid correlation matrix, and then using a copula to impart correlations. A finance example will also be presented, using Oracle Crystal Ball.

4 - Monte Carlo Simulation Based Inventory Algorithm to Achieve Target Service Levels with Job Lot Sales
Hemant Adhav, Manager - Supply Chain Analytics, Mu Sigma Inc., 3400 Dundee Rd,, Suite 160, Northbrook, IL, 60062, United States of America, hemant.adhav@mu-sigma.com, Alexander Quinn, Matthew Graham, Aditya K, Christie Berry, Ravindra Jore

Traditional inventory algorithms are based on assumptions which may not hold true for demand profiles with job lot or bulk sales. This algorithm applies service level concepts to calculate safety stock. Profiles are generated based on demand patterns, seasonality etc. A coin sorter methodology is used to select profiles that effectively account for job lot sales. Monte Carlo simulation is leveraged to calculate Safety Stock. The result is reduced stock outs with right-sized inventory.

■ SA54

H - Charlotte Hall - 3rd Floor

The George B. Dantzig Dissertation Prize

Cluster: The George B. Dantzig Dissertation Prize

Invited Session

Chair: Stephan Biller, GM Fellow & Group Manager Sustainable Manufacturing Systems, General Motors R & D, 30500 Mound Road, M/C 480-106-224, Warren, MI, 48090, United States of America, stephan.biller@gm.com

1 - Approximation Algorithms Via the Primal-Dual Schema: Applications to Problems from Logistics
Tim Carnes, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, tcarnes@mit.edu

In this thesis, we use the simple dual-ascent method, where the feasible dual solution is modified by increasing only a single dual variable at a time, to obtain approximation algorithms for the following problems: lot-sizing, a variant of the

generalized assignment problem, and the location routing problem with a global limit on locations. The last problem has been implemented to provide significant cost savings at Ornge, an air ambulance service provider in the province of Ontario.

2 - Advances in Electric Power Systems: Robustness, Adaptability, and Fairness

Xu Andy Sun, Now post-doc at IBM T.J.Watson Research Center, Operations Research Center, Massachusetts Institute of Technology, 77 Massachusetts Avenue E40-135, Cambridge, MA, 02139, United States of America, sunx@mit.edu

The thesis focuses on two important issues in the current electricity industry: how to reliably operate electric power systems under high penetration of intermittent, uncertain generating resources and uncertain demand, and how to design an auction and pricing scheme for the day-ahead electricity market that achieves both economic efficiency and fairness. We also present new approximation results of finitely adaptable policies for multistage stochastic optimization problems.

3 - New Media Planning Models for New Media

John Turner, Assistant Professor, University of California, Irvine, The Paul Merage School of Business, SB 338, Irvine, CA, 92697-3125, United States of America, john.turner@uci.edu

We study the planning, scheduling, and pricing of advertising for webpages, video games, e-billboards, and digital TV. Our plan-track-revise algorithm for scheduling video game ads at Massive Inc. (now Microsoft) reduces make-good costs by 80%+ and reserves more premium inventory for future sales. We show how to optimally aggregate the high-dimensional audience space, how to reach large audiences, how to minimize the variance of per-period impressions served, and illustrate pricing dynamics.

■ SA55

H - Mecklenburg Hall - 3rd Floor

Adoption of Analytics and OR Methods

Contributed Session

Chair: Neal Bengtson, Professor, Barton College, P.O. Box 5000, Wilson, NC, 27893, United States of America, bengtson@barton.edu

1 - Why Has the Adoption Rate of OR and Analytics Been So Slow?

Gary Cokins, Principal, Consulting, SAS, 401 Hogans Valley Way, Cary, NC, 27513, United States of America, gary.cokins@sas.com

There is sufficient evidence that methods of OR and analytics are proven and provide benefits. The methods have been around for decades. Then why the slow adoption rate of applying them? This provocative presentation will discuss the obstacles of human nature resistance to change, fear of knowing the truth, concerns about being held accountable and measured, and lack of leadership. The barriers are behavioral and cultural. We need to put "behavioral change management" on the discussion table.

2 - Operational Analysis Revisited

Neal Bengtson, Professor, Barton College, P.O. Box 5000, Wilson, NC, 27893, United States of America, bengtson@barton.edu

Operation Analysis(OA) was first defined in 1976 as a technique for calculating network performance measures. No assumptions are made that can't be verified. Real systems may consistently violate all the queuing model assumptions, yet agreed with observed characteristics. Some have found it much easier to teach beginning students queuing using an OA approach then a Markov approach. There has been little development or widespread adoption of OA since its initial introduction. Why?

3 - Strategies for Moving up the Analytics Maturity Curve: Lessons Learned in Financial Services

Lisa Kart, Research Director, Gartner, Inc., Austin, TX, United States of America, Lisa.Kart@gmail.com

The financial services industry is known for its use of predictive and descriptive analytics to understand customer risks and rewards. Within the past decade, prescriptive analytics has emerged as a way to gain competitive advantage. However, despite the gains, prescriptive analytics has not yet been widely adopted. In this talk, we will discuss the hurdles to adoption and how some institutions have managed to move up the analytics maturity curve.

4 - A Study of Efficiency of CMM Level 5 Software Projects – A DEA Analysis

Dinesh Pai, Penn State Harrisburg, 777 W. Harrisburg Pike, Middletown, PA, 17057, United States of America, drp18@psu.edu

DEA is used to investigate the efficiency of a sample of 38 software development and maintenance projects, which includes projects from Fortune 500 companies, drawn from a CMM level 5 company. Benchmark projects are identified and the efficiency differences among projects belonging to different platforms, databases, and application investigated. The average overall efficiencies of the sample are relatively high and that the projects are relatively less sensitive to the frontier projects.

■ SA56

H - Biltmore Boardroom - 2nd Floor

Cooperation and Coordination in Supply Chains

Contributed Session

Chair: Guoqing Zhang, Professor, University of Windsor, Department of Industrial Engineering, 401 Sunset Avenue, Windsor, ON, N9B3P4, Canada, gzhang@uwindsor.ca

1 - The Costs and Benefits of Urban Cooperative Delivery

Qin Chen, PhD Student, Department of Civil and Materials Engineering,University of Illinois at Chicago, MC246, 842 W. Taylor Street, Chicago, IL, 60607, United States of America, qchen23@uic.edu, Jane Lin

Urban cooperative delivery is an effective truck demand management strategy which can significantly mitigates the congestion and environmental impacts, by viewing the individual components as an integrated system. We evaluate this strategy by comparing logistic costs under several scenarios, which rely on several key factors in network topology, business strategies and public policies. Continuous approximation method will be used to model the problem with non-detailed data.

2 - The Coordination Strategy of Service Outsourcing with Service Quality-Dependent Market Demand

Qingqing Yang, Xi'an Jiaotong University, No.28, Xianning West Road, 1875 Box, Xi'an, China, qingqing177@163.com, Qin Su

This paper discuss the coordination strategy of service outsourcing in which the demand is a function of service quality. We develop a homemade model, a noncooperative outsourcing model and a cooperative outsourcing model to analyze the outsourcing decisions, and design a contract to coordinate the outsourcing chain. By comparing homemade strategy with outsourcing strategies, we find that the service quality goal and profit margin goal of service outsourcing can not simultaneous achieve.

3 - Supply Chian Coordination with Price-sensitive Stochastic Demand

Ruo Du, Drexel University, 3141 Chestnut Street, Philadelphia,, Philadelphia, PA, 19104, United States of America, ruodu7@gmail.com, Avijit Banerjee

In this paper, we study a supply chain with price-sensitive stochastic demand under both decentralized and centralized scenario. In the decentralized scenario, we characterized how each facility will set up the price or the production policy. We show that how much the supply chain can better off by coordination and how the service level will be affected.

4 - Cooperative Supply-Chain Decisions – An Agent-based Approach in Dynamic Markets

Juergen Woeckl, Assistant Professor, Vienna University of Economics and Business, Inst. for Production Management, Nordbergstrasse 15/A/3.Stk, Vienna, 1090, Austria, juergen.woeckl@wu.ac.at

This study is focusing on the optimization of cooperative supply chain decisions for highly volatile consumer markets. using an agent-based approach. Two dynamic, agent-based models describing the market dynamic and the supply chain are combined for a joint optimization. The main focus is to study cooperative interaction effects between two vendor agents regarding optimal pricing and supply network decisions.

5 - Manufacturer Cooperation in Supplier Development with Nonlinear Return

Guoqing Zhang, Professor, University of Windsor, Department of Industrial Engineering, 401 Sunset Avenue, Windsor, ON, N9B3P4, Canada, gzhang@uwindsor.ca, Shiping Zhu

This talk extends the work by Talluri et al. (2010) to develop new investment scheme and exams how Markowitz's model can be used to help firms optimally allocate resources under nonlinear returns and comparing the results to linear case. we also investigate a decomposition approach to solve the problem.

■ SA57

W - Providence I- Lobby Level

Air Terminal Area Data Uncertainty

Sponsor: Aviation Applications

Sponsored Session

Chair: David Lovell, Associate Professor, University of Maryland, 1173 Martin Hall, College Park, MD, 20742, United States of America, lovell@umd.edu

1 - Sensitivity Analysis of Wake Vortex Models and Stochastic Flight Tracks

John Shortle, George Mason University, 4400 University Dr., MSN 4A6, Fairfax, VA, United States of America, jshortle@gmu.edu, Zhenming Wang, Yimin Zhang

Many NextGen technologies and concepts, when implemented, will change the underlying stochastic nature of flight tracks. This talk investigates how changes in the stochastic variability of flight tracks have the potential to impact the probability of potential wake encounters. We investigate these relationships for several arrival-track geometries in congested terminal airspace.

2 - Processing Aviation Delay Data for Queueing System Analysis

Kleoniki Vlachou, PhD Candidate, University of Maryland, 1173 Glen Martin Hall, College Park, MD, 20742, United States of America, kvlachou@umd.edu, Andrew Churchill, David Lovell

This work examines several important issues pertaining to data preparation steps necessary for validating and calibrating airport queueing models. Two delay accounting systems are examined: event-based, as is typically used in reported flight delays, and accrual-based, as is typically present in queueing model results. In addition, the impact of propagated flight delays on queueing model validation is examined.

3 - Translating the Uncertainty in Terminal Weather Forecasts Into Arrival Capacity Scenarios

Gurkaran Buxi, University of California Berkeley, 107E Mclaughlin Hall, Berkeley, CA, 94720, United States of America, gkb@berkeley.edu, Mark Hansen

Weather in the terminal airspace plays an important role in determining the arrival capacity at an airport. This research translates the uncertainty in weather forecast into probabilistic arrival capacity scenarios. The forecast enriched scenarios show 10-40% lower cost when compared to scenarios devoid of forecast in GDP simulations.

■ SA58

W - Providence II - Lobby Level

Military Vehicle Routing Problems – Information Gathering

Sponsor: Military Applications Society

Sponsored Session

Chair: Chase Murray, Assistant Professor, Auburn University, 3301 Shelby Center, Auburn, AL, 36830, United States of America, ccm0022@auburn.edu

1 - Managing Information in Large Networks

Paul Scerri, Professor, Carnegie Mellon University, Pittsburgh, PA, United States of America, pscerri@cs.cmu.edu

We have looked empirically at a range of ways that a team can share, fuse and utilize information. This analysis has shown that often the team level impact of some algorithm for moving information around can be very different from what was expected. For example, a very precise level of trust between team members can lead to dramatically better performance fusing uncertain information and that the value of sharing some intuitively useful types of information can be very small.

2 - Realizing Information Gain through Optimization of Reconnaissance and Surveillance

Hector Ortiz-Pena, CUBRC, Inc., 4455 Genesee St., Buffalo, NY, United States of America, Hector.Ortiz-Pena@cubrc.org, Moises Sudit, Mark Karwan

We consider a team of autonomous and cooperative unmanned aerial vehicles (UAVs) gathering information while operating in a decentralized framework. The problem of assigning and scheduling grid cells to UAVs is posed as a mixed integer linear program in which potential information gain is maximized. Each cell is characterized by an information-theoretic function and evidence from local sensors and neighboring UAVs. A subset of UAVs creates the network in which information may be exchanged.

3 - Dynamic Modeling for Particle-filter Tracking of a Ground Vehicle in an Urban Environment

Emily Doucette, Auburn University, 211 Davis Hall, Auburn, AL, United States of America, douceea@tigermail.auburn.edu, Will Curtis, Andrew Sinclair

A particle filter was developed to locate and track a ground vehicle in an urban environment given binary measurements. These measurements model a distributed network of assets that can be queried for the presence of the target in their individual sectors. Two dynamic models for particle propagation are compared using two target paths. The heuristic traffic model provided superior target tracking despite minimal sensor data. A particle-redistribution scheme further improved performance.

■ SA59

W - Providence III - Lobby Level

Health Services

Sponsor: Service Science

Sponsored Session

Chair: Adrian Choo, Georgia State University, Robinson College of Business, 35 Broad St. NW, Atlanta, GA, 30303, United States of America, mgtacc@langate.gsu.edu

1 - Early Detection and Control of Potential Pandemics

Shengpeng Jin, University of Louisville, 782 Frederick Stamm Ct. Apt #4, Louisville, KY, 40217, United States of America, jinshengpeng@gmail.com, Suraj Alexander

Early information is crucial for policy makers and public health officials. Current indicators of the spread of contagious outbreaks lag behind the actual spread of the epidemic, leaving no time for a planned response. Our focus, however, is on the effective control of the spread of contagious outbreaks in their early stages. We do this by defining a more effective way to chart the spread of contagious outbreaks, in a spatio-temporal sense, so that effective control actions can be taken.

2 - The Transformation/Transitional Needs for Community Care Depots Healthcare Services in Middle Taiwan

Ruey-Fa Lin, Head & Associate Professor, Business School, FengChia University, Taichung, Taiwan - ROC, rflin@fcu.edu.tw

The CCD healthcare has been employed to deliver services to the elderly for years. Nonetheless, the quality of healthcare services is subject to the voluntary oriented outcome training and sustainable accountability as a social branding/marketing. This paper aimed to explore the relationship between nonprofit human resource management and its resulted performance as well as quality of service in community care depots in Middle Taiwan areas longitudinally from clustering analysis.

3 - Risk Communication and Safety Efficacy in Shipping: A Multilevel Analysis

Adrian Choo, Georgia State University, Robinson College of Business, 35 Broad St. NW, Atlanta, GA, 30303, United States of America, mgtacc@langate.gsu.edu, Martha Grabowski

We investigate the inter-relationships between risk communication and safety efficacy at vessel- and individual-levels of analysis using survey data from three shipping companies. Initial findings show organizational communication affects how people rely on their individual knowledge in influencing safety efficacy and safety performance. Some implications about managing service operations in risky work environments will be discussed.

■ SA60

W - College Room - 2nd Floor

Clique Relaxations in Networks

Sponsor: Optimization/Networks

Sponsored Session

Chair: Sergiy Butenko, Associate Professor, Texas A&M University, TAMU-3131, College Station, TX, 77843, United States of America, butenko@tamu.edu

1 - Taxonomy of Clique Relaxations

Nataly Youssef, PhD candidate, Texas A&M University, 241 Zachry,3131 TAMU, College Station, TX, 77843, United States of America, nataly.youssef@gmail.com, Sergiy Butenko, Jeffrey Pattillo

Clique relaxation models were originally introduced in social network analysis literature as a way of describing cohesive subgroups. This talk proposes a general classification of clique relaxations and explores which properties each model

ensures. Combination of desirable properties not guaranteed by existing clique relaxations could motivate future research in terms of creating and analyzing new relaxation structures.

2 - CVaR-constrained Minimum Spanning k-core Problem for Robust Network Design

Juan Ma, Oklahoma State University, Industrial Engineering & Management, Stillwater, OK, 74078, United States of America, juan.ma@okstate.edu, Foad Mahdavi Pajouh, Balabhaskar Balasundaram, Vladimir Boginski

We propose a conditional-value-at-risk (CVaR) based approach to obtain robust solutions for the minimum spanning k-core problem under probabilistic arc failures. We exploit the graph-theoretic properties of this model and introduce a new approach to survivable network design via spanning k-cores. We discuss some of the desirable characteristics of this approach and also investigate the sensitivity of the solutions to the CVaR constraint via numerical experiments.

3 - On the CVAR-constrained Maximum 2-club Problem

Esmaeel Moradi, Oklahoma State University, 322 Engineering North, School of Industrial Engineering & Manag, Stillwater, OK, 74075, United States of America, esmaeel@ostatemail.okstate.edu, Balabhaskar Balasundaram, Foad Mahdavi Pajouh

A subgraph of diameter at most k is called a k-club, a relaxation of cliques for k larger than 1. The k-clubs were introduced in social network analysis to model cohesive social subgroups. Detecting diameter-2 clusters in protein interaction networks for instance, is used to identify protein complexes and functional modules. This talk will present preliminary results on a conditional value-at-risk (CVaR) based model to detect large 2-clubs in random graphs with probabilistic edge failures that provides a measure of solution robustness under uncertainty.

4 - Maximum k-plex Problem in Networks under Uncertainty

Oleksandra Yezerska, Texas A&M University, TAMU-3131, College Station, TX, 77843, United States of America, yaleksa@tamu.edu, Sergiy Butenko, Vladimir Boginski

An approach for solving maximum k-plex problem in networks subject to multiple possible edge failures is suggested. In particular, we utilized the appropriate quantitative risk measures (CVaR) to modify the original integer programming formulation of the problem. The new formulations capable of addressing the uncertainty properties of the network are constructed, and the preliminary results of numerical experiments are reported.

■ SA63

W - Tryon North - 2nd Floor

MCDM for Sorting Methods

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Jose Figueira, Professor, Instituto Superior Tecnico, Av. Rovisco Pais, Lisbon, 1049-001, Portugal, figueira@ist.utl.pt

1 - A Stochastic Programming Approach to Multicriteria Multi-period Portfolio Optimization

Ceren Tuncer Sakar, Research Assistant, Middle East Technical University, Industrial Engineering Department, Ankara, 06531, Turkey, ceren@ie.metu.edu.tr, Murat Koksalan

Recently, researchers started to incorporate multiple criteria to portfolio optimization problems. We follow this trend and develop a stochastic programming-based approach to work on multi-period portfolio optimization problems that may have three or more criteria. We demonstrate our results based on tests performed with stocks traded on Istanbul Stock Exchange.

2 - A New Sorting Method Where Each Category is Characterized by Several Reference Actions

Jose Figueira, Professor, Instituto Superior Tecnico, Av. Rovisco Pais, Lisbon, 1049-001, Portugal, figueira@ist.utl.pt, Juscelino Almeida-Dias, Bernard Roy

This paper presents a new sorting method which takes into account several reference actions for characterizing each category. This new method gives a particular freedom to the decision maker in the co-construction decision aiding process with the analyst to characterize the set of categories, while there is no constraint for introducing only one reference action as typical of each category like in Electre Tri-C.

3 - Robust Ordinal Regression in Case of Interactions on Bipolar Scales: The UTAGSS Method

Johannes Siebert, Akademischer Rat, University of Bayreuth, Universitätsstr. 30, Bayreuth, 95440, Germany, Johannes.Siebert@uni-bayreuth.de, Roman Slowinski, Salvatore Greco

Robust Ordinal Regression (ROR) consider the whole set of value functions compatible with the preference information supplied by the Decision Maker (DM) defining a necessary and possible preference relation, corresponding to preferences holding for all compatible value functions and for at least one value function, respectively. We present a new ROR method called UTAGSS which consider value functions that take into account interaction between criteria having bipolar scales.

4 - Multidimensional Scaling (MDS) Analysis on the Consensus in Group Decision Making

Yuan-Sheng Lee, Tamkang University, Graduate Institute of Management Science, Danshui, Taipei, 25137, Taiwan - ROC, yuan_sheng_0101@yahoo.com.tw, Hsu-Shih Shih

Consensus is an important issue to make an effective decision in a group. Geometric and statistical measures are the common ways to estimate the consensus. However, these measures were via thresholds to identify the outliers. This study proposes a visualized technique to show the agreement/disagreement perceptual map by MDS analysis.

■ SA64

W - Queens Room - 2nd Floor

Joint Session SPPSN/HAS: Organizational Decision Making in Disaster Relief and Recovery Operations

Sponsor: Public Programs, Service and Needs/Health Applications

Sponsored Session

Chair: John Coles, Graduate Student, University at Buffalo, 13 State Street, Potsdam, NY, 13676, United States of America, johnbcoles@gmail.com

1 - Improving Partnership Selection in Disaster Relief Environments: Game Theory and Resource Allocation

John Coles, Graduate Student, University at Buffalo, 13 State Street, Potsdam, NY, 13676, United States of America, johnbcoles@gmail.com, Jun Zhuang

In this talk we present a framework describing a many player game involving local and external/entering actors where their objective is to maximize the perceived impact of their effort during a disaster relief operation across multiple periods. By analyzing the dynamics of relationships that may occur in disaster recovery through the lens of game theory, we provide a new perspective on optimizing the efficacy of disaster relief operations.

2 - Cultural Influences on Interagency Cooperation and Decision-making in Disaster Relief and Recovery

James Van Scotter, Associate Professor of ISDS, Louisiana State University, College of Business Administration, Department of ISDS, Baton Rouge, LA, 70803, United States of America, jvanscot@lsu.edu, Karen Leonard, Suzanne Pawlowski, Tung Cu

Organizational culture is frequently identified as an obstacle to effective inter-organizational coordination, but it has received little systematic study in the context of disaster management. We examine specific barriers to coordination identified by responders from different disciplines and different organizational levels from a cultural perspective. Conclusions are drawn from a review and conceptual analysis of the literature and propositions for future research are presented.

3 - A Planning Tool for Emergency Response

Burcu Keskin, University of Alabama, 361 Stadium Dr., Tuscaloosa, AL, 35406, United States of America, bkeskin@cba.ua.edu, Sharif Melouk, Ibrahim Capar

Traffic incidents and natural or man-made disasters can impose significant safety risks and disruptions on traffic flows. Moreover, congestion resulting from such occurrences may impede the ability of EMS to respond in a timely fashion. In this research effort, we develop an optimization-based planning tool to investigate the positioning of emergency responders so as to reduce response time. Experimentation is performed on several scenarios, and managerial insights are gleaned.

4 - Quantifying and Explaining the Equity of H1N1 Vaccine Distribution

Jessica Heier Stamm, Kansas State Univesity, Manhattan, KS, United States of America, jlhs@k-state.edu, Nicoleta Serban, Julie Swann

We study supply chain problems motivated by response scenarios where individual decision-makers' choices impact system outcomes. We develop models to assign users (centralization) or allow user choice (decentralization) for service sites and apply them to actual shipment data from the 2009-2010 H1N1 vaccination campaign. We compare the two systems and use spatial statistics to explain service inequity as a function of factors such as income, ethnicity and race, and service site availability.

■ SA65

W - Kings Room - 2nd Floor

Services Innovation

Sponsor: Service Science

Sponsored Session

Chair: Genady Grabarnik, St. John's University, 8000 Utopia Parkway, Queens, United States of America, genadyg@gmail.com

Co-Chair: Larisa Shwartz, IBM TJ Watson Research, Yorktown Heights, NY, United States of America, lshwart@us.ibm.com

1 - Combined Analytical and Simulation Modeling for Optimal Staffing in Services Delivery

Aliza Heching, Research Staff Member, IBM Thomas J Watson Research Center, Yorktown Heights, NY, United States of America, ahechi@us.ibm.com, Mark S. Squillante

We describe a two-stage approach for determining optimal skills-differentiated staffing with SLAs in a services environment. In the first stage we propose staffing levels based on approximate stochastic models. These levels are used in the second stage to initialize a discrete event simulation model, which considers all the environment complexities.

2 - Comparison Measurement of Service Processes

Yefim Haim Michlin, Technion - Israel Institute of Technology, Faculty of Industrial Engineering & Mana, Haifa, 3200, Israel, yefim@technion.ac.il, Genady Grabarnik, Larisa Shwartz

The talk describes design of experiment for evaluating critical metrics of service processes based on comparison Wald's analysis, that allows robust comparison of measured characteristics. We consider cases of error rate, processing time and throughput metrics on actual data.

3 - Defining Monitoring Parameters for Better Service Delivery Cost

Larisa Shwartz, IBM TJ Watson Research, Yorktown Heights, NY, United States of America, lshwart@us.ibm.com, Genady Grabarnik

The goal of a monitoring system is to alert the owner of early signs of malfunction. Conservatively configured system produces excessive alerts, which create an additional workload and contribute to an increased service delivery cost. Alternatively, unwarranted minimization of the number of alerts could affect the quality of service and result in an SLA penalty. This paper proposes a framework for the dynamic configuration of an event monitoring system resulting in better service delivery cost

4 - Distributions of the Services Processes

Genady Grabarnik, St. John's University, 8000 Utopia Parkway, Queens, United States of America, genadyg@gmail.com, Larisa Shwartz, Yefim Haim Michlin

We consider different distributions that may arise as a statistics for the business processes. We analyze the basic processes operations (like synchronization, join, merge, etc.) on the elemental operators and see how compositions effect characteristics of the processes.

■ SA66

W - Park Room - 2nd Floor

Applications of Data Envelopment Analysis

Contributed Session

Chair: Endre Bjôrndal, Associate Professor, Norwegian School of Economics (NHH), Helleveien 30, Bergen, 5045, Norway, endre.bjorndal@nhh.no

1 - An Input and Output Variable Selection Framework for DEA Analysis Among Logistics Service Providers

Carlos Ernani Fries, Professor, Federal University of Santa Catarina, Caixa Postal 476, Florianopolis, SC, 88040900, Brazil, ernani@deps.ufsc.br, Mônica M. M. Luna, Antònio Galvao Novaes

DEA has been widely used as a benchmarking tool that allows performance assessment of alike units. A drawback of this technique is that results are sensitive to inclusion/exclusion variables. A stepwise framework for the selection of input/output variables is suggested for LSP benchmarking that are known to be heterogeneous regarding services offered and therefore require distinct sets of resources. An application considering the Brazilian logistics market is also presented and evaluated.

2 - Analysis of Energy Efficiency in China under Dynamic DEA framework

Ming Lei, Professor, Peking University, 5 Yiheyuan Road, Haidian District, Beijing, 100871, China, leiming@gsm.pku.edu.cn, Xinna Zhao

The linkage for energy, economy and environment has received increased attention. Based on inter-temporal distance function, we develop dynamic DEA, and from the slacks-based measure view, we provide Dynamic Inter-temporal SBM model. For an applicable purpose, we evaluate Energy Efficiency with environment efficiency in China considering the relation of desirable and undesirable outputs. This paper aims at providing the objective for industrialization and promoting the sustainable development.

3 - DEA with Streaming Data

Jose Dula, Professor, Virginia Commonwealth University, School of Business, Richmond, VA, 23284, United States of America, jdula@vcu.edu, Francisco Lopez

DEA can be seen as a general data mining tool. Applications involving large data sets can be found in auditing, appraisals, fraud detection, and security. In many settings the data domain is dynamic and data stream in at high rates. We present the framework for this extension of the concept of frontier analysis which we refer to as "Streaming DEA".

4 - Estimation of Inefficiency in the Presence of Exogenous Variables with DEA

Seock-Jin HONG, Professor, Bordeaux Management School, 680 Cours de la Liberation, Talence, 33405, France, antoinehong@gmail.com, Jong-Seok Kim

This study was to clarify the problems of estimating inefficiency using the existing approach's limitations. The effect of exogenous variables was distorted by misspecification or missing variables. A new method excludes the effect on exogenous variables, the author estimate the unbiased relationship between dependent variables and exogenous variables. This study also discusses executing DEA after controlling the effect of exogenous variables on the output.

5 - Strategic Cost Allocation under Regulatory Benchmarking – The Case of Electricity Networks

Endre Björndal, Associate Professor, Norwegian School of Economics (NHH), Helleveien 30, Bergen, 5045, Norway, endre.bjorndal@nhh.no, Mette Björndal, Elena Fominykh

The Norwegian regulation model consists of a revenue cap that is based on actual costs as well as a cost norm. The cost norm is derived from DEA efficiency estimates, and there are separate DEA models for distribution and transmission. We look at how companies may influence their revenue caps by reallocating costs between the two network levels. Based on data from 2005-2009 we investigate the potential benefit for the companies, and whether reallocation of costs seems to have taken place.

Sunday, 11:00am - 12:30pm

■ SB01

C - Room 201A

Nicholson Student Paper Prize II

Cluster: Nicholson Student Paper Prize

Invited Session

Chair: Mor Armony, Associate Professor, New York University, 44 West 4th Street, New York, NY, 10012, United States of America, marmony@stern.nyu.edu

1 - An Axiomatic Approach To Systemic Risk

Chen Chen, Columbia University, S. W. Mudd 325, 500W 120th Street, New York, NY, 10027, United States of America, chenchen05@gmail.com, Garud Iyengar, Ciamac Moallemi

We propose an axiomatic framework for systemic risk, which allows for a specification of a functional of the cross-sectional outcomes across firms and a functional of the profile of aggregated outcomes across scenarios. This class captures many proposed forms of systemic risk as special cases. Our axioms yield a decentralized decomposition, which attributes risk to individual firms. A shadow price for each firm also accounts for the externalities of the firm's individual decision-making.

2 - Information Transmission and the Bullwhip Effect: An Empirical Investigation

Robert Bray, Stanford GSB, 29137 Covecrest Dr, Rancho Palos Verdes, CA, 90275, United States of America, robertlbray@gmail.com, Haim Mendelson

We investigate the bullwhip effect in a sample of 4,689 public U.S. companies over 1974-2008. The sample's mean and median bullwhips, both significantly positive, respectively measure 15.8% and 6.7% of total demand variability. We decompose the bullwhip by information transmission lead time. We find that demand signals firms observe with more than three quarters' notice drive 30% of the bullwhip, and those firms observe with less than one quarter's notice drive 51%.

3 - On the Power of Centralization in Distributed Processing

Kuang Xu, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D666, Cambridge, MA, 02139, United States of America, kuangxu@mit.edu, John Tsitsiklis

We study a multi-server model that captures a trade-off between centralized and distributed processing, where a fraction p of all resource is deployed centrally, and the remaining allocated to local servers. We show that in a many-server limit, whenever p>0, the steady-state delay scales as log(1/(1-r)), as load r goes to 1, which is exponentially smaller than the M/M/1-queue (p=0) scaling of 1/(1-r). This indicates that a small degree of resource pooling can deliver significant benefits.

■ SB02

C - Room 201B

Supply Chain Risk Management

Cluster: Risk Management

Invited Session

Chair: John Birge, Professor, University of Chicago, Booth School of Business, Chicago, IL, United States of America, john.birge@chicagobooth.edu

1 - Supply Network Structure, Visibility, and Risk Diffusion: A Computational Approach

Rahul Basole, Georgia Institute of Technology, Tennenbaum Institute, Atlanta, GA, 30332, United States of America, rahul.basole@ti.gatech.edu, Marcus Bellamy

We define and introduce the concept of global supply network health using relevant metrics from operational, financial, collaborative, and strategic perspectives. Using a computational network analysis approach, we examine the impact of global supply network structure on risk diffusion and show the particular importance of supply network visibility. Our analysis is complemented with an application of network visualization techniques.

2 - Analyzing Scrip Systems: Selection Rules and Optimality

Kris Johnson, Massachusetts Institute of Technology, Operations Research Center, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, krisdj@mit.edu, David Simchi-Levi, Peng Sun

Scrip systems provide a non-monetary trade economy for exchange of resources. We model a scrip system as a stochastic game and study selection rules to match potential trade partners over time. We show the optimality of one particular rule in terms of maximizing social welfare, while satisfying individual rationality constraints. We also analyze the long-run average system welfare gain of different policies, and how they change with the number of agents and total amount of scrip in the system.

3 - Estimating Bias-corrected Inventory Order Quantities with Uncertain Demand Forecasting Models

Yun Shin Lee, University of Cambridge, Judge Business School, Cambridge, CB2 1AG, United Kingdom, ysl27@cam.ac.uk, Stefan Scholtes

In practice, it is difficult to expect a chosen demand forecasting model to fully capture the true underlying behavior of demand. However, an incorrectly specified model leads to biased and suboptimal inventory levels. We investigate an empirical approach to systematically correct for a model bias under a serially correlated demand process. We give an asymptotic justification of the approach and evaluate its small sample performance by simulation and with empirical data.

4 - Eliciting a Customers Semand Distribution in a Supply Chain with a Price Mechanism

Phil Lederer, Professor, Simon School, University of Rochester, Rochester, NY, 14627, United States of America, phil.lederer@simon.rochester.edu

In a supply chain, a firm needs to determine the amount/kinds of capacity to meet customers' needs. To make good decisions, she needs to know the probability distribution of customers' demand. We present a mechanism that allows a service provider to learn the distribution of a customer's demand by offering a set of contracts which are partially pre-paid. We describe the form of a set of contracts that will cause the customer to reveal his demand distribution.

■ SB03

C - Room 202A

Optimization Software

Sponsor: Optimization/Computational Optimization and Software

Sponsored Session

Chair: Robert Fourer, Professor, Northwestern University, Department of Indutrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@northwestern.edu

1 - Strategies for Using Algebraic Modeling Languages to Formulate Second-order Cone Programs

Robert Fourer, Professor, Northwestern University, Department of Indutrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, 4er@northwestern.edu, Jared Erickson

A surprising variety of optimization applications can be written as convex quadratic problems known as second-order cone programs (SOCPs), which popular solvers can be extended to handle effectively. The power and convenience of algebraic modeling languages may also be extended to SOCP modeling through automated detection of SOCP-equivalent formulations and transformation to forms solvers require. These facilities moreover integrate well with other common linear and quadratic transformations.

2 - Meta-modeling Based Optimization Modeling Framework

Kysang Kwon, Research Assistant, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, kkwon3@gatech.edu, Leon McGinnis

A meta-modeling based optimization modeling framework facilitates reusability of problem solving methodologies. Separating problem description from problem solving methodology, allows the methodology to be reused for other problems. The reflection property of the meta-model is a critical enabler. We demonstrate the proposed framework with a Benders Decomposition method applied to two different problems.

■ SB04

C - Room 202B

Computing Equilibria in Large Games

Sponsor: Computing Society

Sponsored Session

Chair: Yevgeniy Vorobeychik, Sandia National Laboratories, 2632 8th Avenue, Oakland, CA, United States of America, eug.vorobey@gmail.com

1 - Bayesian Action-graph Games

Kevin Leyton-Brown, University of British Columbia, 201-2366 Main Mall, Vancouver, BC, Canada, kevinlb@cs.ubc.ca, Albert Jiang

Bayesian action-graph games (BAGGs) are a novel graphical representation that can represent arbitrary Bayesian games, and can compactly express games exhibiting symmetry, action- and type-specific utility independence, and/or probabilistic independence of types. We give an algorithm for computing expected utility in BAGGs, and discuss conditions under which it runs in polynomial time. We show both theoretically and empirically that our approaches significantly improve the state of the art.

2 - Learning Equilibria in Continuous-strategy Stochastic Nash Games

Uday Shanbhag, University of Illinois, Department of ISE, Urbana, IL, United States of America, udaybag@illinois.edu

Recently, there has been much interest in the computation of equilibria. We review some of our recent efforts in this regime. We begin with a summary of distributed stochastic approximation approaches for computing equilibria. Next, we examine variants of such problems wherein both parameters and equilibria are learnt simultaneously. Finally, we comment on recent efforts in which agent incentives are incrementally modified in an effort to derive more efficient equilibria.

3 - Game Theory-based Opponent Modeling in Large Imperfect-information Games
Tuomas Sandholm, Professor, Carnegie Mellon University, Pittsburgh, PA, United States of America, sandholm@cs.cmu.edu, Sam Ganzfried

We develop an algorithm that combines Nash equilibrium and opponent modeling, yielding a hybrid that can effectively exploit opponents after only a small number of interactions. Unlike prior opponent modeling approaches, ours is fundamentally game theoretic and takes advantage of recent algorithms for abstraction and equilibrium finding rather than relying on domain-specific prior distributions, historical data, or hand-crafted features. Success is shown on Heads-Up Limit Texas Hold'em.

4 - Approximation Methods for Infinite Bayesian Stackelberg Games
Christopher Kiekintveld, Assistant Professor, University of Texas at El Paso, 500 W. University Avenue, Room 207, El Paso, TX, 79968, United States of America, cdkiekintveld@utep.edu, Janusz Marecki, Milind Tambe

Game models for homeland security applications are typically based on expert elicitation. Existing models and algorithms offer limited means to express uncertainty about key parameters. We introduce a new class of models that allows continuous representations of attacker payoff distributions, present several methods for computing approximate solutions for this class of games, and provide empirical evidence of their efficacy.

■ SB05

C - Room 203A

Value-Focused Thinking

Cluster: Tutorials

Invited Session

Chair: Ralph Keeney, Research Professor, Duke University, Fuqua School of Business, 101 Lombard Street Suite #704W, San Francisco, CA, 94111, United States of America, KeeneyR@aol.com

1 - Value-focused Thinking
Ralph Keeney, Research Professor, Duke University, Fuqua School of Business, 101 Lombard Street Suite #704W, San Francisco, CA, 94111, United States of America, KeeneyR@aol.com

Value-focused thinking involves identifying and using values to guide all aspects of decision making. This tutorial covers the concepts, procedures, and applications of value-focused thinking. Topics addressed include structuring complex decisions, specifying objectives, creating alternatives, using value-focused thinking in brainstorming, and taking proactive control of your decision-making.

■ SB06

C - Room 203B

Financial Engineering

Cluster: Quantitative Finance

Invited Session

Chair: Kay Giesecke, Assistant Professor, Stanford University, Huang Engineering Center, 475 Via Ortega 307, Stanford, CA, 94305, United States of America, giesecke@stanford.edu

1 - First Passage Times of Two-dimensional Brownian Motion and Credit Risk
Steve Kou, Professor, Columbia University, 312, Mudd Building, Columbia University, New York, NY, 10027, United States of America, sk75@columbia.edu, Haowen Zhong

First passage times (FPT) of two-dimensional Brownian motion has been applied to study the correlation of default times under structural models. We obtain the analytical solution for the joint Laplace transform of FPTs, leading to an efficient inversion algorithm to compute the FPT's. The results are then applied to study correlated defaults.

2- Default and Systemic Risk in Equilibrium
Agostino Capponi, Purdue University, 315 N. Grant Street, West Lafayette, IN 47906, United States of America, capponi@purdue.edu, Martin Larsson

We develop a finite horizon continuous time market model, where risk averse investors maximize utility from terminal wealth by dynamically investing in a risk-free money market account, a stock written on a default-free dividend process, and a defaultable bond, whose prices are determined via equilibrium. We analyze financial contagion arising endogenously between the stock and the defaultable bond via the interplay between equilibrium behavior of investors, risk preferences and cyclicality properties of the default intensity. We find that the equilibrium price of the stock experiences a jump at default, despite that the default event has no causal impact on the dividend process. We characterize the direction of the jump in terms of a relation between investor preferences and the cyclicality properties of the default intensity. We conduct similar analysis for the market price of risk and for the investor wealth process, and determine how heterogeneity of preferences affects the exposure to default carried by different investors.

3 - Vertex Nomination for a Random Graph Based on Self-exciting Point Processes
Nam Lee, Johns Hopkins University, Baltimore, MD, United States of America, nhlee@jhu.edu, Tim Leung

We consider the problem of detecting abnormality from data exchanged amongst a collection of entities. We model the data generation by a multi-channel self-exciting point process. We propose a vertex nomination methodology to identify a subgroup of entities with the same attribute that is related to the event in interest (e.g. fraud, bankruptcy). We illustrate some experiment results based on data from a defaulted firm.

4 - Large Portfolio Asymptotics for Loss from Default
Kay Giesecke, Assistant Professor, Stanford University, Huang Engineering Center, 475 Via Ortega 307, Stanford, CA, 94305, United States of America, giesecke@stanford.edu, Richard Sowers, Kostas Spiliopolous

We prove a law of large numbers for losses from defaults and use it for approximating the distribution of losses from defaults in large heterogenous portfolios. The density of the limiting measure solves a non-linear SPDE, and the moments of the limiting measure are shown to satisfy an infinite system of SDEs. The numerical solution to this system provides an estimator of the distribution of the limiting portfolio loss, and of the solution of the SPDE via an inverse moment problem.

■ SB07

C - Room 204

Analysis of Many-Server Queues

Sponsor: Applied Probability

Sponsored Session

Chair: Josh Reed, Assistant Professor, New York University, 44 West 4th Street, New York, NY, 10012, United States of America, jreed@stern.nyu.edu

1 - Algorithms Approximating Performance for Time-varying Non-Markovian Many-server Queueing Networks
Yunan Liu, Assistant Professor, Columbia University, 500 West 120th Street, New York, NY, 10027, United States of America, yl2342@columbia.edu, Ward Whitt

Aiming at approximating performance for the (G_t/GI/s_t + GI)^m/M_t queueing network: the generalized Jackson network with many servers and time-varying model data, we consider its corresponding fluid limiting model and provide efficient algorithms to compute all standard performance measures, such as the fluid in queue and in service, the potential waiting time, etc. Simulation experiments verify the effectiveness of the fluid approximations.

2 - Numerical Analysis for Diffusion Models of Many-server Queues
Shuangchi He, Assistant Professor, Georgia Institute of Technology/National University of Singapore, 765 Ferst Avenue NW, Atlanta, GA, 30336, United States of America, heshuangchi@gatech.edu, Jim Dai

We use multidimensional diffusion processes to approximate the dynamics of a many-server queue. The queue has a phase-type service distribution and the customers may abandon the queue before service begins. We propose two diffusion models, using different methods to approximate the abandonment process. An algorithm is developed to solve the stationary distribution of each model. Numerical experiments show that they are good approximate models for queues with a medium to large number of servers.

3 - Near-optimal Control of Parallel Server Queueing Networks
Ramandeep Randhawa, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States of America, Ramandeep.Randhawa@marshall.usc.edu, Achal Bassamboo, Assaf Zeevi

We consider a problem of dynamic control in parallel server queueing networks with impatient customers, and propose a family of simple structured control policies that performs surprisingly well. In particular, we prove that if an underlying fluid problem admits a non-degenerate solution, then the performance of the prescribed control policy is within O(1) of that of the optimal policy; that is, the gap in performance does not increase as the volume of work and capacity of the system scale up.

4 - Heavy-traffic Analysis of the V-model for the G/GI/N Queue
Xi Wang, PhD Student, New York University, 44 West 4th Street, KMC, Suite 8-154, New York, NY, 10012, United States of America, xwang2@stern.nyu.edu, Josh Reed

In this talk, we study V-model for the G/GI/N queue. Our first result is to obtain a deterministic fluid limit for the properly scaled number of customers in the system. We then proceed to obtain a second order stochastic approximation in the Halfin-Whitt regime.This is accomplished by first showing the a state-space collapse result holds for the number of waiting customers of each type.

■ SB08

C - Room 205

New Models and Computing Methods for Discrete Optimization

Sponsor: Computing Society/ Large-Scale Computation

Sponsored Session

Chair: Bo Zeng, Assistant Professor, University of South Florida, Tampa, FL, 33647, United States of America, bzeng@usf.edu

1 - The SAS MILP Solver: A Progress Report
Philipp Christophel, Linear & Integer Optimization Developer, SAS Institute Inc., 100 SAS Campus Dr, Cary, NC, United States of America, Yan.Xu@sas.com, Imre Polik, Amar Narisetty, Yan Xu

The SAS MILP solver implements a branch-and-cut algorithm for solving mixed integer linear programs. In this talk, we give an overview of the recent improvements to the SAS MILP solver. The talk will focus on improvements in search strategies and the simplex engines.

2 - Tree-based Multi-dimensional Lifting Function and its Application
Bo Zeng, Assistant Professor, University of South Florida, Tampa, FL, 33647, United States of America, bzeng@usf.edu, Long Zhao

We consider a multi-dimensional lifting problem with a large number of precedence constraints represented in tree structures. We present sufficient conditions for sequence-independent lifting with those trees and prove the strength of the lifted inequality. This approach is applied to the minimal cover and flow cover inequalities with promising computational results will be presented.

3 - A Multi-stage Stochastic Programming Model for Capacity Expansion of Logistics Networks
Kai Huang, Assistant Professor in Operations Management, DeGroote School of Business, McMaster University, Hamilton, ON, L8S4M4, Canada, khuang@mcmaster.ca

The capacity expansion of large scale logistics networks can be modeled as a multi-stage stochastic programming problem. We discuss the value of multi-stage stochastic program compared with two-stage stochastic program, and an approximation algorithm for the multi-stage stochastic program.

4 - A Primal Algorithm for Solving Chance Constrained Mixed Integer Programming Problems
Ludwig Kuznia, University of South Florida, 4202 E. Fowler Avenue ENB118, Tampa, FL, 33620, United States of America, lkuznia@mail.usf.edu, Grisselle Centeno, Bo Zeng

The optimal solution to a restriction of a mixed integer programming problem subject to chance constraints provides a feasible solution to the original problem and, under the right circumstances, can be much easier to solve. Capitalizing on these observations, we develop a primal algorithm to solve MIPs subject to chance constraints by intelligently expanding the feasible region of the restricted problem.

5 - Extended and Strengthened Combinatorial Benders Cuts for Mixed-Integer Programs
J. Cole Smith, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, j.cole.smith@gmail.com, Hanif Sherali

We examine a class of linear mixed-integer problems that contain penalty costs for violating certain constraints. The form of these problems involves at most one binary variable per constraint, and requires the use of big-M terms that weaken the formulation. We provide an alternative approach to the standard combinatorial Benders cutting plane procedure for these problems based on a partial convexification strategy, which eliminates big-M terms from the model and improves its solvability.

■ SB09

C - Room 206A

Topics in Revenue Management

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Baris Ata, Professor, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, b-ata@kellogg.northwestern.edu

Chair: Stefanus Jasin, University of Michigan, Ross School of Business, Ann Arbor, MI, United States of America, stefanjasin@gmail.com

1 - Open-loop Policies for overbooking over a Single Flight Leg
Huseyin Topaloglu, Cornell University, 223 Rhodes Hall, Ithaca, NY, United States of America, ht88@cornell.edu, Nilay Noyan, Hans Frenk, Ilker Birbil

We study a class of open loop policies for overbooking over a single flight leg. In this class of policies, each request is accepted with a fixed probability and the goal is to find the optimal acceptance probabilities. We show that the model admits a nested-order by fare classes and demonstrate that the same property holds when customers make a choice among open fare classes.

2 - Smart Homes with Price-responsive Appliances
Canan Uckun, PhD Student, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, cuckun@chicagobooth.edu, Dan Adelman

The Smart Home promises to make the power grid a more responsive and interactive platform by using a smart meter instead of a traditional one. As well as enabling consumers to control their energy consumption, smart meters give retailers the ability to do real-time pricing. We study the retailers' dynamic pricing problem and consumers' optimal response through smart appliances that automatically respond to price signals.

3 - A Class of "Error-Shrinking" Heuristics for Network Revenue Management
Stefanus Jasin, University of Michigan, Ross School of Business, Ann Arbor, MI, United States of America, stefanjasin@gmail.com

We consider a problem of finding near-optimal heuristics for network RM. I will present a sufficient condition for any heuristic to have an O(1) expected loss under sufficiently frequent re-optimization. It turns out, such heuristics also have a peculiar property in that they literally "shrink" the impact of estimation or modeling error on expected loss. Finally, I will discuss the trade-off between re-optimization frequency and re-estimation frequency.

4 - Revenue Management and Pricing as a Strategic Tool
Maarten Oosten, Senior Analytical Consultant, SAS, World Headquarters, SAS Campus Drive, Cary, NC, 27513, United States of America, maarten.oosten@sas.com

Revenue Management and Pricing Optimization (RMPO)is often thought of as a tactical and operational tool. However, RMPO can also be used as a tool to meet various strategic goals. In fact, it is a relatively nimble tool, compared to changing the production capacity. If the strategic goals change rather abruptly, as we have seen in recent years, pricing and revenue management strategies can be adjusted swiftly. In this presentation we will discuss some options.

■ SB10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - SAS Institute, JMP Division – Analytics Made Easy
Mia Stephens, SAS Institute, JMP Division, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, mia.stephens@jmp.com

JMP is intuitive and interactive data visualization and analytics software. Providing a complete array of statistical procedures, from basic to advanced, all JMP output is dynamic, visual and integrated. We will demonstrate JMP tools for data visualization, including Graph Builder®, Bubble Plots, the data filter, and our popular mapping tools.

2 - Oracle - Crystal Ball in the Classroom and Teaching Resources
Michael Franden, Oracle Crystal Ball, 7700 Technology Way, Denver, CO, 80237, United States of America, michael.franden@oracle.com

Oracle's Crystal Ball software is a spreadsheet-based software suite for predictive modeling, forecasting, Monte Carlo simulation and optimization. Our software is used in over 800 universities and schools worldwide for teaching risk analysis concepts. Teaching applications for Crystal Ball include financial risk analysis, valuation, engineering, portfolio allocation, cost estimation and project management. Learn about teaching resources available in Crystal Ball and online.

■ SB11

C - Room 207A

Graphs and Algorithms for the Web and Other Social Networks

Sponsor: Applied Probability

Sponsored Session

Chair: Mariana Olvera, Columbia University, 500 W 120th Street, New York, NY, 10027, United States of America, molvera@ieor.columbia.edu

1 - Spatial Models for Complex Networks
Pawel Pralat, Assistant Professor, Ryerson University, Department of Mathematics, 350 Victoria St., Toronto, ON, M5B 2K3, Canada, pralat@ryerson.ca

In order to explain the link structure of complex networks various spatial graph models are introduced and analyzed. In a spatial graph model, nodes are embedded in a metric space and link formation depends on the relative position of nodes in the space. Spatial models form a good basis for link mining: assuming a spatial model, the link information can be used to infer the spatial position of the nodes, and this information can then be used for clustering and recognition of node similarity.

2 - Network Centrality and Source Detection
Tauhid Zaman, Wharton, UPenn, Philadelphia, Philadelphia PA, United States of America, tzaman@wharton.upenn.edu, Devavrat Shah

This talk presents a rigorous study of a class of network centrality measures by establishing them as maximum likelihood estimators for source detection based on observations in terms of "infected" nodes in a network graph. We shall also establish the effectiveness of such an estimator based on the "expansion" property of the network graph.

3 - Ranking Algorithms on Trees
Mariana Olvera, Columbia University, 500 W 120th Street, New York, NY, 10027, United States of America, molvera@ieor.columbia.edu, Predrag Jelenkovic

We will present a family of ranking algorithms whose behavior can be described by analyzing the solution to a certain stochastic fixed point equation. One important example is given by Google's PageRank algorithm, which solves a nonhomogeneous linear recursion built on a weighted branching tree. In particular, we show how our techniques allow us to consider algorithms with mixed signed weights, which can be of potential interest in the ranking of opinion or reputation networks.

■ SB12

C - Room 207BC

Biological Networks

Cluster: Computational Biology (Joint cluster ICS)

Invited Session

Chair: Carl Kingsford, Assistant Professor, University of Maryland, College Park, CBCB, Bldg #296, College Park, MD, 20742, United States of America, carlk@umiacs.umd.edu

1 - Reconstruction of Ancestral Biological Networks
Carl Kingsford, Assistant Professor, University of Maryland, College Park, CBCB, Bldg #296, College Park, MD, 20742, United States of America, carlk@umiacs.umd.edu

We describe several optimization techniques for inferring the existence of protein-protein or regulatory interactions in ancestral species, with the aim of learning how present-day pathways and protein complexes evolved and how they have diverged in different species. The techniques seek either the maximum likelihood or most parsimonious ancestral network.

2 - Systems-level Insights from Large-scale Combinatorial Perturbation Experiments in Yeast
Chad Myers, University of Minnesota- Twin Cities, 200 Union St SE, Minneapolis, MN, 55455, United States of America, cmyers@cs.umn.edu

I will describe our recent efforts to understand the results of large-scale combinatorial perturbation experiments in the context of the model organism yeast. In collaboration with a yeast genetics lab, we have measured quantitative phenotypes for millions of double deletion mutants. I will address the general question of how we can learn systems-level biology from these experiments and discuss where innovations in machine learning and data mining are particularly relevant.

3 - Graph Cuts in Biological Networks
Benjamin Hescott, Tufts University, Medford, MA, United States of America, hescott@cs.tufts.edu

We explore two different cuts in graphs based on biological data. We use a fast minimum cut procedure on a graph built with PPI data to identify key regulatory proteins in an organism. Next, we approximate the maximum cut in a graph based on genetic interaction to uncover functionally coherent modules and BPM motifs in yeast. We then discuss how both simple methods generate motifs with biological significance.

4 - Identifying Causal Genes and Dysregulated Pathways in Complex Diseases
Yoo-Ah Kim, Research Fellow, National Institue of Health, 8600 Rockville Pike, Bethesda, MD, United States of America, kimy3@ncbi.nlm.nih.gov, Teresa Przytycka, Stefan Wuchty

In complex diseases, combinations of genomic perturbations dysregulate the same pathways. Aiming to provide an integrated perspective on complex disease mechanisms, we developed a computational method to identify causal genes and dysregulated pathways. Assuming that gene expression changes are caused by genomic alterations, we determined paths from genomic causes to target genes through a molecular interactions network. We applied our method to a dataset of Glioblastoma multiforme patients.

■ SB13

C - Room 207D

Dynamic Markets

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Ramesh Johari, Stanford University, Mgmt. Sci. and Eng., Stanford, CA, 94305, United States of America, ramesh.johari@stanford.edu

1 - Optimal Multi-Period Pricing with Service Guarantees
Ozan Candogan, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, candogan@mit.edu, Christian Borgs, Ilan Lobel, Jennifer Chayes, Hamid Nazerzadeh

We study the problem of matching time-varying supply and demand via a sequence of posted-prices over a finite time horizon. This work is motivated in part by the applications in cloud computing services.

2 - A Revenue Equivalence Theorem for Dynamic Auctions with Learning
Krishnamurthy Iyer, Stanford University, 101 Hoskins Court Apt 102, Stanford, CA, 94305, United States of America, kriyer@stanford.edu, Ramesh Johari, Mukund Sundararajan

We consider a dynamic auction market where identical copies of a good are sold through a sequence of standard auctions. The bidders have an unknown private valuation that determines the distribution of the reward they obtain from the good. We characterize bidder behavior using an approximation methodology where the bidders optimize only with respect to long run average of the distribution of others' bids. Using this, we obtain a dynamic version of the revenue equivalence result.

3 - Welfare in US Airline Revenue Management
Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, vivekf@mit.edu, Yiwei Chen

We present the very first empirical analysis of the social efficiency of US Airline RM. Our analysis is made possible by a unique proprietary data set of ticket purchases and a fairly sophisticated application of the so-called 'micro'-BLP methodology. We also present an interesting theoretical counterpart to our empirical work.

4 - Timing the Revelation of Information in a Model of Experimentation

Kostas Bimpikis, Assistant Professor, Stanford University, 655 Knight Way, Stanford, CA, 94305, United States of America, kostasb@stanford.edu, Kimon Drakopoulos

We study a model of strategic experimentation motivated by collective decision making with costly information acquisition. When the outcomes of experimentation are publicly observable, free-riding results in inefficiently low experimentation at equilibrium. However, when a third party holds all the information and commits when to reveal it, efficiency increases. We construct the unique symmetric Markovian equilibrium of the underlying game and solve for the optimal revelation time.

■ SB14

C - Room 208A

New Trends in Electricity Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Victor M. Zavala, Assistant Computational Mathematician, Argonne National Laboratory, 9700 S Cass Avenue, Argonne, IL, 60439, United States of America, vzavala@mcs.anl.gov

1 - Dynamic Stability and Robustness of Wholesale Electricity Markets

Victor M. Zavala, Assistant Computational Mathematician, Argonne National Laboratory, 9700 S Cass Avenue, Argonne, IL, 60439, United States of America, vzavala@mcs.anl.gov, Mihai Anitescu

We present stability and robustness conditions of wholesale electricity markets. The analysis makes use of a control-theoretic framework that merges concepts of market efficiency, Lyapunov stability, game-theory, and predictive control. Using this framework, we analyze how current market designs can be destabilized in the presence of tight ramp constraints, wind supply, incomplete gaming, and short forecast horizons.

2 - A Dynamic Pivot Mechanism with Application to Real Time Pricing in Power Systems

Cedric Langbort, Assistant Professor, University of Illinois, Urbana, IL, United States of America, langbort@illinois.edu

We present a dynamic VCG-like mechanism, which induces followers to implement the optimal control desired by a leader when playing a Nash equilibrium in a dynamic Stackelberg game, and achieves properly defined notions of individual rationality and budget balance. The benefits of this mechanism are illustrated through a comparison with existing real-time power pricing techniques for the load frequency control problem.

3 - An Extreme-point Global Optimization Technique for Convex Hull Pricing in Electricity Markets

Gui Wang, University of Illinois at Urbana-Champaign, 157CSL, 1308 West Main Street, Urbana, IL, 61801, United States of America, guiwang2@illinois.edu, Eugene Litvinov, Sean Meyn, Uday Shanbhag, Tongxin Zheng

We present an extreme-point-based method for the global maximizer to the Lagrangian dual of an MIP in the context of convex hull pricing for electricity. The algorithm moves along the steepest ascent direction with an a priori constant steplength, and uses backtracking to mitigate the impact of excessively large steps. We discuss the finite-termination property of the method and provide some numerical results. Notably, the scheme is seen to significantly outperform standard subgradient methods.

4 - Future Energy Markets

Alberto Lamadrid, Cornell University, 250 Warren Hall, Ithaca, NY, 14853, United States of America, ajl259@cornell.edu, Ray Zimmerman, Tim Mount

The objective of this paper is to asses the role that ramping costs can have in the operation of the system, to counteract the unpredictable nature of Renewable Energy Sources (RES). The analysis is done by simulation in MATPOWER (Zimmerman, Murillo-Sanchez, and Thomas (2011)) for a Multi-period, stochastic, security constrained AC optimal power flow. This is a continuation of work in stochastic AC-OPF modeling (Thomas, Murillo-Sanchez, and Zimmerman (2008).

■ SB15

C - Room 208B

Behavioral / Descriptive Decision Models I

Sponsor: Decision Analysis

Sponsored Session

Chair: Yael Grushka-Cockayne, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, GrushkaY@darden.virginia.edu

1 - Better Metrics for Energy Decisions

Rick Larrick, Professor of Management, Duke University, Fuqua School of Business, 100 Fuqua Drive, Durham, NC, 27516, United States of America, larrick@duke.edu, Jack Soll, Ralph Keeney

Many energy metrics are expressed as an output divided by an energy input, such as "miles per gallon" of gas for automobiles. Consumers frequently take differences to estimate energy savings from different technologies, leading them to misestimate savings. We argue for adopting metrics in which energy consumed is divided by a fixed level of output (e.g., "gallons per 100 miles"). We explain why energy consumption metrics improve intuitive decisions and show their relevance in several domains.

2 - Repeated Risk Bias: A Resolution of the Allais Paradox

Yael Grushka-Cockayne, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, GrushkaY@darden.virginia.edu, Casey Lichtendahl

Empirical evidence suggests people nonlinearly weight probabilities of events. We offer an alternative explanation to prospect theory: a repeated risk bias - evolutionary forces have shaped human tendencies to choose based on repeated risk. Such a bias means that individuals perceive risk as if they will experience several independent and identical trials of that risk. We find that Allais choices can be consistent with expected utility under a repeated risk bias.

3 - Outcome Framing in Intertemporal Choice

Daniel Read, Warwick Business School, Coventry, Coventry, United Kingdom, Daniel.Read@wbs.ac.uk, Marc Scholten, Shane Frederick

We describe the DRIFT model, a heuristic description of framing effects in intertemporal choice, and four experiments testing its implications. In the experiments we vary how outcomes are framed – either as total interest earned, as the rate of interest or, as is traditionally done in studies of intertemporal choice, as total amount earned. In addition, we describe the future earnings as resulting from investment, or else make no mention of its origin. People are much more patient when outcomes are described as the result of investment. For small amounts they are more patient when the returns are given in interest terms (whether as rates or as total amount earned) when amounts are small, but for large amounts, this effect is eliminated or even reversed. Consequently, the magnitude effect (less discounting for larger amounts) is attenuated for both interest frames. Most strikingly, the interest rate frame reverses the common finding of "hyperbolic" discounting (less discounting for longer delays). Composite frames, which present two different characterizations of the same outcomes, result in preferences that lie between those observed for the component frames, and in our studies show "exponential" discounting. We suggest many major results in studies of time preference arise when frames emphasize option features – specifically differences in times and monetary amounts – that naturally produce hyperbolic discounting and the magnitude effect. Alternative framings eliminate or reverse these results, and the DRIFT model summarizes how this happens.

4 - Utility for Consumption and Payment: A Reference Price Approach

Woonam Hwang, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, whwang.phd2009@london.edu, Manel Baucells

We propose a simple theoretical framework that evaluates distinct hedonic benefits of various consumption and payment streams. Our model explains various anomalies in consumer choices, which could not be explained with existing utility models. In particular, our model predicts the existence of the flat-rate bias and the strong preference for advance payment, which are widely observed anomalies in consumer choices.

■ SB16

C - Room 209A

The Problem Solving Competition

Sponsor: Railway Applications

Sponsored Session

Chair: Homarjun Agrahari, Sr. Operations Research Specialist, BNSF Railway, Fort Worth, TX, 76131, United States of America, Homarjun.Agrahari@BNSF.com

1 - Problem Solving Competition

Homarjun Agrahari, Sr. Operations Research Specialist, BNSF Railway, Fort Worth, TX, 76131, United States of America, Homarjun.Agrahari@BNSF.com

The railroad operations are inherently complex/large scale and source of many challenging OR problems. The Problem Solving Competition is designed to introduce participants to railroad problems, an exciting and challenging application area for Operations Research and Management Sciences. The judging panel selects up to three finalists who then make a presentation at the Informs Annual Meeting. The presenters names will be provided once the finalists have been selected before the conference.

■ SB17

C - Room 209B

Decision Analysis Applications in Public Health

Sponsor: Decision Analysis

Sponsored Session

Chair: Ozgur Araz, The University of Texas at Austin, Austin, TX, United States of America, oaraz@mail.utexas.edu

1 - Estimating a Dynamic Model of Obesity Using Cross-sectional Data

Hazhir Rahmandad, Assistant Professor, Virginia Tech, 7054 Haycock Rd., Falls Church, VA, 22043, United States of America, hazhir@vt.edu, Nasim Sabounchi

Models that can assess the potential impact of alternative interventions are much needed in turning the alarming obesity trend. In this research we build an individual-level model of weight gain and loss and use cross sectional data from National Health And Nutrition Examination Survey to estimate both individual level and population level parameters through simulated method of moments. The calibrated model can be used for community, state, or national policy analysis.

2 - Integrated Simulation Modeling for Screening of Diabetic Retinopathy

Irene Vidyanti, irenevidyanti@gmail.com, Shinyi Wu

Diabetic retinopathy (DR) is the leading cause of acquired blindness among adults. Early diagnosis reduces risk of blindness significantly, but many diabetic patients do not follow screening guidelines. Simulations modeling the effect of various strategies of DR screening on screening compliance and cost-effectiveness at the spatial, population, and service level help to design the optimal screening strategy. Examples of these models and a framework on integrating them would be presented.

3 - Stockpiling Ventilators for Pandemic Influenza

Hsin-Chan Huang, PhD Student, The University of Texas at Austin, Graduate Program in ORIE, Austin, TX, 78712, United States of America, neo.hsinchan.huang@utexas.edu, David Morton, Ozgur Araz, Lauren Meyers, Paul Damien

A stochastic program sizes stockpiles of ventilators for pandemic influenza in Texas. The Texas Department of State Health Services holds a central stockpile and hospitals in eight health service regions (HSRs) hold regional stockpiles. A Bayesian dynamic linear model estimates the distribution of peak-week demand for ventilators across the eight HSRs. We analyze the tradeoff between the total stockpile and expected shortfall of ventilators under mild, moderate, and severe pandemic scenarios.

■ SB18

C - Room 210A

Contemporary Scheduling

Cluster: Scheduling and Project Management

Invited Session

Chair: Joseph Leung, Distinguished Professor, New Jersey Institute of Technology, University Heights, Newark, NJ, 07102, United States of America, leung@oak.njit.edu

1 - Bicriteria Scheduling Concerned with Makespan and Total Completion Time Subject to Machine Availability

Yumei Huo, Associate Professor, CUNY at Staten Island, Staten Island, NY, 10314, United States of America, yumei.huo@csi.cuny.edu, Hairong Zhao

In this paper we simultaneously consider both bi-criteria scheduling and scheduling with limited machine availability. We focus on two parallel machine environment and the goal is to find preemptive schedules to optimize both makespan and total completion time subject to machine availability. Our main contribution in this paper is that we showed three bicriteria scheduling problems are in P by providing polynomial time optimal algorithms.

2 - Coordination Mechanisms with Hybrid Local Policies

Michael Pinedo, Professor and Chair, New York University, Stern School of Business,, 44 West 4th Street, Room 8-59, New York, NY, 10012, United States of America, mpinedo@stern.nyu.edu, Joseph Leung, Kangbok Lee

Consider n jobs and m machines in parallel. Each job is represented by an agent who acts selfishly to minimize the completion time of his job without considering system's performance. The Price of Anarchy (POA) is the maximum ratio of the overall objective of an equilibrium schedule divided by an optimal schedule. The machines use a mixed local policy: some machines use SPT, others LPT. We analyze the POA for problems minimizing the makespan or flow time.

3 - Approximation Schemes for Scheduling with Availability Constraints

Hairong Zhao, Associate Professor, Purdue University at Calumet, Hammond, IN, 46323, United States of America, hairong@purduecal.edu, Bin Fu, Yumei Huo

We investigate the problems of scheduling weighted non-resumable jobs on constant number of parallel-machines with availability constraints. We consider two different models of availability constraints: the preventive model and the fixed job model. For both models, we develop approximation schemes for special cases and give inapproximability results for general cases.

4 - Minimizing Maximum Lateness Subject to Maintenance Activites

Dirk Briskorn, University of Siegen, Hölderlinstr. 3, Siegen, Germany, dirk.briskorn@uni-siegen.de

We consider a single machine scheduling problem where maintenance activities are to be considered. We have high flexibility regarding the timing of the maintenance activities as long as we prevent the machine from breaking down. We provide complexity results for the minimization of maximum lateness.

■ SB19

C - Room 210B

JFIG Paper Competition I

Sponsor: Junior Faculty Interest Group (JFIG)

Sponsored Session

Chair: Esra Buyuktahtakin, Assistant Professor, IME Department, Wichita State University, Wichita, KS, United States of America, esra.b@wichita.edu

The JFIG paper competition aims to encourage research among junior faculty and increase the visibility of research conducted by junior faculty within the fields of operations research and management science. Papers are submitted for this year's competition, and each one is evaluated based on the importance of the topic, appropriateness of the research approach, and the significance of research contribution. In this session the finalists-selected in two rounds of review, will present their papers. For all the selected finalists and the abstracts of the selected papers, please refer to the online program.

1 - Supply Chain Performance under Market Valuation: An Operational Approach to Restore Efficiency

Guoming Lai, Professor, University of Texas-Austin, 1 University Station, B6500, CBA 5.202, Austin, TX 78705, United States of America, Guoming.Lai@mccombs.utexas.edu, Wenqiang Xiao, Jun Yang

Based on a supply chain framework, we study the ordering decision of a downstream buyer firm who receives private demand information and has the incentive to influence her capital market valuation. We characterize a separating market equilibrium under a general single contract offer. We show ordering distortion may arise. Then, we investigate operational mechanisms to prevent such inefficient ordering distortion.

2 - Sequential Bayes-optimal Policies for Multiple Comparisons with a Control

Jing Xie, Cornell University, 232 Rhodes Hall, Ithaca, NY, United States of America, jx66@cornell.edu, Peter Frazier

We consider the problem of efficiently allocating simulation effort to support multiple comparisons with a standard. Using a Bayesian formulation, we show that the optimal fully sequential policy is the solution to a dynamic program. We show that this dynamic program can be solved efficiently, and the Bayes-optimal allocation policy is found, using techniques from optimal stopping and multi-armed bandits. We apply the resulting policy to an application in ambulance positioning.

■ SB20

C - Room 211A

Joint Session Optimization/ENRE: Global Optimization in Energy

Sponsor: Optimization- Global Optimization/Energy, Natural Resources and the Environment- Energy

Sponsored Session

Chair: Steffen Rebennack, Assistant Professor, Colorado School of Mines, Engineering Hall 310, Golden, CO, 80401, United States of America, srebenna@mines.edu

1 - Global Optimization of Thermochemical Coal, Biomass, and Natural Gas to Liquids Processes

Christodoulos A Floudas, Princeton University, Department of Chemical and Biological Eng., Engineering Quadrangle, Princeton, NJ, United States of America, floudas@princeton.edu, Richard C. Baliban, Josephine A Elia

A global optimization approach is proposed for the process synthesis of hybrid energy plants with simultaneous heat, power, and water integration. A branch-and-bound scheme is introduced that utilizes piecewise linear underestimators to determine tight lower bounds on the optimal solution. The capability of the method is demonstrated using two large MINLP case studies that feature 2,266 nonconvex terms, 21 binary variables, 183,962 continuous variables, and 184,270 constraints.

2 - Customizing Global Optimization Solvers for Power Flow Problems

Ashutosh Mahajan, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, United States of America, mahajan@mcs.anl.gov, Sven Leyffer, Todd Munson

Optimization problems based on transmitting power in electricity grid are difficult because of nonconvex nonlinear constraints and integer constrained variables. We will discuss some branch-and-cut based methods to solve these problems. Computational experiments performed using our solver, MINOTAUR, will be presented. We will also describe how specific routines in MINOTAUR can be customized to attack these problems.

3 - Effects of Uncertainty About Global Economic Recovery on Energy Demand and CO2 Prices

Yves Smeers, Université Catholique de Louvain, CORE, Voie du Roman Pays 34, Louvain-la-Neuve, 1348, Belgium, yves.smeers@uclouvain.be, Andreas Ehrenmann, Axel Pierru

We model a "lost decade" type phenomenon in a stochastic version of the MERGE model modified to get a closer representation of investments in the power sector. The recovery of economic growth is uncertain but differentiated between DM and EM, a gobal carbon abatement objective is set for 2050.

4 - A New Method for Solving Mathematical Programs and Equilibrium Problems with Equilibrium Constraints

Sauleh Siddiqui, PhD Candidate, University of Maryland, Applied Math, Stats, Sci. Comp. Prog, College Park, MD, 20742, United States of America, siddiqui@umd.edu, Steven Gabriel

This presentation introduces an original method for solving mathematical programs and equilibrium problems with equilibrium constraints. Schur's decomposition followed by two separate methods of approximating absolute-value functions are presented. The advantage of this method over disjunctive constraints is that computational time is much lower, which is corroborated by numerical examples.An application to the United States natural gas market is also given.

■ SB21

C - Room 211B

Risk, Robustness and Chance Constraints in Stochastic Programming with Applications to Finance

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Dimitrios Karamanis, D.Karamanis@lse.ac.uk

1 - Multi-period Portfolio Optimization with Risk and Transaction Costs

Dimitrios Karamanis, D.Karamanis@lse.ac.uk, Katerina Papadaki

In this study we develop a multi-period portfolio optimization model that includes both risk and transaction costs. The model is solved using Stochastic Programming and Approximate Dynamic Programming methods, which are compared with respect to complexity and out-of-sample performance. Computations suggest superiority of Approximate Dynamic Programming over Stochastic Programming and other existing portfolio investment methods.

2 - Portfolio Selection under Extreme Moment Uncertainty: Stochastic Programming v.s. Robust Optimization

Roy Kwon, Associate Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, rkwon@mie.utoronto.ca, Jonathan Li

We consider single-period portfolio selection and address the problem of providing a "reasonably" robust policy in the presence of "extreme" moment uncertainty. We consider a penalized moment-based robust optimization approach and a sample-based stochastic programming approach using S&P500 historical data and find distinct performances during the financial crisis period of 2007-2008.

3 - Probability Maximization in Stochastic Programming without Recourse

Robert Bordley, Booz-Allen, 101 West Big Beaver Suite #505, Troy, MI, 48085, United States of America, Bordley_robert@bah.com

A recent publication addresses chance-constrained programming problems as probability maximizations problems where the objective function was rewritten as a stochastic constraint. (Other publications established that it was always possible to represent an objective function as a stochastic constraint.) This highlights the importance of probability maximization problems. This presentation draws on work in econometrics to present new approaches for solving probability maximization problems.

■ SB22

C - Room 212A

Efficient Learning In Stochastic Optimization

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Ilya Ryzhov, Princeton University, Princeton, NJ, United States of America, iryzhov@Princeton.edu

1 - Optimal Hiring and Retention Policies for Heterogeneous Workers that Learn Over Time

Alessandro Arlotto, University of Pennsylvania, The Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104, United States of America, alear@wharton.upenn.edu, Stephen Chick, Noah Gans

We study the hiring and retention of heterogeneous workers that learn over time. We formulate the problem as an infinite-armed bandit and characterize the optimal hiring and retention policy in detail. We develop approximations that allow the efficient implementation of the optimal policy and the evaluation of its performance. Our numerical examples show that the active screening and monitoring of employees leads to substantial gains.

2 - Shelf Space Driven Assortment Planning for Seasonal Consumer Goods

Joern Meissner, Kuehne Logistics University, Brooktorkai 20, Hamburg, 20457, Germany, joe@meiss.com, Kevin Glazebrook, Jochen Schurr

Zara and others have invested in merchandize procurement strategies that permit lead times as short as two weeks. Our research investigates the use of the most valuable resource of such a retailer: shelf space. We propose the use of multi-armed bandits to model the assortment decisions under demand learning. The learning aspect is captured by a Bayesian Gamma-Poisson model. We propose a knapsack based index heuristic that results in policies that are close to theoretically derived upper bounds.

3 - Efficient Reinforcement Learning

Zheng Wen, Stanford University, Packard 247, Stanford, CA, 94305, United States of America, zhengwen@stanford.edu, Benjamin Van Roy

We present a reinforcement learning algorithm that generalizes using function approximation and strikes an effective balance between exploration and exploitation. This algorithm is efficient in the sense that in a Markov decision process it achieves near-optimal reward with high probability after a number of state transitions polynomial in the number of basis functions, the cardinality of the action space, the mixing time, and the maximum reward.

4 - Information Collection in a Linear Program

Ilya Ryzhov, Princeton University, Princeton, NJ, United States of America, iryzhov@Princeton.edu, Warren Powell

Consider a linear program where the objective coefficients are uncertain, for which we have a Bayesian prior. We can collect information to improve our understanding of these coefficients, but this may be expensive. We wish to optimize the collection of information to improve the quality of the solution relative to the true cost coefficients. We derive a knowledge gradient policy which maximizes the marginal value of each measurement.

■ SB23

C - Room 212B

Joint Session Homeland/MAS/Law: Advances in Risk Analysis at the Local, State and Federal Level II

Cluster: Homeland Security-Emergency Prep/Military Applications Society/Law, Law Enforcement and Public Policy

Invited Session

Chair: Barry Ezell, Associate Research Professor, Old Dominion University's VMASC, 1030 University Blvd., Suffolk, VA, 23435, United States of America, bezell@odu.edu

1 - Managing Risk at the Tucson U.S. Border Patrol

Evan Levine, Chief Scientist, Office of Risk Management and Analysis, U.S. Department of Homeland Security, 245 Murray Lane SW, Washington, DC, 20528, United States of America, Evan.Levine@dhs.gov, Julie Waters

This presentation describes a risk assessment used to inform resource allocation at the Tucson Sector of the United States Border Patrol, the busiest sector for alien and drug trafficking along the Southwest land border with Mexico. The methodology that underlies this assessment is generally applicable to many resource allocation decisions regarding managing frequently occurring hazards. The assessment was executed by agents without previous risk expertise working under a short timeframe.

2 - Securing Critical Infrastructure in a Resource Constrained Environment

George Gabriel, Manager; Security, Preparedness and Emergency Management, Whitney, Bradley and Brown Consulting, 4429 Bonney Rd, Suite 400, Virginia Beach, VA, 23462, United States of America, GGabriel@WBBinc.Com

A comprehensive Risk Assessment is the foundation behind the strategy in securing CI/KR in a resource constrained environment. The process begins with a Capabilities Based Assessment, in which capabilities are identified through a strategy to task assessment; gaps are identified and prioritized, followed by risk analysis in which gap severity is measured, ultimately identifying potential solutions and mitigation strategies.

3 - The Re-engineering of Traditional Approaches to Emergency Preparedness and Planning Exercises

Joshua Behr, Old Dominion University, 1030 University Blvd, Suffolk, VA, 23435, United States of America, jbehr@odu.edu, Barry Ezell, Rafael Diaz

Broad theory suggests that the injection of Live, Virtual, and Constructive (LVC) simulation elements into traditional table top exercises will enhance emergency preparedness. A preliminary step towards the injection of LVC elements within a traditional tabletop exercise took place at a Hampton Roads emergency planning event, the 2011 Hampton Roads Chief Administrative Officer (CAO) Tabletop Exercise (TTX). We developed and deployed a set of purposively selected Spatially Integrated Incidence Maps (SIIMS) within a hurricane flooding exercise. In this presentation we offer the substance of these maps and report on their utility in increasing both situational awareness and rapidity of decision making.

4 - Comparative Risk Assessment in Homeland Security

Russell Lundberg, Doctoral Fellow, Pardee RAND Graduate School, 1776 Main Street, P.O. Box 2138, Santa Monica, CA, 90407-2138, United States of America, rlundber@prgs.edu, Henry Willis

This presentation describes an on-going study to apply comparative risk assessment to homeland security. First steps identify the set of characteristics that must be covered when describing diverse terrorism and disasters in a comprehensive manner, which are used to develop concise summaries of the hazards. Using these, the study elicits relative concerns about the hazards. The relative concerns about hazards provide a starting point for prioritizing solutions for homeland security risks.

■ SB24

C - Room 213A

Optimization Society Prizes

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Jon Lee, United States of America, jonxlee@umich.edu

1 - Student Paper Prize: On the Chvátal-Gomory Closure of a Compact Convex Set

Daniel Dadush, PhD Student, Georgia Tech, Atlanta, GA, United States of America, dndadush@gatech.edu

In this work, we show that the Chvátal-Gomory closure of any compact convex set is a rational polytope. This resolves an open question of Schrijver for irrational polytopes (Annals of Discrete Math, 1980), and generalizes the same result for the case of rational polytopes, rational ellipsoids (IPCO, 2010) and strictly convex bodies (MOR, 2011). Joint work with Santanu Dey and Juan Pablo Vielma.

2 - Prize for Young Researchers: Comparing SCIP to CPLEX

Tobias Achterberg, IBM Deutschland Research & Development GmbH, Berlin, 14195, Germany, achterberg@de.ibm.com

SCIP is an academic solver for constraint integer programming, which is a generalization of mixed integer programming and finite domain constraint programming. CPLEX is a commercial solver for mixed integer programming and other more general problem types. This talk discusses some of the differences between the solvers in performance, applicability, design, and coding style.

3 - Farkas Prize: Highway Dimension: from Practice to Theory and Back

Andrew Goldberg, Principal Researcher, Microsoft Research – Silicon Valley, Mountain View, CA, United States of America, goldberg@microsoft.com

Several recent shortest path heuristics that answer queries on continental-scale road networks in real time. We give the first theoretical analysis for them that also explores an unexpected relationship to VC-dimension. In addition, we show that a hub labeling algorithm achieves a better theoretical time bound. Our experimenters show that its implementation outperforms the previous codes, validating the theoretical prediction.

4 - Khachiyan Prize: Seduced by Optimization

Kees Roos, Delft Univeristy of Technology, Delft, 2628, Netherlands, c.roos@tudelft.nl

During my career my research interest became more and more application-oriented. After a PhD in pure algebra (1975) algebraic coding theory became my favorite subject. A revolutionary LP bound for codes raised my interest in optimization. The work of Khachiyan and Karmarkar was decisive to keep me busy the last 30 years with contributions to the development of the theory of interior-point methods, and the last years increasingly with exciting applications. I will discuss some highlights.

5 - Khachiyan Prize: Optimization for Decision Making

Jean-Philippe Vial, Professor Emeritus, University of Geneva and Ordecsys, Geneva, Switzerland, jpvial@ordecsys.com

I intend to give a brief sketch of my research itinerary. Being convinced that numerical tractability is the crux for success in real applications of optimization, I have concentrated my research efforts on interior point method for linear programming, on the analytic center cutting plane method for general convex programming and more recently on robust optimization.

■ SB25

C - Room 213BC

Empirical Work in Auctions and Pricing

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Gabriel Weintraub, Columbia University, Columbia Business School, New York, NY, United States of America, gyw2105@columbia.edu

Co-Chair: Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 417, New York, NY, 10027, United States of America, molivares@columbia.edu

1 - An Empirical Analysis of Price, Quality, and Incumbency

Tunay Tunca, Associate Professor, Stanford University, Graduate School of Business, Stanford, CA, United States of America, tunca_tunay@GSB.Stanford.Edu, Vivian Zhong, D.J. Wu

Using data from legal service procurement auctions, we study the effectiveness of using auctions for procuring business services. Supported by our theoretical results, we empirically explore the effectiveness of the various award structures of the auctions. We further extract and quantify buyer's revealed preferences, which indicate a significant under-weighting of quality in the buyer's stated preferences.

2 - Structural Estimation of a Large-scale Procurement Combinatorial Auction

Sang Won Kim, PhD Candidate, Columbia Business School, New York, NY, United States of America, skim14@gsb.columbia.edu, Marcelo Olivares, Gabriel Weintraub

Combinatorial auctions are particularly useful in procurement when items exhibit cost synergies. However, allowing bidders to bundle items that do not exhibit synergies may hurt the efficiency of the allocation. In this study, we develop a structural estimation method to uncover the bidders' cost structure of a large-scale combinatorial auction; the Chilean auction for school meals. Based on these estimates we analyze and suggest important improvements to the auction design.

3 - Impact of Purchase Delays on Revenues: A Structural Model Based on Arts Organization Data

Senthil Veeraraghavan, The Wharton School, 3730 Walnut Street, Suite 500, Jon M Huntsman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Necati Tereyagoglu

Firms, which rely heavily on discounts, may end up with significant revenue losses due to a new generation of consumers. We examine the impact of strategic delays in consumer ticket purchases, on the revenues of a firm, using individual level ticket sales and seat pricing data for a season of 21 concerts from a well-known arts organization. We use a structural model to estimate the factors that influence the consumer's purchase time decision and suggest a pricing policy using these estimates.

4 - Empirical Analysis of Reputation in Online Marketplaces for Service Procurement

Antonio Moreno-Garcia, Northwestern University, Kellogg School of Management, Evanston, IL, United States of America, a-morenogarcia@kellogg.northwestern.edu, Christian Terwiesch, Elena Krasnokutskaya

Online service marketplaces, where buyers post request for proposals and service providers bid for them, are becoming a popular alternative for service procurement in some industries. Using a detailed dataset from a leading on-line intermediary for the outsourcing of software development services, we study the tradeoffs made by buyers and sellers, focusing on the role of reputation.

■ SB26

C - Room 213D

Sustainability and Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Li Chen, Assistant Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, Lc91@duke.edu

1 - The Effect of Variability in Climate Policy on Facility Location and International Trade

Ozge Islegen, PhD Student, Stanford Graduate School of Business, 655 Knight Way, Stanford University, Stanford, United States of America, oislegen@stanford.edu, Erica Plambeck, Terry Taylor

One region imposes either a tax on GHG emissions or a cap-and-trade system in which the cost of a permit for emissions is uncertain and has mean equal to the tax. We show how variability in the permit cost affects manufacturers' decisions to relocate to a region with no climate policy, the associated "leakage" of emissions, trade quantities, and social welfare in the region with climate policy.

2 - Training, Production, and Channel Separation in ITCs e-Choupal Network

Z. Max Shen, Professor, University of California Berkeley, Department of IEOR, Berkeley, CA, United States of America, shen@ieor.berkeley.edu, Ying-Ju Chen, George Shanthikumar

We investigate the novel e-Choupal business model developed by ITC. We show that the implicit agreement between ITC and farmers behaves as a formal contract, the e-Choupal network leads to the complete separation of selling channels, and ITC may provide the best training to the farmers outside the network.

3 - Responsible Sourcing Models: Social Value and Risk Analysis

Li Chen, Assistant Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, Lc91@duke.edu, Hau Lee

As companies increasingly outsource manufacturing to emerging economies, they are also exposed to higher levels of risks in the form of production cost increases and supplier non-compliance of environmental or labor standards. In this paper, we consider how a company and its supplier can invest in training and process improvements that would ultimately increase the profits of the supply chain, but at the same time reduce the risk of supplier non-compliance.

■ SB27

C - Room 214

Product Disposition Decisions in Closed-Loop Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Gilvan "Gil" Souza, Associate Professor, Indiana University, Kelley School of Business, Bloomington, IN, 47401, United States of America, gsouza@indiana.edu

1 - Solving the Disassemble-to-order Problem under Yield Process Misspecification

Karl Inderfurth, Otto-von-Guericke University, Faculty of Economics and Management, POB 4120, Magdeburg, 39016, Germany, inderfurth@ww.uni-magdeburg.de, Stephanie Vogelgesang, Ian Langella

In disassembly planning, the yield uncertainty in harvesting parts from cores can be modeled as either stochastically proportional or binomial. A statistical analysis of data from engine remanufacturing of a major car producer fails to provide conclusive evidence on which kind of yield randomness might prevail. In order to gain insight into the importance of this yield assumption, the impact of possible yield misspecification on the solution of the disassemble-to-order problem is investigated.

2 - Dynamic Disposition Decisions in a Closed-loop Supply Chain: Dismantle, Refurbish, or Salvage?

Goker Aydin, Associate Professor, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States of America, ayding@indiana.edu, Moritz Fleischmann, Gilvan "Gil" Souza

Consider a closed-loop supply chain, in which a returned product can be disposed in one of three ways: dismantling the product to obtain spare parts, refurbishing the product, or salvaging it. The attractiveness of each option depends on how the future demand for spare parts and the refurbished product measure up against the existing inventory levels. In this setting we study the optimal disposition decisions with the goal of devising simple yet effective policies.

3 - Coordinating Multiple Spare Parts Procurement Options After End-of-production

Rainer Kleber, Otto-von-Guericke University, Faculty of Economics and Management, POB 4120, Magdeburg, 39016, Germany, rainer.kleber@ovgu.de, Karl Inderfurth

Spare parts provision is a challenge for many OEMs due to the substantial demand uncertainty over a long time horizon and limited procurement flexibility. For coordinating the three sourcing options final order, extra production, and remanufacturing we propose a heuristic that accounts for the main stochastic and dynamic interactions. In a numerical study it shows good performance under a wide range of conditions allowing for major cost reductions compared to decision rules used in practice.

4 - A Profit-maximizing Approach to Disposition Decisions for Product Returns

Gilvan "Gil" Souza, Associate Professor, Indiana University, Kelley School of Business, Bloomington, IN, 47401, United States of America, gsouza@indiana.edu, Moritz Fleischmann, Mark Ferguson

We analyze the optimal disposition decision for product returns in electronic products industries, motivated by IBM. Returns may be either remanufactured or dismantled for spare parts. We develop a multi-period stochastic optimization model for the disposition problem, and find the optimal policy structure. We show that a simple myopic heuristic performs well.

■ SB28

C - Room 215

Design of Service Contract: Insurance, Warranty and Return Policy

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Ming Hu, University of Toronto, Rotman School of Management, Toronto, ON, Canada, Ming.Hu@Rotman.Utoronto.Ca

1 - Loss Aversion Leading to Advantageous Selection

Christina Aperjis, HP Labs, Palo Alto, CA, 94304, United States of America, christina.aperjis@hp.com, Filippo Balestrieri

Even though classic economic theory predicts that ex-post risk and coverage are positively correlated in an insurance market, the opposite has been observed in a variety of settings. From the prospective of the insurer, this is associated with advantageous selection, because the agents who buy insurance are also the cheapest to insure in the market. We consider a model with loss-averse agents and offer plausible conditions under which advantageous selection occurs.

2 - Dynamic Pricing with Returns

Ying-Ju Chen, University of California- Berkeley, 4121 Etcheverry Hall, Berkeley, CA, 94720, United States of America, chen@ieor.berkeley.edu, Selina Cai

Our paper shows that a seller who faces demand uncertainty and wishes to sell over multiple periods can effectively set a return policy to achieve profit maximization. As the capacity becomes more constraint, the seller can offer a higher refund amount; the optimal first period price may not be monotonic.

3 - Base Warranties vs. Extended Warranties:Supply Chain Conflict and Extended Warranty Sales Strategies

H. Sebastian Heese, Indiana University, 1309 E 10th St, Kelley School of Business, Bloomington, IN, 47405, United States of America, hheese@indiana.edu

Consider two competing manufacturers who sell their products through the same retailer. If this retailer derives profits from extended warranty sales, the manufacturers face a dilemma in setting their base warranties. While they have incentive to increase their warranties to make their products attractive to consumers, the retailer prefers lower base warranties to enhance extended warranties sales. We analyze optimal manufacturer and retailer strategies in this setting.

4 - Flexible Duration Warranties with Dynamic Reliability Learning

Julie Ward, HP Labs, 1501 Page Mill Rd, Palo Alto, CA, 94301, United States of America, jward@hp.com, Guillermo Gallego, Ruxian Wang, Ming Hu, Enis Kayis, Jose Luis Beltran, Shailendra Jain

Rapid price declines & technology improvements in industries like consumer electronics make product replacement a viable alternative to buying an extended warranty (EW). We study flexible-duration EW in a setting where customers update beliefs of product reliability over time & make warranty continuation decisions accordingly. We show how such services can expand the market to frequent-upgraders & those who are uncertain about the product reliability) & can earn more profit for the provider.

■ SB29

C - Room 216A

Healthcare Operations Management

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations

Sponsored Session

Chair: Carri Chan, Columbia Business School, 3022 Broadway, Uris Hall 410, New York, NY, United States of America, cwchan@columbia.edu

1 - Patient Prioritization and Triage in Mass-casualty Incidents

Alex Mills, University of North Carolina, Department of Statistics and Operations, CB 3260, Chapel Hill, NC, 27599, United States of America, amills@unc.edu, Nilay Argon, Serhan Ziya

In a mass-casualty incident, the most widely used triage method, START, relies on a fixed ordering among the classes of patients to determine priority in accessing resources. Using a fluid model, we developed a simple time-dependent priority policy, ReSTART, which significantly outperforms START. We present new simulation results demonstrating applications of ReSTART in different kinds of mass-casualty scenarios.

2 - Improving the Performance of a Hospital ER Fast-Track

Amy Ward, Associate Professor, University of Southern California, Bridge Hall 401H, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu, Linda Green, Jeunghyun Kim

Many ERs have set up "fast-tracks" for non-urgent patients in order to reduce their waiting times and hence the fraction who leave without being seen (LWBS). However, this reduces the pool of physicians treating urgent patients, increasing their waiting times and the risk of adverse outcomes. We propose a flexible policy which dynamically gives scheduling priority to urgent or non-urgent patients so as to better balance the waiting times for urgent patients with the fraction of LWBS.

3 - Optimal Mix of Surgical Procedures under Stochastic Length of Stay

Hessam Bavafa, OPIM Department, The Wharton School, Philadelphia, PA, 19104, United States of America, bavafa@wharton.upenn.edu, Lerzan Ormeci, Sergei Savin

We provide analytical insights on the optimal allocation of hospital operating capacity among several types of elective surgical procedures. In our model, each surgical procedure has an associated revenue and a stochastic length of stay for a patient undergoing the procedure. We describe the optimal mix of procedures in the presence of a service-level constraint on the number of occupied beds for arbitrary length-of-stay distributions.

4 - Queues with Delay Sensitive Service Times

Carri Chan, Columbia Business School, 3022 Broadway, Uris Hall 410, New York, NY, United States of America, cwchan@columbia.edu, Vivek Farias

In a healthcare setting, the service requirements of a job may depend on the state of the queue upon its arrival. Indeed, delays in receiving treatment can potentially lead to longer lengths of stay (LOS) when the patient ultimately does receive care. We empirically measure the impact of ED LOS on ICU LOS. Next, we incorporate these measured delayed effects into a queueing model and characterize approximations to various quantities of interest when the service time increases with delay.

■ SB30

C - Room 216B

Yield and Procurement Risk Management in Commodity Markets

Sponsor: Manufacturing & Service Oper Mgmt/ iFORM SIG

Sponsored Session

Chair: Onur Boyabatli, Assistant Professor, Singapore Management University, 50 Stamford Road 04-01, Singapore, 178899, Singapore, oboyabatli@smu.edu.sg

1 - Optimal Energy Procurement in Spot and Forward Markets

Nicola Secomandi, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ns7@andrew.cmu.edu, Sunder Kekre

Energy storage capacity is limited. Spot and forward purchases for delivery on the usage date are thus important to match the supply and uncertain demand of energy. Transaction costs tend to be larger in spot than forward energy markets. We study the optimal joint spot and forward procurement of energy in the

presence of such differential transaction costs. We provide insights into the structure of the optimal procurement policy and the value provided by the forward market and optimization.

2 - Pricing and Production Planning under Supply and Quality Uncertainty with Downward Substitution

Tim Noparumpa, Dotoral Student, Syracuse University, Whitman School of Management, Syracuse, NY, 13204, United States of America, tnoparum@syr.edu, Burak Kazaz, Scott Webster

We examine the influence of downward substitution, pricing, and fruit-trading flexibilities on an agricultural firm's pricing and production decisions under supply and quality uncertainty. The firm grows its own fruit, and obtains two grades of fruit, and makes two types of products: a high-end and a low-end product. The study identifies the conditions when high-quality fruit can be substituted for low-quality fruit.

3 - The Value of Operational Flexibility in Uncertain Supply and Demand Environments

Xiaole Sherri Wu, Washington University in St. Louis, St. Louis, MO, 63130, United States of America, x.wu@wustl.edu, Panos Kouvelis, Lingxiu Dong

This paper studies the interconnection among multiple-stage decisions of the oil refining process and how those decisions are affected by conditions of input and output markets and the refinery's processing capability, especially its two types of operational flexibility, namely, crude oil mixing in crude procurement and conversion of heavy fraction to light fraction in refining. We offer insights on the impact of market conditions on the values of conversion and mixing flexibility.

4 - Yield Management in Agricultural Commodity Markets

Kwan Eng Wee, Assistant Professor, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road #04-01, Singapore, 178899, Singapore, kewee@smu.edu.sg, Onur Boyabatli

This paper analyzes the impact of yield uncertainty on a processor that uses a single commodity input to produce a single output. The yield of the input not only determines the volume available for production but also impacts the quality of the output by altering the amount of output produced from a single input. We investigate the impact of yield and input spot price variability, correlation on the optimal ordering decision and the expected profit of the processor.

■ SB31

C - Room 217A

Game-Theoretic Applications in Healthcare II

Sponsor: Health Applications

Sponsored Session

Chair: Reza Yaesoubi, Post-Doctoral Research Staff, IBM Watson Research Center, 19 Skyline Dr., Hawthorne, NY, 10532, United States of America, reza.yaesoubi@gmail.com

1 - Optimizing the Societal Benefits of the Annual Influenza Vaccine

Osman Ozaltin, Assistant Professor, University of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo, ON, Canada, oyo1@pitt.edu, Oleg A. Prokopyev, Mark Roberts, Andrew Schaefer

Seasonal influenza is a major public health concern. The World Health Organization recommends a new flu shot annually based on surveillance and epidemiological analysis. There are two critical decisions regarding the flu shot design. One is its composition, which influence vaccine effectiveness. The other is the timing of the composition decisions, which affects the flu shot availability. We propose a multistage stochastic mixed-integer program to address the optimal annual flu shot design.

2 - A Game-Theoretic Pediatric Vaccine Pricing Model

Sheldon Jacobson, Professsor, University of Illinois, 201 N. Goodwin Avenue, MC258, Urbana, IL, 61801, United States of America, shj@illinois.edu, Uday Shanbhag, Matthew Robbins

The United States pediatric vaccine manufacturing market is analyzed using a static Bertrand oligopoly pricing model to characterize oligopolistic interactions between asymmetric firms in a homogeneous multiple product market. Sufficient conditions for the existence of pure strategy Nash equilibria are provided. Practical implications of these results are discussed.

3 - Optimal Financing Structure Mechanism Design for Traumatic Brain Injury (TBI) Patients

Zhen Zhu, Purdue University, West Lafayette, IN, 47906, United States of America, zzhu@purdue.edu, Nan Kong, Andrew Liu

Over-utilization and insurance overhead are the two major structural costs in healthcare financing with no contribution to the patients' well-being. We consider a mechanism design problem to minimize the structure costs. A leader-follower game is formulated with the public insurer as the leader whose objective is to minimize the total structure cost subject to both budgetary and patients' stop-loss constraints, and private insurer as the follower, whose objective is to maximize its revenue.

4 - Equilibrium Stability and Payoff Efficiency in Paired Kidney Exchanges

Murat Kurt, Assistant Professor, University at Buffalo, SUNY, 415 Bell Hall, Buffalo, NY, 14260, United States of America, muratkur@buffalo.edu, Utku Unver, Andrew Schaefer, Mark Roberts

Paired kidney exchanges (PKE) alleviate the shortage in the supply of kidneys for transplantation. We consider transplant timing decisions in a prearranged PKE and formulate the resulting problem as a non-zero sum stochastic game. We focus on the trade-off between the payoff efficiency and the stability of the equilibria, and characterize the socially efficient stable equilibrium as an optimal solution to a mixed-integer linear program. We present computational results based on clinical data.

■ SB32

C - Room 217BC

Forecasting and Learning in Retail

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Adam Mersereau, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, ajm@unc.edu

1 - Asymmetric Responses of Retailers to Economic Shocks

Saravanan Kesavan, University of North Carolina, Chapel Hill, NC, United States of America, skesavan@unc.edu, Tarun Kushwaha, Vishal Gaur

We analyze the response of U.S. public retailers to expansion and contraction shocks in the economy using quarterly data on macroeconomic indicators and quarterly filings of U.S. public retailers. Our results show that inventory turns move counter cyclically with expansion and contraction shocks. We also quantify the short-term effects, long-term effects, and duration of the impacts of their actions on inventory turns.

2 - Demand Estimation with Stockouts and Substitution at the Cornell Store

Suresh Muthulingam, Assistant Professor of Operations Management, Cornell University, The Johnson School, 401P Sage Hall, Ithaca, NY, 14853, United States of America, sm875@cornell.edu, Vishal Gaur, Joonkyum Lee

We investigate the effect of stockouts on the accuracy and efficiency of demand estimation in the presence of substitution. Our study uses data for the sales of new and used textbooks from the Cornell Store to benchmark alternative methods. We apply our findings to the bookstore.

3 - Demand Estimation with Censored Observations and Uncertain Inventory

Adam Mersereau, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, ajm@unc.edu

We consider a newsvendor trying to estimate a demand distribution from historical sales data. We assume the newsvendor uses stocking levels to account for censoring but these stocking levels may be subject to unobserved errors. We discover systematic biases in demand estimates even while service levels appear to the firm to meet targets. Our work identifies a new component of the value of information technologies such as RFID.

■ SB33

C - Room 217D

Nanomanufacturing and Nanoinformatics I

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER 240, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

Co-Chair: Lijuan Xu, PhD Student, University of Southern California, Los Angeles, CA, United States of America, lijuanxu@usc.edu

1 - Reliability Issues of Nano Devices at the Electronic System Level

Elsayed Elsayed, Professor, Rutgers University, CORE, Piscataway, United States of America, elsayed@rci.rutgers.edu

The variability of nano devices due to the fluctuations in the manufacturing processes has a major impact at the electronic system level. Many different failure mechanisms and ageing of the devices due to the applied stresses make it difficult to assess or maintain desired reliability levels. This presentation addresses these issues and suggests approaches for reliability modeling under these conditions.

2 - An overview of Nano-imaging and Nano-metrology Issues

Yu Ding, Associate Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77840, United States of America, YuDing@iemail.tamu.edu, Jianhua Huang, Chiwoo Park

People often say that you cannot control what you cannot measure. In nano-manufacturing, many process related measurements are in the format of images, presenting a unique challenge for process control. This talk will present the authors' experience in dealing with those nano-scale images and their thoughts on where things are standing.

3 - Modeling the Interactions Among Neighboring Nanostructures for Local Feature Characterization

Lijuan Xu, PhD Student, University of Southern California, Los Angeles, CA, United States of America, lijuanxu@usc.edu, Qiang Huang

Since properties of nanomaterial are determined by their structures, characterizing nanostructure (NS) features is of great importance. The characterization includes not only summary statistics of NS features but also their spatial distribution and possible defects to quantitatively describe NS "quality". In this work, we provide a method for modeling and estimating interactions among neighboring NS to characterize the local features. Our modeling of interactions also assists defects detection.

4 - Detecting Particle-Clustering in Metal Matrix Nanocomposites (MMNCs) Using Microscopic Image

Qiang Zhou, University of Wisconsin-Madison, 1513 Universtiy Avenue, Madison, 53706, United States of America, qzhou3@wisc.edu, Junyi Zhou, Shiyu Zhou, Michael De Cicco, Xiaochun Li

Light-weight, high-strength MMNCs have high potential in many applications. A uniform distribution of nanoparticles is critical for its high-quality. We aim to detect non-uniformity of particle distribution. We investigate the problem based on statistical modeling and analysis of the number of particles on sample images. The distributions of the number of particles on a single image in both uniform and non-uniform cases are derived. Based on the results, a hypothesis test is proposed.

5 - Process Control and Variability Reduction for Nanopowder Production Scale-up

Chia-Jung Chang, Georgia Intitute of Technology, 755 Ferst Dr. NW, Atlanta, United States of America, cchang43@gatech.edu, Jianjun Shi

Nanopower production scale up is an important, yet a challenging task. The scale up is not just a straight-forward expansion of the Combustion Chemical Vapor Condensation system in terms of its production scale and capability, but also demands innovative in-situ process control methods for the nanopowder manufacturing. In this work, we characterize key process variables, develop the predictive process control to improve process efficiency and variance reduction strategy for the scale-up efforts.

■ SB34

C - Room 218A

Data-driven Modeling in Health Care Delivery

Sponsor: Health Applications

Sponsored Session

Chair: Yihan Guan, Stanford University, Huang Engineering Center 212F, Stanford, CA, 94305, United States of America, yihan@stanford.edu

1 - Resource Allocation for Optimal Control of Epidemics: Can Treatment Compete?

Sabina Alistar, Stanford University, 475 Via Ortega, Stanford, CA, 94305, United States of America, ssabina@stanford.edu, Benjamin Armbruster, Elisa Long

Balancing resources between treatment and prevention to achieve infectious disease control is an important but challenging problem. We develop a resource allocation model based on epidemiological concepts to determine optimal allocations of limited funds to prevention versus treatment of an infectious disease. We further use an optimal control approach to determine how the allocation decision will change over time, as an epidemic evolves.

2 - Cost-Effectiveness of Risk-Factor Guided and Universal Screening for Chronic Hepatitis C in the U.S.

Shan Liu, Stanford University, Huang Engineering Center 212H, 475 Via Ortega, Stanford, CA, 94305-4121, United States of America, shanliu@stanford.edu, Lauren Cipriano, Jeremy Goldhaber-Fiebert

Current U.S. guidelines recommend against screening for chronic hepatitis C in the general population and disagree regarding screening of high-risk individuals. We assessed the cost-effectiveness of universal and risk-factor guided screening for asymptomatic adults in a decision-analytic Markov model. Analyses of the National Health and Nutrition Examination Survey data provided gender- and age-specific estimates of the prevalence of risk factors. Universal screening is likely cost-effective.

3 - Statistical Monitoring of Long-term Effects of Treatment

Yihan Guan, Stanford University, Huang Engineering Center 212F, Stanford, CA, 94305, United States of America, yihan@stanford.edu, Margret Bjarnadottir

Benefits and risks of long-term drug treatment are difficult to evaluate and not a part of the current FDA approval process. Traditional post-marketing studies are relatively short-term clinical trials that do not address concerns associated with long term use. This research develops a statistical framework for long-term monitoring of treatment. We discuss properties of different methods in a stochastic modeling framework and further evaluate their utilization on real-world claims data.

4 - Merging Prediction Models and Optimization for Optimal Prevention Policy

Leila Zia, Stanford University, CA, 94305, United States of America, leilaz@stanford.edu

This research merges risk prediction and cost-effectiveness analysis to optimally apply an intervention or prevention to the "right" sub-group of patients while considering the potential benefit to each patient and the cost and operating characteristics of the intervention/prevention. In particular, the cost of applying the intervention is assumed non-linear. Using a functional approximation to the ROC curve we can apply optimization methods to maximize the benefit of the intervention policy.

5 - Optimal Staffing Mix for the VA Substance Use Disorder Treatment Programs

Jinwoo (James) Im, Stanford University, 475 Via Ortega, Stanford, CA, 94305, United States of America, james.im@stanford.edu, Jodie Trafton, Ross Shachter

403,117 veterans were diagnosed with substance use disorders (SUD) in fiscal 2008, while 133,658 received specialized VA SUD treatment services. For each of the four types of VA SUD treatment programs there were significant variations in the staffing mixes. We recommend new staffing mixes to increase net benefits per patient for the three most intensive treatment programs, saving costs and increasing benefits to make net benefits positive, based on the VA Outcomes Monitoring Project database.

■ SB35

C - Room 218B

Computer Experiments

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Peter Qian, Associate Professor, University of Wisconsin-Madison, Department of Statistics, 1300 University Avenue, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

Co-Chair: Chunfang Devon Lin, Assistant Professor, Queen's University, Department of Mathematics and Statistics, Jeffery Hall, University Avenue, Kingston, ON, K7L 3N6, Canada, cdlin@mast.queensu.ca

1 - Dynamic Trees for Optimization under Constraints

Robert Gramacy, University of Chicago, Booth School of Business, 5807 S Woodlawn Avenue, Chicago, IL, 60637, United States of America, rbgramacy@chicagobooth.edu

We introduce a new response surface methodology, dynamic trees, with an application to the optimization of (noisy) black box functions under unknown constraints. The talk will focus on the real and categorical versions of the dynamic tree process, fast inference by sequential Monte Carlo, and new improvement statistic that acknowledges constraints. It will also highlight an R package implementing the methods, called dynaTree, which is available on CRAN.

2 - Bridge Designs for Modeling Systems with Small Error Variance

Bradley Jones, JMP, SAS Campus Drive, Building S, Cary, NC, 27513, United States of America, bradley.jones@jmp.com

We propose a new class of designs that bridge the gap between Latin Hypercube designs and D-optimal designs. These designs guarantee a minimum distance between points in projection. Subject to this constraint they are D-optimal for any pre-specified model.

3 - Bayesian Site Selection for Fast Gaussian Process Regression

Arash Pourhabib, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, arash.pourhabib@neo.tamu.edu, Yu Ding, Faming Liang

We present a sparse approximation of the full Gaussian Process (GP) regression. The approximation is achieved by modeling the covariance matrix using a small number of unobserved latent variables. We learn the number and location of the unobserved latent variables through Bayesian site selection. We demonstrate that our method makes substantial computational saving and also outperforms other sparse approximations in terms of accuracy.

4 - Sequential Importance Sampling for Rare Event Estimation with Computer Experiments

Brian Williams, Los Alamos National Laboratory, Los Alamos NM 87545, United States of America, brianw@lanl.gov, Rick Picard

Importance sampling often drastically improves the variance of percentile and quantile estimators of rare events. We propose a sequential strategy for iterative refinement of importance distributions for sampling uncertain inputs to a computer model to estimate the probability that the model output exceeds a fixed or random threshold. A framework is introduced for updating a model surrogate to maximize its predictive capability for rare event estimation with sequential importance sampling.

■ SB36

C - Room 219A

Performance Evaluation of Wireless Sensor and Ad-Hoc Networks

Sponsor: Telecommunications

Sponsored Session

Chair: Jeffrey Kharoufeh, Associate Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, jkharouf@pitt.edu

1 - A 6-Approximate Algorithm for the k-Bottleneck Connected Dominating Set Problem

Anurag Verma, Texas A & M University, 241 Zachry,3131 TAMU, College Station, TX, United States of America, anuragverma@tamu.edu, Sergiy Butenko

We present a 6-approximate distributed algorithm for the k-BCDS problem, which is to find a connected dominating set of size k in a ad-hoc sensor network while minimizing the transmission range of the sensors. Using k-BCDS has been proposed as an energy efficient alternative to minimum connected dominating sets (MCDS) for forming a virtual backbone in sensor networks for communication.

2 - The Effect of Multipath Fading in Mobile Ad-Hoc Networks

Binchao Chen, Texas Tech University, 2500 Broadway, Lubbock, TX 79409, binchao.chen@gmail.com, Timothy Matis

Although frequently ignored in the design or evaluation of MANET protocols, multipath fading may amplify or attenuate a wireless signal by up to 30dB from the average. In this presentation, we describe the impact this effect has on popular protocols, and describe mechanisms through which protocols may be designed to account for such at multiple layers.

3 - Optimal Network Coding Decisions in Delay-sensitive Wireless Transmission

Arupa Mohapatra, Texas A&M University, College Station, TX, United States of America, arupa@tamu.edu, Alex Sprintson, Srinivas Shakkottai, Natarajan Gautam

The transmission load in multi-hop wireless networks can be significantly reduced by a technique known as network coding. However network coding opportunities are not always available and waiting for such opportunities can cause substantial delay in transmission. We develop a Markov decision process based delay-aware controller that uses local information to decide the optimal number of coded and uncoded transmissions.

4 - Dynamic Resource Replication and Transmission Range Setting in Query-based Wireless Sensor Networks

Guvenc Degirmenci, PhD Candidate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, gdegirmenci@gmail.com, Jeffrey Kharoufeh, Oleg A. Prokopyev

We derive and analyze approximate performance parameters for query-based wireless sensor networks via an approximate queueing framework. Additionally, we formulate a nonlinear mixed-integer program (MIP) to dynamically select the resource replication level and sensor transmission range that maximize the network's lifetime subject to quality-of-service and connectivity constraints. A heuristic algorithm is devised to solve the MIP, and its performance is illustrated.

■ SB37

C - Room 219B

Degradation Modeling and On-condition Maintenance

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: David Coit, Professor, Rutgers University, Department of Industrial & Systems Eng, Piscataway, NJ, 08844, United States of America, coit@rutgers.edu

1 - Availability Modeling of Systems with Dependent Failure Modes

Xiao Liu, Qatar University, P.O.Box 2713, Doha, Qatar, liuxiaodnn_1@hotmail.com, A.M.S. Hammuda, Elsayed Elsayed, Khalifa Al-Khalifa, David Coit, Jingrui Li

This study develops the optimum Condition-Based Maintenance (CBM) schedules for systems with multiple failure modes that maximizes its availability. In particular, the maintenance time and system failure times are stochastically dependent, and a joint model for system state degradation and failure times is constructed. The optimum maintenance schedules are obtained by maximizing the system's availability over its life cycle.

2 - A Joint Optimal Burn-in and Replacement Policy for n-Subpopulations subject to Stochastic Degradation

Yisha Xiang, Sun Yat-sen University, 135 W. Xingang Rd, Shanheng Hall S458, Guangzhou, China, xiangysh@mail.sysu.edu.cn, David Coit, Qianmei Feng

Burn-in is widely used to eliminate early failures. Conventional burn-in procedures subject components to a short period of simulated operation. If a burn-in threshold can be used to identify the weak subpopulation(s), time required for burn-in can be greatly reduced. Also, limited studies addressed preventive maintenance policies associated for heterogeneous population. This paper proposes a cost model to determine the optimal burn-in time, burn-in threshold, and replacement interval.

3 - Failure Prediction with Incomplete Maintenance Data

Yada Zhu, IBM Research, 1101 Kitchawan Rd, Route 134, Yorktown Heights, NY, 10598, United States of America, yzhu@us.ibm.com, Emmanuel Yashchin, Jonathan Hosking

Many applications, in particular the failure, repair and replacement of industrial components or physical infrastructure, involve recurrent events. Frequently, the available data are window-censored which presents a challenge for recurrence data analysis. However, failure prediction with such data is crucial for the subsequent maintenance planning. We developed the parametric inference procedure for window censored recurrence data and applied it to a set of data on maintenance of water mains.

4 - Reliability Modeling for Ultra-thin Gate Dielectric Subjected to Logistic Degradation Processes with Random Onset Time
Hao Peng, Assistant Professor, Eindhoven University of Technology, Hemelrijken 195 1, Eindhoven, 5612WN, Netherlands, h.peng@tue.nl, David Coit, Qianmei Feng

Dielectric breakdown mechanisms in gate oxides have been investigated intensively during the past decade. In this paper, we characterize the first and the final breakdown event of ultra-thin gate dielectric as a random logistic degradation processes with random onset time. The explicit result of the lifetime distribution is derived. The lifetime data of our model fits better with Lognormal distribution rather than Weibull distribution, which agrees with previous work by other researchers.

■ SB38

H- Johnson Room - 4th Floor

Locational Decisions

Sponsor: Location Analysis

Sponsored Session

Chair: Zvi Drezner, Professor, California State University, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu

1 - Coverage Location of Emergency Devices on a University Campus to Maintain Safety
Eric Delmelle, Assistant Professor, University of North Carolina at Charlotte, 9201 University Boulevard, Charlotte, NC, 28223, United States of America, Eric.Delmelle@uncc.edu

I discuss the importance of locating emergency devices on campus (specifically emergency phones) using traditional coverage models to support safety. GIS is explicitly integrated to derive viewshed information between demand nodes and emergency phones. An application to the University of North Carolina campus illustrates the proposed methodology. The merits of the backup coverage model are also discussed.

2 - Maximum Reward Rectangular Location Problem
Kiavash Kianfar, Assistant Professor, Texas A&M University, TAMU 3131, College Station, TX, 77843-3131, United States of America, kianfar@tamu.edu, Manish Bansal

We present the Maximum Reward Rectangular Location Problem (MRRLP) as a generalization of the planar maximum coverage location problem with rectilinear distance. MRRLP provides a flexible framework to model continuous demand over a region as well as the concept of partial coverage of demand areas by facilities. We prove MRRLP is NP-hard, derive theoretical properties of its optimal solution, present an exact branch and bound algorithm to solve it and demonstrate its computational effectiveness.

3 - The Weber Location Problem: The Threshold Objective
Zvi Drezner, Professor, California State University, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu, Tammy Drezner

A new objective for the Weber location problem is proposed. The weights of the Weber problem are drawn form a multivariate distribution. The objective is to minimize the probability of over-running a cost threshold. Such a concept can be applied to many optimization models as well. We analyze the problem and develop an optimal algorithm to solve it. Computational results for randomly generated problems are presented.

4 - Continuous Location, Polynomials and Semidefinite Programming
Justo Puerto, Universidad de Sevilla, Spain, puerto@us.es, Safae El-Haj Ben-Ali, Victor Blanco

We consider the problem of minimizing ordered weighted averages(ordered median) of several rational functions over compact semi-algebraic sets. The problem can be transformed into a new problem embedded in a higher dimension space and yields the optimal value within any desired accuracy. It is applied to a broad family of continuous location problems. Some difficult problems that could only be solved on the plane using Euclidean distances, are solved with lp-norms in any dimension space.

■ SB39

H - Morehead Boardroom -3rd Floor

Economics of Information Systems

Sponsor: Information Systems Society

Sponsored Session

Chair: Jianqing Chen, The University of Texas at Dallas, School of Management, Richardson, TX, United States of America, chenjq@utdallas.edu

1 - Congestion Sensitive Content and Network Management
Hong Guo, Assistant Professor, University of Notre Dame, 356 Mendoza College of Business, Notre Dame, IN, 46556, United States of America, hguo@nd.edu, Robert Easley

We propose a general framework of network management to address several focal issues in the net neutrality debate including content innovation, broadband infrastructure investment, and consumers' broadband access. The ISP serves both content providers and consumers and may manage its network traffic by offering content providers a premium service for a fee. We compare several potential regulation regimes which have important policy implications for the net neutrality debate.

2 - Measuring the Value of Cloud Scalability, APIs, and Technical Support
Marius Florin Niculescu, Georgia Institute of Technology, 800 West Peachtree NW, Atlanta, GA, United States of America, Marius.Niculescu@mgt.gatech.edu, German Retana, D.J. Wu, Sridhar Narasimhan

We conduct a detailed analysis of cloud infrastructure services usage by firms throughout their lifetimes since adoption of the service. We estimate the magnitude of capacity savings relative to actual capacity usage as a function of cloud-specific factors such as scaling frequency and direction, methods of scalability (horizontal vs. vertical scaling, use of APIs), use of technical support through different support channels (support tickets and live chat sessions), and their interactions.

3 - Evaluating the Impacts of Penny Auction Bidding Restrictions on Consumer Surplus and Behaviors
Ke-Wei Huang, Assistant Professor, National University of Singapore, COM2 04-18, Computing Drive, NUS, Singap, Singapore, huangkw@comp.nus.edu.sg, Hanxiong Zheng, Khim Yong Goh

A penny auction typically ends up with an extremely low final auction price. Therefore, only one bidder can enjoy positive surplus whereas all other bidders suffer from bidding costs incurred. This paper empirically investigates the dynamics of consumer surplus by a field experiment. We show overall customer retention can be enhanced by restricting the number of items won by a small group of bidders so that more bidders can enjoy the thrill and fun of winning an auction.

4 - Supply Chain Coordination under Supply Uncertainty
Zhiling Guo, Assistant Professor, University of Maryland, Baltimore, MD, United States of America, zguo@umbc.edu, Jianqing Chen

Supply uncertainties such as random yields in production and quality related defects are commonly observed phenomena in the supply chain. This paper considers several incentive mechanisms to reduce supply-side vulnerability in supply chain coordination. We show that the proposed mechanisms not only optimize the supply chain performance, but also improve the supplier's incentive for technology investment to reduce supply uncertainty.

■ SB40

H - Walker Room - 4th Floor

Innovation and Entrepreneurship II: Entrepreneurial Process

Sponsor: Technology Management

Sponsored Session

Chair: Sinan Erzurumlu, Assistant Professor, Babson College, 231 Forest Street, Wellesley, MA, 02457, United States of America, serzurumlu@babson.edu

1 - Returns to Entrepreneurship in the Market Process: A Simulation Study
Mohammad Keyhani, York University, 4700 Keele Street, Schulich School of Business, Toronto, ON, M3J 1P3, Canada, mkeyhani08@schulich.yorku.ca, Moren Levesque, Anoop Madhok

We study the notion of entrepreneurial rent and consider what it means to calculate returns to entrepreneurship. We use cooperative game theory to model creation and discovery entrepreneurship and computer simulation to measure

returns to these types of entrepreneurship in a dynamic market process. We compare returns to different kinds of entrepreneurship when other market participants have different entrepreneurial capabilities, and consider implications for entrepreneurship strategy.

2 - Incentives for Collaborative and Cross-Functional Teams
Jeremy Hutchison-Krupat, Georgia Insitute of Technology, College of Management, Atlanta, GA, United States of America, Jeremy.Hutchison-Krupat@mgt.gatech.edu

Metrics drive behavior. The ensuring that a team's performance metrics induce the most profitable actions is a critical step in the implementation of a project. In this paper, we characterize when a manager should choose to implement performance metrics for a project team based on either, incomplete (but direct) observable measures of each functional unit's contribution to profit, or a complete (but indirect) measure of the entire team's contribution to profit.

3 - Knowledge Creation from Exploration and Exploitation in the High-Tech Venture
Jennifer Bailey, Georgia Institute of Technology, 800 West Peachtree Street, Atlanta, GA, 30308, United States of America, Jennifer.Bailey@mgt.gatech.edu, Cheryl Gaimon

It has been recognized that organizations can derive significant benefits from simultaneously learning from both exploration and exploitation in the innovation development process. We introduce a model to develop normative guidelines on the efficient allocation of resources for knowledge creation in the context of a high-tech entrepreneurial venture.

4 - Introduction of Innovations by Start-up Firms
Karthik Ramachandran, Assistant Professor, Southern Methodist University, Dallas, TX, United States of America, karthik@mail.cox.smu.edu, Sinan Erzurumlu, Sreekumar Bhaskaran

Startups can often launch a first version of their product and use the revenues to fund the costly development of a better, but risky, focal product. However, this might adversely affect profits from the focal product itself. We develop a dynamic model of such situations and identify the optimal product launch and development decisions of the start-up firm. We further consider the impact of learning about technological and market parameters on the launch and development decisions.

■ SB41

H - Waring Room - 4th Floor

How Architectures Matter: Their Roles in Products, Processes, and Organizations

Cluster: New Product Development

Invited Session

Chair: Sebastian Fixson, Babson College, Tomasso Hall 226, Babson Park, MA, 02457, United States of America, sfixson@babson.edu

1 - Degree Distribution and Quality in Complex Engineered Systems
Manuel Sosa, INSEAD, Boulevard de Constance, Fontainebleau, France, manuel.sosa@insead.edu, Jürgen Mihm, Tyson Browning

Complex engineered systems tend to have architectures characterized by a small subset of components (hubs) that are more highly connected than others. Based on a sample of open-source applications, we show that complex systems may have an optimal hub size with respect to system quality.

2 - Predicting Technical Debts in Complex Software System Development
Alan MacCormack, Massachusetts Institute of Technology, Cambridge, MA, United States of America, alanmac@mit.edu

Many studies show that measures of component complexity predict the defects experienced by components within a system. Most however, pay no attention to how components are arranged - that is, the role of system architecture. We study this relationship in a large system. We develop a model that predicts defects from the level of coupling between components. We use this model to predict the parts of the design that experience technical problems, in developing the next generation of the system.

3 - Organizational Architecture in Evolving Contexts
Federica Ceci, University G. d'Annunzio, Viale Pindaro 42, Pescara, Italy, f.ceci@unich.it, Andrea Prencipe

Relying on an original dataset of 102 firms operating in the IT sector in Europe, our study identifies a curvilinear relationship between asset specificity and the typology of ties with suppliers: i.e. strong ties – e.g. joint venture or partnership – are found in presence of both low and high asset specificity. These results provide the basis for a reassessment of our understanding of organizational architecture of firms' operating in evolving context.

4 - Strategies to Mitigate Negative Effects of Architectural Mismatches in Complex Product Development
Sebastian Fixson, Babson College, Tomasso Hall 226, Babson Park, MA, 02457, United States of America, sfixson@babson.edu, Benjamin Dawson, Daniel Whitney

The literature has established the challenges for product development performance that are caused by mismatches between product architecture and organizational architecture. We develop a simulation game to test various strategies to mitigate the detrimental mismatch effects in the context of a complex product with an integral product architecture developed by firms forming a modular supply chain.

■ SB42

H - Gwynn Room - 4th Floor

Social Networks and Crowdfunding

Sponsor: Information Systems Society

Sponsored Session

Chair: Sunil Wattal, Temple University, 1810 N 13th Street, Philadelphia, PA, 19122, United States of America, swattal@temple.edu

1 - A Finite Mixture Model of Informational Cascades on Social Networks
Anjana Susarla, Carnegie Mellon, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, anjanas@andrew.cmu.edu

While social media sites are very attractive for digital content creators, recent work has recognized the relatively ephemeral nature of popularity of content on social media sites, where only a tiny fraction attract most views while a majority never receive more than a few clicks. Using data from YouTube, we classify videos into different categories based on intrinsic characteristics of content creators and the nature of content provided to identify how some videos acquire immense popularity.

2 - Antecedents and Consequences of Implicit User-generated Content
Sunil Wattal, Temple University, 1810 N 13th Street, Philadelphia, PA, 19122, United States of America, swattal@temple.edu, Anindya Ghose, Gordon D. Burtch

In this paper, we examine the influence of implicit user generated content (approval or disapproval implied by users' actions) on individuals' behavior in an Internet marketplace for funding journalism projects, via the identification and quantification of herding activity. We find evidence of anti-herding behavior in such a marketplace. Further, we also show that projects that are funded through herding tend to perform more poorly.

3 - An Empirical Investigation of Direct and Indirect Reciprocity in Online P2P Barter Markets
Siva Viswanathan, Associate Professor, University of Maryland, 4313 Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, sviswana@rhsmith.umd.edu, Shun Ye, Il-Horn Hann

This study empirically examines the impact of direct and indirect reciprocal networks in emerging online peer-to-peer (P2P) barter markets. While indirect reciprocity helps improve the probability of success of a transaction, only direct reciprocity helps improve the quality of the transaction. Further, market participants prefer direct reciprocity to indirect reciprocity when the transacted good is rare.

■ SB43

H - Suite 402 - 4th Floor

Potential Impact of Plug-in Electric Vehicles

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50011, United States of America, lzwang@iastate.edu

1 - The Effects of PHEV Adoption on the Systems with High Wind Power Penetration

Jingjie Xiao, PhD Student, Purdue University, School of Industrial Engineering, 315 Grant St., West Lafayette, IN, 47907, United States of America, xiaoj@purdue.edu, Bri-Mathias S. Hodge, Andrew Liu, Joseph F. Pekny, Gintaras V. Reklaitis

The rapid increase in installed wind power has raised concerns about electricity system reliability. Additionally, as adoption rate of plug-in hybrid electricity vehicle (PHEV) increases, its battery charging power consumption would have significant impact on system demand. A two-stage stochastic programming formulation is proposed to co-optimize unit commitment and reserve requirements. The simulation results for the large-scale California system illustrate the effects of PHEV on system costs.

2 - Are Plug-in Vehicles Worth the Cost? Valuation of Oil and Emissions Benefits of Electrification

Jeremy Michalek, Associate Professor, Carnegie Mellon University, Scaife Hall 324, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, jmichalek@cmu.edu, Mikhail Chester, Paulina Jaramillo, Constantine Samaras, Norman Shiau, Lester Lave

We assess the economic externality value of life-cycle air emissions and oil consumption reductions from plug-in vehicles in the U.S. We find that current subsidies intended to encourage sales of plug-in vehicles with large battery packs far exceed estimates of externality benefits. In contrast, policy strategies to promote grid-independent hybrid electric vehicles and plug-in hybrid vehicles with small battery packs offer more emissions and oil consumption reduction benefits per dollar spent.

3 - Measuring and Mitigating PEVs' Potential Impact on Power Systems

Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50011, United States of America, lzwang@iastate.edu

We present a new approach to measure the potential impact of plug-in electric vehicles (PEV) charging load on power systems. This measure is defined as the range of discrepancy between the additional cost to power systems caused by PEV charing load and the charging cost incurred by the PEV users. We can also mitigate the potential impact through improved design of time-of-use electric rates. A case study is conducted using empirical data.

4 - Battery Degradation, Energy Arbitrage, and Net Emissions from Use of PHEVs

Scott Peterson, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, speterson@cmu.edu, Jay Apt, Jay Whitacre

We investigate battery degradation associated with vehicle-to-grid (V2G) activity. Analyses indicate that degradation is in response to throughput not depth of discharge. We use degradation data to examine the potential of energy arbitrage in three locations and find it unlikely for individuals. Finally, we calculate net emissions from plug-in hybrid electric vehicle use phase. CO2 and NOx are likely to decrease, but there is upward pressure on SO2 emissions or allowance prices under a cap.

■ SB44

H - Suite 406 - 4th Floor

Supply Diversification with Strategic Suppliers

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Jun Zhang, The University of Texas at Dallas, 800 West Campbell Road, SM30, Richardson, TX, 75080, United States of America, jun.zhang@utdallas.edu

1 - Comparison of Product Rollover Strategies in the Presence of Strategic Customers

Chao Liang, The University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, cxl071000@utdallas.edu, Metin Cakanyildirim, Suresh P. Sethi

We study two primary rollover strategies: single (-product) rollover and dual (-product) rollover. With single rollover, when a new product is introduced, the old product is phased out from the market. With dual rollover, the old product remains in the market together with the new product. We study the interaction between product rollover strategies and strategic customers' purchase behavior.

2 - Assortment Choices Among Competing Retailers When Consumers Have Uncertain Product Preferences

Haoying Sun, The University of Texas at Austin, 1 University Station, B6500, Department of IROM, Austin, TX, 78712, United States of America, Haoying.Sun@phd.mccombs.utexas.edu, Steve Gilbert

For many products, some (uninformed) consumers may need to experience the touch and feel in order to determine their valuations. In addition, consumers differ in their shopping costs. Under such circumstances, we show that there exists an asymmetric assortment breadth equilibrium in which one retailer carries a full line and the other sells one product only, even though the demand structure for the two products is symmetric and the cost structures of the two retailers are the same.

3 - Dual Sourcing - Comparing Allocation Strategies under Rolling Horizon Math Programming Models

Youssef Boulaksil, Assistant Professor, Al Akhawayn University, Hassan II Avenue, P.O. Box 1639, Ifrane, 53000, Morocco, Y.Boulaksil@aui.ma, Jan C. Fransoo

In this paper, we study, based on a real-life situation, the case where a manufacturer faces uncertain demand and has two different supply sources for the same product. One of the sources is more rigid and cheaper, while the other is more flexible and more expensive. Based on a simulation study, we compare the performance between a rigid and a dynamic allocation strategy. The results reveal interesting managerial insights, which are helpful when having negotiations with suppliers.

4 - Supply Diversification with Strategic Suppliers

Tao Li, PhD Student, University of Texas-Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, txl071000@utdallas.edu, Jun Zhang, Suresh P. Sethi

We study a firm's sourcing problem with two unreliable suppliers who compete for the firm's order. We characterize how upstream competition affects the firm's diversification decisions.

■ SB45

H - Suite 407 - 4th Floor

Core-Selecting Auctions

Cluster: Auctions

Invited Session

Chair: Bob Day, Assistant Professor, University of Connecticut, 2100 Hillside Rd, Unit 1041, Storrs, CT, 06269-1041, United States of America, bob.day@business.uconn.edu

1 - Equilibria in Minimum-revenue Core-selecting Auctions

Marion Ott, RWTH Aachen University, Templergraben 64/III, Aachen, 52062, Germany, marion.ott@vwl1.rwth-aachen.de, Marissa Beck

Exploring Bayesian equilibrium in core-selecting auctions, we find, in contrast to previous work, that a bidder might bid above his valuation for a bundle. Moreover, we find that core-selecting auctions can lead to a higher expected revenue than that of the Vickrey auction. We discuss conditions under which core-selecting auctions outperform the Vickrey auction. Furthermore, we characterize the set of complete-information Nash equilibria of minimum-revenue core-selecting auctions.

2 - Loss of Efficiency in Core-selecting Auctions

Mark Schneider, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269-1041, United States of America, mark.schneider@uconn.edu, Bob Day

Core-selecting auctions pick a point that is within the core with respect to submitted bids, and have been used in several recent spectrum auctions. For a fixed set of bids a core-selecting auction generates more revenue than VCG, but since incentive compatibility is sacrificed bidders will in fact shade in equilibrium, resulting in a loss of efficiency in many instances. We investigate the effects of competition and risk aversion to see to what extent they counteract this loss of efficiency.

3 - Envy Quotes and the Iterated Core-selecting Combinatorial Auction

Abe Othman, Carnegie Mellon University, Computer Science Department, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, aothman@cs.cmu.edu, Tuomas Sandholm

Using a model of agent behavior based around envy-reducing strategies, we describe an iterated combinatorial auction in which the allocation and prices converge to a solution in the core of the agents' true valuations. In each round of the iterative auction mechanism, agents act on envy quotes produced by the mechanism: hints that suggest the prices of the bundles they are interested in. We describe optimal methods of generating envy quotes for two different core-selecting mechanisms.

■ SB46

H - Suite 403 - 4th Floor

Case Competition I

Sponsor: INFORM-ED

Sponsored Session

Chair: Mike Racer, University of Memphis, 334 Fogelman, Memphis, TN, 38152, United States of America, mracer@memphis.edu

1 - Harry Potter and the Sorting Hat: Math Versus Magic

Alaina Hesson, Candidate, Masters in Public Policy and Management, Carnegie Mellon University, 1405 Severn St, B4, Pittsburgh, PA, 15217, United States of America, alaina.hession@gmail.com, Jonathan Caulkins

Today's graduate, undergraduate, and high school students have grown up with J.K. Rowling's Harry Potter series. This case draws upon the connection between students and Harry Potter to strengthen their understanding of Discriminant Analysis (DA), a classification prediction method that uses existing observation data to predict future observation outcomes. Given the fun, familiar, and easily comprehensible material, the objective of this case is to make a sophisticated statistical technique accessible to students of all math backgrounds. The paper will discuss business and industry uses for DA by citing examples of organizations that require an applicant filtration system and how DA informs the system design process. It will also discuss pedagogical issues encountered when presenting standard textbook material, and demonstrate how a familiar and fun case can alleviate instructor challenges.

2 - Forecasting Offertory Revenue at St. Elizabeth Seton Catholic Church

Matthew J. Drake, Assistant Professor, Duquesne University, Pittsburgh, PA, 15282, United States of America, drake987@duq.edu, Ozgun Caliskan Demirag

This case requires students to build a forecasting model to help the Finance Committee at a struggling Catholic Church in Alabama predict its weekly offertory revenue. The church had been spending more than its collections allowed in recent years and now has serious cash flow concerns for the upcoming fiscal year. The committee has recognized that their previous budgeting process was flawed because it did not focus enough on revenue; thus, they need a better prediction of revenue for the upcoming year and will ensure that their planned expenses do not exceed these predicted cash inflows. The case provides students with a rich data set on which they can apply forecasting methods and models that they have discussed in class. The case is entirely open-ended in that it does not specify a specific type of model to use. Students are challenged to find the best model that they can within the repertoire that they have developed. The case also exposes students to managerial issues in the not-for-profit organization sector, which is often underrepresented in OR/MS case studies.

3 - Chandpur Enterprises Limited, Steel Division

Samuel E. Bodily, John Tyler Professor of Business Administration, Darden Graduate Business School, 100 Darden Boulevard, Charlottesville, VA, 22903, United States of America, bodilys@virginia.edu, Akshay Mittal

The managing director of the steel plant owned by Chandpur Enterprises Limited (CEL) faces the decision of how much of each raw material to order for the following month. Due to lower and upper bounds on the amounts of each raw material in a batch and varying amounts of electricity and time consumed for different raw materials, one can't simply use the cheapest raw material. A linear program and Excel's solver optimization feature will provide the optimal amounts that meet the constraints. Interestingly, the best mixture for a single batch is not the best mixture for a monthly plan, due to different time requirements to produce a batch with different raw materials used. Shadow prices indicate the value of relaxing constraints. The typical monthly model from a student will be nonlinear, although it can be written as a linear model. This case provides the basis for an introductory class on linear programming and linear versus nonlinear models.

■ SB47

H - Dunn Room - 3rd Floor

Rich Vehicle Routing Problems

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Michel Gendreau, Professor, CIRRELT, Ecole Polytechnique, C.P. 6079, Succ. Centre-ville, Montreal, QC, H3C 3A7, Canada, michel.gendreau@cirrelt.ca

1 - Timing Problems and Vehicle Routing

Thibaut Vidal, LOSI - Université de Technologie de Troyes / CIRRELT - Université de Montréal, 12, Rue Marie Curie, BP 2060, Troyes, 10010, France, thibaut.vidal@cirrelt.ca, Michel Gendreau, Teodor Gabriel Crainic, Christian Prins

"Timing" involves a choice of activity execution times within a fixed processing sequence on a single machine, under various time constraints or objectives. We present here a unifying analysis of these problems and related algorithms, which are frequently encountered within feasibility checks and cost evaluations in local searches for many rich vehicle routing problems. This study leads to valuable insights for designing more general and efficient VRP heuristics.

2 - The Fleet Mix and Size Vehicle Routing Problem: A Continuous Approximation Approach

Ola Jabali, Post-Doctoral Fellow, CIRRELT, P.O. Box 6128, Station Centre-ville, Montreal, QC, H3C 3J7, Canada, Ola.Jabali@cirrelt.ca, Michel Gendreau, Gilbert Laporte

We study a realistic extension of the VRP in which a number of vehicle types are available for distributing customers' demand. The objective is to minimize the vehicle procurement costs and their resulting long-term daily operating costs. We model the problem by continuous approximation, assuming a probabilistic distribution on customers' locations. We derive managerial insights considering various costs and demand structures.

3 - Integrative Cooperative Search

Teodor Gabriel Crainic, Professor, CIRRELT and ESG UQAM, 2920 Chemin de la Tour, Montréal, QC, H3T 1J4, Canada, TeodorGabriel.Crainic@cirrelt.ca, Nadia Lahrichi, Thibaut Vidal, Michel Gendreau, Walter Rei

We propose ICS, a new metaheuristic for multi-attribute combinatorial optimization. ICS decomposes the problem along attribute dimensions and uses several solution methods to address particular subproblems and combine partial solutions into complete ones. The methods cooperate through an adaptive global-search coordinator according to the central-memory cooperative search paradigm. We present the ICS and discuss application to multi-depot, periodic vehicle routing problems.

4 - A Hybrid Genetic Algorithm for Multi-depot and Periodic Vehicle Routing Problems

Michel Gendreau, Professor, CIRRELT, Ecole Polytechnique, C.P. 6079, succ. Centre-ville, Montreal, QC, H3C 3A7, Canada, michel.gendreau@cirrelt.ca, Nadia Lahrichi, Thibaut Vidal, Teodor Gabriel Crainic, Walter Rei

We propose an algorithmic framework that addresses three vehicle routing problems: the multi-depot VRP, the periodic VRP, and the multi-depot periodic VRP. It combines the exploration breadth of population-based evolutionary search, the improvement capabilities of neighborhood-based metaheuristics, and advanced population-diversity management schemes. Extensive computational experiments show that the method performs impressively, in terms of computational efficiency and solution quality.

■ SB48

H - Graham Room - 3rd Floor

Innovations in Pricing and Financing of Transportation Systems: II

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Siriphong (Toi) Lawphongpanich, University of Florida, Industrial & Systems Engineering, 303 Weil Hall, Gainesville, FL, 32611, United States of America, lawphong@ise.ufl.edu

1 - Transaction Cost and Tradable Mobility Rights

Yu (Marco) Nie, Northwestern University, Civil and Environmental Engineering, 2145 Sheridan Road, Evanston, IL, 60208-3109, United States of America, y-nie@northwestern.edu

Artificial markets for tradable mobility rights have been proposed as an alternative to conventional congestion pricing schemes. This paper examines the effects of transaction costs on two types of markets: a centralized market which is created by government to simply auction off mobility rights; and a more decentralized market in which users trade with each other their initial endowment of mobility rights initially distributed by the government.

2 - Self-financed Optimal Incentive for Staggered Work Hours

Jeff Ban, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, United States of America, banx@rpi.edu, Wilfredo Yushimito, Jose Holguin-Veras

We present a multi-level formulation for finding the optimal incentive to induce firms to assign workers out of the regular peak-hour. The model requires the transportation planner to be at the highest level seeking to reduce the system travel time and financing the incentive with the tolls collected in the network. Firm behavior and Dynamic User's Equilibrium are at the lower levels. In addition, a solution approach is presented and some initial results are discussed.

3 - Welfare Analysis of Vehicle Ownership-use Rationing and Congestion Pricing Policies

Shanjiang Zhu, Assistant Research Scientist, University of Maryland, Department of Civil &Environmental Engineerin, 1173 Glenn Martin Hall, College Park, MD, United States of America, zhuxx120@umd.edu, Longyuan Du, Lei Zhang

Vehicle ownership and/or use rationing, recently implemented in cities such as Beijing, Shanghai, and Mexico City as a travel demand and congestion management tool, has not been adequately studied. This research develops an analytical model and applies welfare analysis methods to evaluate vehicle ownership rationing and vehicle use rationing policies. The effectiveness of these rationing policies is also compared to that of congestion pricing.

4 - Optimal Selection of Build-operate-transfer Projects on Transportation Networks

Di Wu, University of Florida, 518C Weil Hall, University of Florida, Gainesville, FL, 32611, United States of America, wudi@ufl.edu, Yafeng Yin, Siriphong (Toi) Lawphongpanich

This paper considers the problem of how to select highway projects for the build-operate-transfer development with the objective of improving the social benefit while ensuring the marketability of those selected. The problem can be viewed as a tri-level leader-follower game and is formulated as a mixed integer program with equilibrium constraints. By investigating it unique property, we develop an efficient heuristic algorithm for solving the project selection problem.

■ SB49

H - Graves Room - 3rd Floor

Accounting for Input Model Uncertainty in Stochastic Simulations

Sponsor: Simulation

Sponsored Session

Chair: Canan Gunes Corlu, Assistant Professor, Bilkent University, Ankara, 06800, Turkey, canan.corlu@bilkent.edu.tr

1 - Design of Experiments for Metamodel-based Simulation Input Model Uncertainty Analysis

Russell Barton, Program Director, National Science Foundation, Arlington, VA, United States of America, rbarton@nsf.gov, Barry L. Nelson, Wei Xie

The distribution of simulation output statistics includes variation from the finiteness of samples used to construct input probability models. Metamodels and bootstrapping provide a way to characterize this error. The metamodel-fitting experiment benefits from a sequential design strategy. We describe the elements of such a strategy, and show how they impact performance.

2 - An Interval Based Approach to Model Input Uncertainty in Discrete-event Simulation

Ola Batarseh, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States of America, ola.batarseh@isye.gatech.edu

The objective of this research is to increase the robustness of discrete-event simulation when input uncertainties associated models and parameters are present. An interval-based simulation mechanism based on imprecise probabilities is proposed. The statistical distribution parameters in simulation are intervals instead of precise real numbers to incorporate both variability and uncertainty.

3 - Representing Demand Parameter Uncertainty in Inventory Simulations

Canan Gunes Corlu, Assistant Professor, Bilkent University, Ankara, 06800, Turkey, canan.corlu@bilkent.edu.tr, Bahar Biller

Assuming the availability of limited demand data, we consider the discrete-event simulation of an inventory system with stochastic product demands. We quantify the demand parameter uncertainty in the service level variance and investigate how the impact of demand parameter uncertainty changes with data length, critical fractile, and demand distribution in inventory simulations.

■ SB50

H - Ardrey Room - 3rd Floor

Statistical Modeling for Adaptive Dynamic Programming

Sponsor: Data Mining

Sponsored Session

Chair: Victoria Chen, Professor, The University of Texas at Arlington, Arlington, TX, 76019, United States of America, vchen@uta.edu

1 - MARS Variants: Convex vs. Non-convex and Piecewise-linear vs. Smooth

Diana Martinez, The University of Texas at Arlington, Campus Box 19017, Arlington, TX, 76019, United States of America, diana.martinezcepeda@mavs.uta.edu, Victoria Chen

Multivariate Adaptive Regression Splines (MARS) is a statistical method for high-dimensional modeling with interactions. MARS terms are based on truncated linear functions where interaction terms are formed as products. In this research, interaction terms are converted to a piecewise-linear form for two reasons: (i) to facilitate convexity constraints on MARS, and (ii) to enable use of linear programming methods. Our algorithm also gives a smoothing option to using a quintic routine.

2 - Using Data Mining to Orthogonalize the State Space in Approximate Dynamic Programming

Bancha Ariyajunya, University of Texas at Arlington, Industrial & Manufacturing Systems Eng., Campus Box 19019, Arlington, TX, 76019-0017, United States of America, bancha.ariyajunya@mavs.uta.edu, Victoria Chen, Seoung Bum Kim

We address multicollinearity among state variables for an approximate dynamic programming (ADP) method that combines data mining with design and analysis of computer experiments. Experimental design is used to discretize the state space; however, ideal designs are typically orthogonal. Data mining methods are used to both reduce the dimension of the state space and enable the use of ideal experimental designs via orthogonalization. The approach is demonstrated on an ozone pollution case study.

3 - Multivariate Adaptive Regression Spline (MARS) Based Framework For Adaptive Dynamic Programming

Subrat Sahu, University of Texas at Arlington, Department of Industrial Engineering, 420 Woolf Hall, P.O. Box 19017, Arlington, TX, 76019, United States of America, subrat.sahu@mavs.uta.edu, Victoria Chen

We present sequential framework for adaptive dynamic programming which is based on multivariate adaptive regression splines (MARS) modeling to achieve statistical parsimony in data-driven (adaptive) future value function approximation.

4 - Global and Semilocal Estimation in Multistage Optimal Control

Danilo Macciò, CNR-ISSIA, Via De Marini 6, Genova, Italy, ddmach@ge.issia.cnr.it, Cristiano Cervellera, Victoria Chen

A main issue in multistage optimal control (MOC) problems is the choice of a suitable class of models for the approximation of the cost and/or the control functions. We present a comparison between local and global approaches to estimation through the application of semilocal kernel models and neural networks, respectively. Two methods for the solution of MOC are considered, namely, the approximate dynamic programming and a method based on a direct optimization of the optimal control functions.

■ SB51

H - Caldwell Room - 3rd Floor

Shared Mobility Systems II

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Tal Raviv, Tel Aviv University, Ramat Aviv, Tel Aviv, 69978, Israel, talraviv@eng.tau.ac.il

1 - Dynamic Repositioning in a Bike-Sharing System

Michal Tzur, Tel Aviv University, Industrial Engineering Department, Tel Aviv University, Tel Aviv, 69978, Israel, tzur@eng.tau.ac.il, Dana Pessach, Tal Raviv

Dynamic repositioning in a bike sharing system is the problem of routing trucks to load/unload bicycles to/from stations during the system's activity. This problem is especially intricate since in addition to the changing state of the system, forecasted demand for bicycles and lockers need to be considered. We approach the problem through a rolling horizon framework, adjusted to the unique characteristics of the problem. A numerical study indicates that our algorithm performs very well.

2 - Engineering Tomorrow's Transportation Market

Maged Dessouky, University of Southern California, 3715 McClintock Avenue, Department of Industrial & Systems Eng., Los Angeles, CA, 90089, United States of America, maged@usc.edu, Masabumi Furuha, Fernando Ordonez, Sven Koenig, Kenny Daniel, Xiaoqing Wu, Huayu Xu

We describe a proposed Transportation Market, a distributed system based on auction mechanisms, for negotiating routes and prices between consumers and providers of transportation in real-time. Each vehicle on the road can be viewed as a resource and with an appropriate market mechanism these resources can be made available to consumers to facilitate an efficient allocation of unused vehicle capacity.

3 - Operating Self Service Transport Systems in Real Time

Frédéric Meunier, Ecole des Ponts, 6-8 avenue Blaise Pascal, Cité Descartes, France, frederic.meunier@enpc.fr, Daniel Chemla, Thomas Pradeau, Roberto Wolfler, Houssame Yahiaoui

Motivated by the operation of self service bike hiring systems, we propose several real time heuristics to manage them with the help of trucks or through pricing strategies. Our solutions are tested with a versatile simulator, which captures the main features of such a system, and show promising performances.

■ SB52

H - North Carolina - 3rd Floor

Mobility In and Between Organizations

Sponsor: Organization Science

Sponsored Session

Chair: Joseph Broschak, Associate Professor of Management & Organizations, University of Arizona, Eller College of Management, 405 McClelland Hall, Tucson, AZ, 85721, United States of America, broschak@email.arizona.edu

1 - Career Mobility Among Coaches in Women's Intercollegiate Athletics

Joseph Broschak, Associate Professor of Management & Organizations, University of Arizona, Eller College of Management, 405 McClelland Hall, Tucson, AZ, 85721, United States of America, broschak@email.arizona.edu, Emily Block

We integrate arguments from ecological and institutional theory and organizational demography to predict mobility patterns of male and female managers in an emerging labor market. We propose that industry-wide mobility patterns are a function of both the demography of managers, the number of new organizations founded and the social legitimacy of the labor market. We test our predictions using data on coaches of three women's intercollegiate sports in 319 U.S. colleges between 1973 and 1998.

2 - Organizational Status Hierarchies and Individual Mobility Among Large U.S. Law Firms

Christopher Rider, Assistant Professor of Organization & Management, Emory University, Goizueta Business School, 1300 Clifton Road, Atlanta, GA, 30322, United States of America, Chris_Rider@bus.emory.edu, David Tan

We examine hiring patterns among the largest U.S. law firms and specifically focus on how firm status shapes these patterns. Results are consistent with status homophily theory. Most individual transitions within the AM Law 200 are between firms of similar status. Ongoing analyses disaggregate the effect of status differentials into both social (i.e., prestige) and financial (e.g., profits per partner, leverage) components to clarify the underlying mechanisms.

3 - A Behavioral Perspective on Inventor Mobility: Geographical Patterns, Industrial Dynamics and Performance

Paul Almeida, Associate Professor, Georgetown University, McDonough School of Business, 37th & O Streets, NW, Washington, DC, 20057, United States of America, almeidap@georgetown.edu, Francesco Di Lorenzo

Re-interpreting the literature on inter-organizational mobility from a behavioral perspective, in particular employing the concept of aspiration levels, we tackle theoretically and empirically the following fundamental questions associated with mobility: Which environmental, firm, inventor characteristics predict mobility? What factors explain the direction (geographic, industrial and organizational) of mobile individuals? How does mobility affect the innovative performance of a mobile inventor?

4 - Lighting the Way or Stealing the Shine? Duality in Stars' Effects on Colleagues' Performance

Daniel Tzabbar, Assistant Professor of Management, Drexel University, Lebow College of Business, Philadelphia, PA, 19104, United States of America, dt396@drexel.edu, Rebecca Kehoe

Does the hiring of a star benefit or hinder the performance of other employees in an organization? Firms often make substantial investments to recruit stars based on their exceptional performance and deep expertise. However, the less direct consequences of hiring a star are not fully understood. We examine how two conditions – breadth of a star's expertise and degree of star-colleague collaboration – affect newly hired stars' impact on colleagues' productivity and abilities to lead research.

■ SB53

H - South Carolina - 3rd Floor

INFORMS Data Mining Contest Results

Sponsor: Data Mining

Sponsored Session

Chair: Louis Duclos-Gosselin, Predictive Analysis, Data Mining Consultant, Sinapse, Sinapse, 1170, Boul. Lebourgneuf, Suite 320, Quebec, QC, G2K 2E3, Canada, louis.gosselin@hotmail.com

1 - INFORMS Data Mining Contest Results

Louis Duclos-Gosselin, Predictive Analysis, Data Mining Consultant, Sinapse, Sinapse, 1170, Boul. Lebourgneuf, Suite 320, Quebec, QC, G2K 2E3, Canada, louis.gosselin@hotmail.com, Xenos Khan

In this session, we will present the INFORMS Data Mining Contest results. This contest required participants to develop a model that predicts stock price movements (over 60 minutes) at five minute intervals. Being able to better predict short-term stock price movements would be a boon for high-frequency traders, so the methods developed in this contest could have a big impact on the finance industry.

■ SB54

H - Charlotte Hall - 3rd Floor

INFORMS Data Mining Best Student Paper Competition

Sponsor: Data Mining

Sponsored Session

Chair: Myong K (MK) Jeong, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, mjeong@rci.rutgers.edu

1 - INFORMS Data Mining Best Student Paper Competition

Myong K (MK) Jeong, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, mjeong@rci.rutgers.edu

Four selected finalists will present their papers for the INFORMS DM Best Student Paper competition. The winner will be announced at the INFORMS DM business meeting and all finalists will receive an award certificate.

■ SB55

H - Mecklenburg Hall - 3rd Floor

Decision Support Systems

Contributed Session

Chair: T.H. Diep Dao, UNC-Charlotte, 9201 University City Blvd., Charlotte, NC, 28223, United States of America, tdao@uncc.edu

1 - Balance Decision Speed and Decision Quality Using Business Intelligence Systems

Yufeng Tu, Trident University, 9489 Sycamore Ln, Cypress, United States of America, ytu@tuiu.edu, Criston Cox, Yajiong Xue

Research indicates that decision speed is vital to organizational performance in high velocity, hypercompetitive environments. If the amount of information exceeds cognitive decision-making abilities, it results in slower, suboptimal decisions. This study investigates the extent to which Business Intelligence (BI) Systems usage may mitigate the effects of information availability, overload and quality in such environments to improve decision quality and decision speed.

2 - Managing Operational Efficiency and Information Disclosure Risk in Workflow Processes

Manuel Nunez, University of Connecticut, 2100 Hillside Road, OPIM, School of Business, Storrs, CT, 06269, United States of America, Manuel.Nunez@business.uconn.edu, Dmitry Zhdanov, Ram Gopal, Xue Bai

While throughput optimization on a workflow is useful to maximize operational efficiencies, it can expose organizations to information disclosure risks that can be exploited to violate information security. We develop a two-stage decision making methodology to optimize workflow personnel assignment and mitigate information disclosure risks through various security control strategies.

3 - The Development of Maintenance Opportunity Windows for Manufacturing Systems

Xi Gu, Graduate student, University of Michigan, 1210 H.H. Dow Building, 2300 Hayward St., Ann Arbor, MI, 48109, United States of America, xig@umich.edu, Seungchul Lee, Jun Ni

We investigate the Maintenance Opportunity Window (MOW) which is defined as how long maintenance can be performed during scheduled production time by strategically shutting down machines without bringing extra production losses. Deterministic models are derived and the heuristic algorithms are also developed to deal with uncertainties in production lines such as random failures, starvation, and blockage. The effectiveness of MOW is validated through numerical simulation and real production line.

4 - An Integrated Aggregate Planning Model

Nico Vandaele, Katholieke Universiteit Leuven, Naamsestraat 69, Leuven, 3000, Belgium, nico.vandaele@econ.kuleuven.be, Heinrich Kuhn, Gerd Hahn, Chris Kaiser, Lien Perdu

Aggregate Production Planning (APP) models cover the mid-term planning level, and de-termine a cost-optimal trade-off between overtime capacity and (seasonal) inventories for the master production schedule. We introduce an aggregate stochastic queuing (ASQ) model for each time period of the APP model to anticipate average lead time offset and ca-pacity loss due to setups and breakdowns. The APP and ASQ model are integrated into a hierarchical framework, and are solved in an iterative approach.

5 - Database Structure for a Stochastic Optimization Based DSS System for ALM of a Life Insurance Firm

Harish Rao, Indian Institute of Management Ahmedabad, Vastrapur, Ahmedabad, 380015, India, harishrao@iimahd.ernet.in, Goutam Dutta

In this paper, we discuss the issues related to the development of a database structure for the strategic planning needs (asset-liability management) of a life insurance firm using a multi-period stochastic optimization model incorporating uncertainties in liabilities. We discuss the issues related to interface design, database updation and solution reporting.

■ SB56

H - Biltmore Boardroom - 2nd Floor

Contracts in Supply Chain

Contributed Session

Chair: Nishant Mishra, Assistant Professor of Operations Management, Rotterdam School of Management, Erasmus University, Rotterdam, Netherlands, nmishra@rsm.nl

1 - Motivating Sales Agents with Supply Contracts

Samar Mukhopadhyay, Professor, SKK University GSB, 53 Myungryun-dong 3-ga, Jongno gu, Seoul, 110 745, Korea, Republic of, samar@skku.edu, Ying Zhang

Manufacturers design contracts to motivate sales agents to exert selling efforts for increasing sales revenue. The agent competes with other agents selling competing products. Market conditions are known to selling agents only. We study two contact types in a non-cooperative game setting. Optimum strategies and managerial guidelines are developed.

2 - Supply Chain Coordination with Retailer's Sale Effort

Xinghao Yan, Assistant Professor, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond Street North, London, ON, N5X 4P6, Canada, xyan@ivey.uwo.ca

In this paper, we investigate how many parameters we do need to coordinate a supply chain with retailer's sale effort. We showed that a single contract cannot coordinate the system. Instead, we must involve a nonlinear term in terms of order quantity or effort if a 2-paratemer coordination contract is intended to be used.

3 - Time-based and Quantity-based Contracts for Items with Declining Economic Value

Aysegul Toptal, Bilkent University, Bilkent University, Department of Industrial Engineering, Ankara, Turkey, toptal@bilkent.edu.tr

We consider a buyer-vendor system trading a single item with a short life cycle. We take into account several scenarios where the decisions regarding how much to produce and when to exit the market are under the control of varying parties. We propose time-based and quantity-based contracts for each scenario.

4 - Performance-based Contracting in After-sales Service Supply Chains

Nishant Mishra, Assistant Professor of Operations Management, Rotterdam School of Management, Erasmus University, Rotterdam, Netherlands, nmishra@rsm.nl, Dong Li

We analyze a performance based contract in the case of after-sales service supply chains, where both players are trying to maximize their profits. Our approach differs from the traditional principal agent framework, and we show how the contract parameters affect the optimal solution in comparison with a traditional transaction based contract. We also show that the contract efficiency can be improved using a revenue-sharing performance based contract.

■ SB57

W - Providence I- Lobby Level

Impact of Competition and Collaboration on Air Traffic Management

Sponsor: Aviation Applications

Sponsored Session

Chair: Shervin AhmadBeygi, Metron Aviation, Reston, VA, United States of America, Shervin.AhmadBeygi@metronaviation.com

1 - The Role of Airline Frequency Competition in Airport Congestion Pricing

Vikrant Vaze, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, vikrantv@MIT.EDU, Cynthia Barnhart

We develop an equilibrium model of airline competition in order to determine the effectiveness of congestion pricing. We find that the effectiveness of congestion pricing critically depends on three essential parameters of frequency competition in individual markets. Variation in the number of passengers per flight is found to play a vital role in determining the degree of attractiveness of congestion pricing to the airlines. This impact is not captured by prior models in the literature.

2 - Priority-based Allocation in Air Traffic Flow Management
Douglas Fearing, Assistant Professor, Harvard University, Harvard Business School, Soldiers Field Road, Boston, MA, 02163, United States of America, dfearing@hbs.edu, Ian Kash

Existing approaches for rationing air space or airport capacity in ATFM treat impacted flights equivalently regardless of the aircraft size, passenger load, mix of connecting passengers, etc. We develop a non-monetary, priority-based allocation scheme which allows airlines to differentiate flights by airport and show that this scheme achieves similar benefits to congestion pricing.

3 - Do More U.S. Airports Need Slot Controls? A Welfare based Approach to Determine Slot Levels
Prem Swaroop, University of Maryland, College Park MD, United States of America, pswaroop@rhsmith.umd.edu, Michael Ball, Mark Hansen, Bo Zou

The international air transportation system has the structure of a complex queuing network. As such system delays can be reduced either by expanding capacity or restricting system demand. While capacity expansion through infrastructure investment is most often called for to reduce delays, the fact that delays have fluctuated, sometimes substantially, with yearly demand suggests that controlling, in some way, the demand placed on the system could also yield substantial reductions in delay. The most common approach to restricting air transportation demand is through the use of airport slot controls. We develop models that quantify the fundamental tradeoff s associated with implementing slot controls and apply these models to determine the need for slot controls at US airports. We also discuss a number of important design decisions related to the use of slot controls.

4 - Alternative Metrics for Assessing Airline On-time Performance
Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

A key consequence of congestion in the aviation system is delay. To quantify delays attributable to carrier behavior versus to system congestion, we must understand how delays vary by carrier. We consider the limitations of the traditional binary OTP metric (all flights within 14 minutes of scheduled arrival time are equally "on time"; all flights arriving 15 minutes or more past schedule are equally "late") and present alternatives for analyzing on-time performance.

■ SB58

W - Providence II - Lobby Level

Military Vehicle Routing Problems – UAV Control

Sponsor: Military Applications Society

Sponsored Session

Chair: Chase Murray, Assistant Professor, Auburn University, 3301 Shelby Center, Auburn, AL, 36830, United States of America, ccm0022@auburn.edu

1 - Decentralized Cooperative Unmanned Vehicles
Michael Hirsch, Raytheon, 3323 Pelham Road, Orlando, FL, 32803, United States of America, mjh8787@ufl.edu, Daniel Schroeder, David Barnett, David Ii

In this research, we consider multiple unmanned vehicles tasked with searching an area for targets and tracking those targets detected. The vehicles operate in a decentralized cooperative framework. A rigorous mathematical formulation is presented and some illustrative test cases are considered.

2 - Developing Cooperative, Heterogeneous Unmanned Aircraft Systems
Daniel Pack, Professor, United States Air Force Academy, 2354 Fairchild Drive, Suite 2F6, US Air Force Academy, United States of America, Daniel.Pack@usafa.edu

In this talk, we present an overview of unmanned aircraft systems research activities at the US Air Force Academy. In particular, we describe our on-going efforts toward developing autonomous, heterogeneous, and cooperative unmanned systems technologies at the Academy Center for Unmanned Aircraft Systems Research using a number of current research projects sponsored by government and industry partners.

3 - A Heirarchical Consensus-based Bundle Algorithm
David Casbeer, Research Engineer, AFRL-WP, B146 R300, 2210 8th St, WPAFB, OH, 45433, United States of America, david.casbeer@wpafb.af.mil

The consensus based bundle algorithm (CBBA) is incorporated into a hierarchical concept of operation. In the team CBBA each team of unmanned vehicles plans for all agents in the team to service a set of tasks. The hierarchical structure of the team CBBA gives an manageable architecture for large numbers of unmanned agents through human centered operations. This is because each (small) team would be managed by a human operator with the Team CBBA coordinating between teams.

4 - Advanced Tabu Search Approach to Solving the Intratheater Airlift Operations (IAO) Problem
Kiel Martin, Capt, USAF, PhD Candidate, University of Texas at Austin, 1 University Station, Austin, TX, United States of America, c05kielmartin@gmail.com, Wesley Barnes, Michael Ciarleglio

We consider the intratheater airlift operations problem and propose an approach to improve the current planning process. A small cell within the United States Air Mobility Command is responsible for supporting ongoing operations by assisting with intratheater airlift. We describe an advanced tabu search approach to solve this problem: scheduling airlift missions that pick up and deliver prioritized cargo within time windows over a multi-day time horizon.

■ SB63

W - Tryon North - 2nd Floor

Goal Programming: Theory and Application

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Dylan Jones, University of Portsmouth, Department of Mathematics, Lion Terrace, Portsmouth, PO1 3HF, United Kingdom, Dylan.Jones@port.ac.uk

1 - Weight Sensitivity Analysis for Goal and Multiobjective Programs
Dylan Jones, University of Portsmouth, Department of Mathematics, Lion Terrace, Portsmouth, PO1 3HF, United Kingdom, Dylan.Jones@port.ac.uk

This seminar presents a practical weight sensitivity analysis algorithm that can be used for goal or multi-objective programming. The algorithm is able to use prior decision maker preference information in order to restrict the analysis to the region of weight space of interest to the decision maker. The preference information can be given in direct or in pairwise comparison form. The algorithm is illustrated on two examples taken from the literature.

2 - Supplier Selection Models with Product Life Cycle Considerations
Richard Titus, PhD Candidate, Pennsylvania State University, Industrial Engineering, 310 Leonhard, University Park, PA, 16802, United States of America, rjt186@psu.edu, Ravi Ravindran

This research examines the supplier selection process and includes supplier attributes, determined by an empirical case study, and product life cycle considerations. The empirical study examines the relationship of key supplier attributes to quality and delivery performance. Goal programming methodologies are used to solve the multi-objective supplier selection problem. An illustrative example and an industrial case study will be included in the testing of the supplier selection models.

3 - Integrating Balanced and Aggregated Achievement Into Goal Programming
Kyle Eyvindson, University of Helsinki, Latokartanonkaari 7, Helsinki, 00014, Finland, kyle.eyvindson@helsinki.fi

The paper demonstrates the feasibility of integrating goals to be treated in a Weighted GP manner or in a Chebyshev GP manner. The aggregation is done through the introduction of a binary variable to indicate the inclusion or exclusion of each criterion for either variant. This variant is designed for situations which require balance for some criteria, and require additive aggregated achievement of other criteria. The functionality is shown through a forest management planning situation.

■ SB64

W - Queens Room - 2nd Floor

Health Delivery Infrastructure in Africa

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Jeremie Gallien, Associate Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, jgallien@london.edu

1 - Improving HIV Early Infant Diagnosis (EID) Supply Chains in Sub-Saharan Africa

Sarang Deo, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, 500032, India, sarang_deo@isb.edu, Jeremie Gallien

Many sub-Saharan countries experience high mortality rates among HIV+ infants; one reason being long delay to obtain the diagnosis due to ineffective supply chains to transport samples and results. We develop a queueing network model of the EID supply chain and uncover key operational decisions that cause delays and suggest systematic improvements to reduce mortality. We quantify the improvement based on a representative dataset that combines information from several sub-Saharan countries.

2 - Now or Later? Treatment Adherence and Clinic Capacity Investment Decisions

Jessica McCoy, Stanford University, 665 Roble Avenue, Unit J, Menlo Park, CA, 94025, United States of America, jhmccoy@stanford.edu, M. Eric Johnson

Adherence affects both the treatment efficacy and the spread of epidemics like HIV. We develop an optimization model to analyze the impact that funding decisions have on disease incidence, considering patients' adherence behavior. We derive insights on how funding strategies affect the number of infections averted by a clinic's treatment program and hence disease incidence in the area. In particular, we use our model to investigate how funding for capacity building should be allocated over time.

3 - National Network Design for South African Breastmilk Reserve

Melih Celik, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30339, United States of America, melihcelik@gatech.edu, Julie Swann, Wenwei Cao, Nadia Viljoen

Supplying donor-expressed breastmilk is the most effective way for mitigating neonatal infections for children that cannot be breastfed by their mothers. In this study, we develop network expansion models for the South African Breastmilk Reserve, which aims at accomplishing this goal in South Africa. We make use of facility location models with fairness constraints, and consider various transportation alternatives to come up with decisions that lead to an effective expansion of the network.

■ SB65

W - Kings Room - 2nd Floor

Complex Services Modeling

Sponsor: Service Science

Sponsored Session

Chair: Ruoyi Zhou, IBM, San Jose, CA, 95120, United States of America, ruoyi@us.ibm.com

1 - Drivers of Variation and Limits of Standardization in Complex Global Service Systems

Ben Shaw, Research Staff Member, IBM Research - Almaden, 650 Harry Rd., San Jose,, CA, 95120, United States of America, shawbe@us.ibm.com, Laura Anderson, Jeanette Blomberg, Melissa Cefkin, Susan Stucky, Yolanda Rankin, Heiko Ludwig

Cost-effective provisioning of business services requires providers to standardize whenever possible. Service is, however, enacted co-creation of value and this necessitates accommodation to each client's particular needs. We highlight recurring sources of variation in a global deployment of standardized cost modeling infrastructure that pose substantial challenges to such systems realizing their full potential. Mitigating strategies and design responses are also discussed.

2 - Modeling Resource Requirements for Complex Services

Ray Strong, IBM Almaden Research Center, United States of America, strong@almaden.ibm.com, Ruoyi Zhou, Sechan Oh, Anca Chandra, Mario Lichtsinn

To respond to requests for complex service offering proposals, solution architects construct complex service solutions from hierarchies of service elements. After predictive cost modeling comes the prediction of resource requirements. Here we focus on deriving staffing requirements from complex service models. We translate standard descriptions of service elements into standard descriptions of human skills by means of an expert system with a text analytics engine at its heart.

3 - Service Network Protection under Uncertainty

Suh-Wen Chiou, National Dong Hwa University, 1 DaHsueh Road, Hualien, Taiwan - ROC, chiou@mail.ndhu.edu.tw

We propose an optimal defense solution to a service network where consumers seek risk aversion. A bilevel mathematical model is proposed subject to a risk-averse assignment model. Numerical examples are illustrated for service network where best protection strategies are presented and the most vulnerable components are identified.

■ SB66

W - Park Room - 2nd Floor

DEA I

Cluster: Data Envelopment Analysis

Invited Session

Chair: Andy Johnson, Assistant Professor, Texas A&M University, Department of I&SE, College Station, TX, 77843-3131, United States of America, ajohnson@tamu.edu

1 - A Homothetic Reference Technology for Data Envelopment Analysis

Ole Bent Olesen, Professor, University of Southern Denmark, Department of Business and Economics, Campusvej 55, Odense, DK 5000, Denmark, ole@sam.sdu.dk, Niels Christian Petersen

The assumption of a homothetic production function is often maintained in production economics. In this paper we explore the possibility of maintaining homotheticity within a nonparametric DEA framework. An estimation procedure derived from the BCC-model and from a maintained asumption of homotheticity is proposed. The performance of the estimator is analysed using simulation.

2 - Proactive Data Envelopment Analysis: Effective Production under Stochastic Environment

Chia-Yen Lee, Texas A&M University, 303L Zachry Engineering Center, College Station, TX, United States of America, cylee1980@neo.tamu.edu, Andy Johnson

Data envelopment analysis (DEA) is a nonparametric approach to analyze productivity and efficiency. However, demand fluctuations will lead to variations in the output levels affecting the technical inefficiency measures. Actually, in the short-run, firms can adjust their variable resources to handle demand fluctuates. This study separates the capacity and demand processes, and proposes proactive DEA that quantifies the effective production under demand uncertainty using a stochastic programming.

3 - Production and Efficiency Analysis in the Fishing Industry

John Ruggiero, University of Dayton, Dayton, OH, United States of America, John.Ruggiero@notes.udayton.edu, Trevor Collier

In this paper, we analyze efficiency using a two stage model. In the first state, we employ a DEA model to measure aggregate output, consisting of combinations of various species of fish. A second stage stochastic frontier model is employed to estimate production and to evaluate efficiency.

Sunday, 1:30pm - 3:00pm

■ SC01

C - Room 201A

Game-Theoretic Models in Global Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Soo-Haeng Cho, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15217, United States of America, soohaeng@andrew.cmu.edu

1 - Combating Child Labor: Incentives and Information Transparency in Supply Chain

Ying Xu, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, yingx1@andrew.cmu.edu, Soo-Haeng Cho, Sridhar Tayur

An estimated 158 million children aged 5-14 are engaged in child labor. Besides poverty in underdeveloped countries, extensive outsourcing has slowed child labor reform by encouraging firms to seek low labor costs. This paper examines the incentive of a multinational firm to induce or combat child labor via its supply contract and internal monitoring. We then investigate the potential effects of the new legislation in the U.S. that requires disclosures on corporate efforts to combat child labor.

2 - Capacity Investment of Start-ups and Established Firms In a Vertically Differentiated Market

Gang Wang, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, Campus Box 3490, McColl Building, Chapel Hill, NC, 27599, United States of America, Gang_Wang@unc.edu, Lauren Xiaoyuan Lu

We analyze how the behaviorial difference between start-ups and estalished firms affects their decisions on the timing and quantity of capacity investment in a vertically differentiated market with demand uncertainy. We find that a start-up firm, unlike an established firm, never chooses to invest in the low quality product late when investing in the high quality product early and the dynamics of competition involving start-up firms depends on product quality.

3 - A Chain of Oligopolies with Multi-products

Ming Hu, University of Toronto, Rotman School of Management, Toronto, ON, Canada, Ming.Hu@Rotman.Utoronto.Ca, Awi Federgruen

We investigate equilibrium behavior in a Stackelberg game of multiple competitive suppliers under asymmetric cost structures selling multiple substitutable products through multiple competing retailers. The demand structure is derived from a representative consumer's quadratic utility maximization problem. We solve a unique subgame perfect equilibrium in closed-form, with joint strategy spaces of suppliers' wholesale prices and retailers' retail prices being the entire set of nonnegative values.

4 - Supply Contracts for On-time Delivery: The Case of the U.S. Influenza Vaccine Market

Tinglong Dai, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, dai@cmu.edu, Soo-Haeng Cho, Fuqiang Zhang

Motivated by the flu vaccine industry, we consider a supply chain facing three sources of uncertainty: design, delivery, and demand. Coordinating contracts should motivate a manufacturer to choose optimal timing and quantity of production by trading off delivery advantage of early production against informational advantage of late production. By evaluating various conventional contracts, we construct new coordinating contracts that are reported in practice but not studied in extant literature.

■ SC02

C - Room 201B

Price Mechanisms in Risk Mitigation

Cluster: Risk Management

Invited Session

Chair: Burak Kazaz, Associate Professor, Syracuse University, Whitman School of Management, 721 University Avenue, Syracuse, NY, 13244, United States of America, bkazaz@syr.edu

1 - Joint Pricing and Capacity Planning with Flexible Resources

Sandra Transchel, Kuehne Logistics University, Hamburg, Germany, stranschel@gmail.com

This paper studies the interaction of pricing and capacity investment in flexible systems. Resource capacity and prices must be decided before demand uncertainty is resolved. As capacity can be scarce, allocation is prioritized to the product with the higher profit margin which is endogenous and determined by the price decisions. We analyze the impact of investment cost and demand uncertainty on selling prices, buffer capacity, and profitability and quantify the benefit of simultaneous planning.

2 - Risk Mitigation of Production Hedging

John Park, Doctoral Candidate, Syracuse University, Whitman School of Management, 721 University Avenue, Syracuse, NY, 13244, United States of America, jhpark03@syr.edu, Burak Kazaz, Scott Webster

This research analyzes the influence of exchange-rate uncertainty on a global manufacturer's pricing and production planning decisions. It shows that production hedging, defined as producing less than the total demand, is not only a legitimate scheme to maximize expected profits, but also an effective supply chain strategy to mitigate the exchange-rate risk. Modified versions of production hedging strategies that guarantees non-negative profits are also introduced in this research.

3 - Price-setting Newsvendor Problem with Supply Uncertainty, Recourse, and Risk Aversion

Burak Kazaz, Associate Professor, Syracuse University, Whitman School of Management, 721 University Avenue, Syracuse, NY, 13244, United States of America, bkazaz@syr.edu, Scott Webster

We extend the price-setting newsvendor problem with supply uncertainty, and study two pricing models: price-setting in the presence of supply and demand uncertainty, and price-setting after supply is realized in the presence of demand uncertainty. We introduce a new elasticity measure that leads to conditions for joint concavity and/or unique optimal solutions. We show that these conditions are robust as they continue to hold under risk aversion.

■ SC03

C - Room 202A

Best of WORMS 2010

Sponsor: Women in OR/MS

Sponsored Session

Chair: Eva Regnier, Associate Professor, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States of America, eregnier@nps.edu

Co-Chair: Susan Martonosi, Assistant Professor, Harvey Mudd College, Claremont, CA, 91711, United States of America, martonosi@hmc.edu

1 - Fair Dynamic Routing in Large-scale Heterogeneous-server Systems

Amy Ward, Associate Professor, University of Southern California, Bridge Hall 401H, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu

In a call center, there is a natural trade-off between minimizing customer wait time and fairly dividing the workload amongst agents of different skill levels. The relevant control is the routing policy; that is, the decision concerning which agent should handle an arriving call when more than one agent is available. We formulate an optimization problem whose objective is to minimize steady-state expected customer wait time subject to a "fairness" constraint on the workload division.

2 - Assortment Planning and Inventory Decisions under Stockout-based Substitution

Dorothee Honhon, Assistant Professor, University of Texas at Austin, McCombs School of Business, 1 University Station, Austin, TX, United States of America, dorothee.honhon@mccombs.utexas.edu

We present an efficient dynamic programming algorithm to determine the optimal assortment and inventory levels in a single-period problem with stockout-based substitution. Total demand is random and comprises of a fixed proportion of customers of different types. Each type corresponds to a specific ordering amongst products. We establish properties of the value function and help characterize multiple local optima.

3 - The Impact of Information Technology on Scientists' Productivity, Quality and Collaboration Patterns

Waverly Ding, Assistant Professor, University of Maryland, R. H. Smith School of Business, Van Munching Hall, College Park, MD, 20742, United States of America, wding@haas.berkeley.edu, Paula Stephan, Anne Winkler, Sharon Levin

This study investigates the impact of information technology (IT) on productivity and collaboration patterns in academe. We analyzed a random sample of 3,114 research-active life scientists and find that IT is an equalizing force, providing a greater boost to productivity and more collaboration opportunities for scientists who are more marginally positioned in academe.

■ SC04

C - Room 202B

COOPR - A Common Optimization Python Repository

Sponsor: Computing Society

Sponsored Session

Chair: David Woodruff, Professor, University of California-Davis, Graduate School of Management, Davis, CA, 95616, United States of America, dlwoodruff@ucdavis.edu

1 - Recent Advances in the Coopr Optimization Software

William Hart, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, United States of America, wehart@sandia.gov, Jean-Paul Watson

Coopr is a collection of Python software packages that supports a diverse set of optimization capabilities for formulating and analyzing optimization models. Key drivers for Coopr development include Pyomo, a Pythonic modeling tool, and PySP, a package for stochastic programming. This talk presents an overview of recent advances in Coopr, including improved scalability performance, support for set logic operations in Pyomo, and new support for advanced scripting.

2 - Tackling Large-scale Optimization Problems Within a Python-based Modeling Environment (Pyomo)

John Siirola, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, 87185, United States of America, jdsiiro@sandia.gov, William Hart, Jean-Paul Watson

The Pyomo modeling package can be used to formulate optimization models natively within the Python scripting language. Pyomo is an open-source modeling language that is being actively developed to support COIN-OR users in a variety of application areas. This talk will highlight recent developments in Pyomo and related Coopr packages, focusing on the overall speed and scalability of the modeling environment for large-scale optimization problems.

3 - Asynchronous Computation and Scenario Bundling for Progressive Hedging

Jean-Paul Watson, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185, United States of America, jwatson@sandia.gov, David Woodruff, Roger Wets

We address two critical, but largely ignored, computational issues when solving stochastic programs via Rockafellar and Wets' Progressive Hedging algorithm: asynchronous barriers and scenario bundling. Asynchronous sub-problem solves are necessary to retain parallel efficiency when considering large-scale stochastic programs. Scenario bundling - the creation of extensive forms containing a handful of scenarios - can yield dramatic reductions in iteration counts required for convergence.

4 - Suffixes Needed for Out-of-the-box Progressive Hedging

David Woodruff, Professor, University of California-Davis, Graduate School of Management, Davis, CA, 95616, United States of America, dlwoodruff@ucdavis.edu, Jean-Paul Watson

In this talk we examine the data needed from modelers to support Progressive Hedging. An impediment to deployment of multi-stage stochastic MIPs has been the need for substantial algorithmic development and tuning. Relationships between data elements can be described by the modeler than enable Progressive Hedging to address some of these problems.

■ SC05

C - Room 203A

Queues in Service Systems: Customer Abandonment and Diffusion Approximations

Cluster: Tutorials

Invited Session

Chair: Jim Dai, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, dai@gatech.edu

1 - Queues in Service Systems: Customer Abandonment and Diffusion Approximations

Jim Dai, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, dai@gatech.edu, Shuangchi He

Parallel-server queues with customer abandonment serve as a building block to model service systems. Such a queue is able to be operated in the quality- and efficiency-driven (QED) regime to achieve both quality of service and high server utilization. We survey recent results for these queues. They include insensitivity of patience time distribution, data-driven modeling of customer abandonment, diffusion models as a practical tool for performance analysis.

■ SC06

C - Room 203B

History of Operations Research

Cluster: Tutorials

Invited Session

Chair: Saul Gass, Professor Emeritus, University of Maryland, College Park, Smith School of Business, College Park, MD, 20742-1815, United States of America, SGass@rhsmith.umd.edu

1 - History of Operations Research

Saul Gass, Professor Emeritus, University of Maryland, College Park, Smith School of Business, College Park, MD, 20742-1815, United States of America, SGass@rhsmith.umd.edu, Arjang Assad

We discuss the history of Operations Research from the following perspectives: Origins and people of OR; The major sites of early U.S. OR research; The best stories from contributors to early OR; Lessons learned or how history informs OR today.

■ SC07

C - Room 204

Stochastic Models of Market Microstructure

Sponsor: Applied Probability

Sponsored Session

Chair: Costis Maglaras, Columbia University, 3022 Broadway, New York, NY, United States of America, c.maglaras@gsb.columbia.edu

Co-Chair: Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu

1 - Optimal Order Flow Routing, Exchange Competition, and the Effect of Make/Take Fees

Hua Zheng, PhD Student, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, hzheng14@gsb.columbia.edu, Costis Maglaras, Ciamac Moallemi

In modern equity markets, traders have the choice of many exchanges, each operating as an electronic limit order book that can be modeled as a pair of multiclass queues under a price/time priority rule. The dynamics are coupled via price protection mechanisms. We present a model to study the order routing problem, characterize market equilibria, and derive insights of the queue, delay and adverse selection measures of different exchanges. We present empirical data that supports our findings.

2 - Coupling between a Stochastic Model of a Limit Order Book and Branching Random Walks

Florian Simatos, CWI, Science Park 123, Amsterdam, 1098XG, Netherlands, florian.simatos@cwi.nl, Elie Aidekon

I will explain how to couple a simple stochastic model for one-sided limit order books to a classical model in probability theory, namely branching random walks. This coupling allows for instance to determine whether the price in the limit order book model goes to 0 or infinity.

3 - Fluid Limits for the Limit Order Book

Josh Reed, Assistant Professor, New York University, 44 West 4th Street, New York, NY, 10012, United States of America, jreed@stern.nyu.edu, Peter Lakner, Sasha Stoikov

We model a one-sided limit order book for sell (or buy) orders as a process taking values in the space of counting measures. Limit and market orders arrive to the book according to independent Poisson processes and limit orders are placed on the book according to a distribution which is a function of the current best price. In a high-liquidity heavy-traffic regime, we obtain a fluid limit for the order book process. We then provide transient and steady-state analysis of our fluid limit.

■ SC08

C - Room 205

Network Design and Interdiction

Sponsor: Computing Society/ Large-Scale Computation

Sponsored Session

Chair: Richard Chen, Senior Member of Technical Staff, Sandia National Laboratories, P.O. Box 969 MS 9155, Livermore, CA, 94551, United States of America, rlchen@sandia.gov

1 - Optimizing Network Recovery After Natural Disasters

Alexander Gutfraind, Los Alamos National Laboratory, Theoretical Division, Los Alamos, CA, United States of America, agutfraind.research@gmail.com, Milan Bradonjic, Tim Novikoff

Natural disasters destroy infrastructure networks on a vast scale, which motivated us to consider the problem of scheduling the recovery operations. Assume that the cost of installing a node depends on which other nodes have already been installed. This leads to an NP-hard optimization problem over n! permutations. Fortunately, dynamic programming can find optimal solutions to small instances and efficient approximations exist for large-scale problems.

2 - Interdiction Models for Border Security

Alexander Galenko, University of Texas, Austin, 1 University Station, C2200, Austin, TX, 78712, United States of America, agalenko@gmail.com, Stefan Goshev, David Morton, Michael Nehme, Ned Dimitrov

We analyze an interdiction problem in which a smuggler can traverse a transportation network, wherein each edge has an intrinsic probability of evasion. We seek optimal locations for a limited number of detectors at ports of entry across all networks (maritime, road and rail) to minimize the smuggler's evasion probability. Our analysis aims to provide a complete prioritization and picture of the threat at all ports of entry, leading to insight into good practical locations for detectors.

3 - Determining Network Arc Capacities when Node Supplies and Demands Are Uncertain

Kathryn Schumacher, PhD Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48104, United States of America, kaschu@umich.edu, Amy Cohn, Richard Chen

We consider the problem of assigning minimum-cost arc capacities such that there exists a feasible network flow for any one of a finite and known set of possible supply/demand scenarios. We present a linear programming formulation whose size does not depend on the number of scenarios and a delayed constraint generation algorithm that can be solved quickly even when the number of scenarios is large. We also explore algorithms for when only a fraction of the scenarios are required to be satisfied.

4 - An Implicit Optimization Approach for Survivable Network Design

Richard Chen, Senior Member of Technical Staff, Sandia National Laboratories, P.O. Box 969 MS 9155, Livermore, CA, 94551, United States of America, rlchen@sandia.gov, Amy Cohn, Ali Pinar

We consider the problem of designing a network of minimum cost such that a feasible flow exists given, a budget-constrained, destruction of a subset of the network's arcs. We develop a cut-generation based algorithm for solving this problem. But rather than explicitly considering all disruption scenarios, however, we develop an efficient bilevel program and corresponding separation algorithm that enables us to implicitly evaluate the exponential set of disruption scenarios.

■ SC09

C - Room 206A

Choice Modeling in Revenue Management

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Huseyin Topaloglu, Cornell University, 223 Rhodes Hall, Ithaca, NY, United States of America, ht88@cornell.edu

1 - Assortment Optimization under General Choice

Srikanth Jagabathula, Massachusetts Insitute of Technology, 32D-672 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, jskanth@mit.edu, Devavrat Shah, Vivek Farias

We consider the classic decision problem of static assortment optimization: find an offer set that maximizes revenue subject to a constraint on its size. We assume access to only revenue estimates for different offer sets. Finding the optimal solution in general requires exhaustive search over offer sets. We propose an approximation algorithm with far fewer calls to revenue function than exhaustive search requires. We also establish theoretical performance guarantees.

2 - Assortment Optimization with Mixtures of Logits

Huseyin Topaloglu, Cornell University, 223 Rhodes Hall, Ithaca, NY, United States of America, ht88@cornell.edu, David Shmoys, Paat Rusmevichientong

We consider assortment optimization problems where there are multiple customer classes and choices of customers belonging to different customer classes are captured by multinomial logit models with different parameters. The goal is to maximize the expected revenue over all customer classes. The problem is NP-hard, but we give special cases with multiple customer classes that make the problem tractable.

3 - Robust Assortment Optimization under the Multinomial Logit Choice Model

Paat Rusmevichientong, Cornell University, Ithaca, NY, United States of America, paatrus@cornell.edu, Huseyin Topaloglu

We study robust assortment optimization problems under the multinomial logit choice model. The true parameters of the logit model are unknown, and we represent the set of likely parameter values by a compact uncertainty set. The objective is to find an assortment that maximizes the worst case expected revenue. We consider the static model that ignores inventory consideration, and the dynamic problem, where there is a limited initial inventory that must be allocated over time.

4 - Randomization Approaches for Network RM with Choice Behavior

Sumit Kunnumkal, Indian School of Business, Gachibowli, Hyderabad, India, sumit_kunnumkal@isb.edu

We present new approximation methods for the network RM problem with customer choice behavior. The starting point for our methods is a dynamic program that allows randomization. An attractive feature of this dynamic program is that the size of its action space is linear in the number of itineraries. We present two approximation methods that build on this dynamic program and use ideas from the independent demands setting.

■ SC10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - GAMS Development Corporation - GAMS

Steven Dirkse, Director of Optimization, GAMS Development Corporation, 1217 Potomac Street NW, Washington, DC, 20007, United States of America, sdirkse@gams.com

GAMS Development will demonstrate how an application can be built using GAMS. We'll use both fundamental modeling practices, our state-of-the-art solvers and the latest in data access and application integration tools to quickly produce a working application.

2 - Maximal Software - MPL OptiMax 2.0 for Python and .Net: Introducing New Scripting and Library Interfaces for the MPL Modeling Language

Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

MPL has been distributed with a standard GUI interface for development and the object-oriented OptiMax Component library for deployment for many years now. With the advent of scripting language frameworks such as Python that are becoming increasingly popular, there are now new opportunities for integrating optimization into real-world applications. With the new MPL OptiMax 2.0 for Python and .Net, we are introducing a new scripting and component library interfaces for MPL that takes full advantage of the many powerful features of Python, CSharp and VB.Net.

■ SC11

C - Room 207A

Analysis of Spatially Distributed Networks

Sponsor: Applied Probability

Sponsored Session

Chair: Robert Hampshire, Assistant Professor of Operations Research and Public Policy, Carnegie Mellon University, Heinz College, 4800 Forbes Avenue, 2102B Hamburg Hall, Pittsburgh, PA, 15217, United States of America, Hamp@andrew.cmu.edu

1 - The Way You Move, and the Conditions of Small World Emergence

Augustin Chaintreau, Columbia University, 1214 Amsterdam Avenue, New York, NY, 10027, United States of America, augustin@cs.columbia.edu, Pierre Fraigniaud, Emmanuelle Lebhar

Small world navigation is the surprising property stating that the network of our social connections contains short chains of acquaintance that may be found using local information. Even more surprising is the fact that nature exhibits such networks while mathematics predicts that they only appear near a critical phase transition of the role of locality in human relationship. This talk presents recent results and open problem on the first explicative proof of this phenomenon.

2 - Spatial Reservation Management for Car Sharing

Robert Hampshire, Assistant Professor of Operations Research and Public Policy, Carnegie Mellon University, Heinz College, 4800 Forbes Avenue, 2102B Hamburg Hall, Pittsburgh, PA, 15217, United States of America, Hamp@andrew.cmu.edu

Many studies have shown that car sharing reduces environmental pollution and the transportation costs for a large segment of the population. Car sharing also reduces the number of private vehicles on the road because members do not purchase their own car. This paper presents a spatial reservation model and simulation of carsharing. The reservation control policy balances car utilization and renter quality of service.

3 - Probabilistic Analytical Modeling of Spatial Dependency in Urban Networks

Carolina Osorio, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Office 1-232, Cambridge, MA, 02139, United States of America, osorioc@mit.edu, Gunnar Flötteröd

We investigate probabilistic analytical methods that account for spatial dependency in urban transportation networks. The objective is to decompose the joint distribution of the main network performance measures (e.g. queue lengths), such that consistent marginals can be evaluated in a computationally efficient manner.

4 - A Parking Queue Network

Katsunobu Sasanuma, PhD Student, Carnegie Mellon University, Heinz College, 4800 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ksasanum@andrew.cmu.edu, Robert Hampshire, Alan Scheller-Wolf, Richard Larson

Traffic condition in downtown is affected by the congestion of on-street parking due to the cruising behavior. In this talk, we discuss how the changes of on-street/garage parking price and road capacity/congestion affect parking search behavior and overall congestion. We also discuss how the addition of a new link exacerbates traffic congestion. We propose that some combinations of parameters reduce traffic congestion effectively.

■ SC12

C - Room 207BC

Modeling Biological Systems

Cluster: Computational Biology (Joint cluster ICS)

Invited Session

Chair: Joe Song, Associate Professor, New Mexico State University, P.O. Box 30001, Las Cruces, NM, 88003, United States of America, joemsong@cs.nmsu.edu

1 - Discovering Biological Progression underlying Gene Expression Data

Peng Qiu, University of Texas, MD Anderson Cancer Center, 1400 Pressler Street, Houston, TX, 77030, United States of America, pqiu@mdanderson.org, Sylvia Plevritis, Andrew Gentles

We present a novel method, Sample Progression Discovery (SPD), to discover biological progression underlying gene expression data. In contrast to the majority of existing methods which identify differences between sample groups (normal vs. cancer), SPD aims to identify an underlying progression among individual samples, both within and across sample groups. We validated SPD's ability to discover biological progression using datasets of cell cycle, stem cell differentiation, and prostate cancer.

2 - Lyapunov Stability for a Biological Self-organization Process

Ezgi Eren, Texas A&M University, Industrial and Systems Engineering Department, College Station, TX, United States of America, ezgi@tamu.edu, Natarajan Gautam, Ram Dixit

Microtubules are polymers that regulate critical processes in living cells. In this research, we model their dynamics and interactions inside the plant cell by using a coarse-grained fluid model. Their dynamics and interactions result in an integro-differential system of equations. Using Lyapunov's method for stability, we derive sufficient conditions for the self-organization to occur. We test our results with simulations which replicate the real microtubule dynamics.

3 - Learning Generalized Logical Networks

Joe Song, Associate Professor, New Mexico State University, P.O. Box 30001, Las Cruces, NM, 88003, United States of America, joemsong@cs.nmsu.edu

Understanding of biological networks is still primitive for most organisms due to the complexity of molecular interactions in biological systems. Existing methods to infer network topology cannot meet the challenges from limited biological data. I will introduce methods to learn generalized logical networks from observed data and global behavior of system dynamics. These methods attempt to overcome limitation of data insufficiency in today's biological experiments.

■ SC13

C - Room 207D

New Topics in Revenue Management

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Gustavo Vulcano, Associate Professor, New York University, 44 West Fourth St, Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu

Co-Chair: Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, vivekf@mit.edu

1 - Dynamic Pricing with Delayed Purchasing Decision

Victor Araman, American University of Beirut, Beirut, Lebanon, va03@aub.edu.lb, Gustavo Vulcano

We consider the problem of pricing a finite capacity to customers who might inquire about the product but make their final purchase decision at a later time. We suggest a modeling framework, formulate the optimal policy and analyze from a pricing and revenues perspective the impact of neglecting information about potential future sales.

2 - Collaborative Revenue Management through Trading Favors

Rene Caldentey, New York University, New York, NY, United States of America, rcaldent@stern.nyu.edu, Xing Hu

We study two firms providing service to customers with limited capacity. Either firm can share capacity with the other when the other firm cannot satisfy its own demand, thereby, providing a favor to the other firm. We study efficient equilibria under incomplete information in which firms provide favors to the other and expects in the future to be granted favors in return. We characterize the efficient equilibrium and find both firms can significantly improve their performance by trading favors.

3 - Dynamic Referrals: Matching Traffic to Content

Yonatan Gur, Columbia University, 3022 Broadway Avenue, New York, NY, 10027, United States of America, ygur14@gsb.columbia.edu, Omar Besbes, Assaf Zeevi

This talk focuses on the emerging practice of generating related links on the fly to guide traffic on the internet. We highlight the challenges associated with this new internet business model, and study the underlying content-users online matching problem.

4 - Fast Dynamic Ad Allocation

Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, vivekf@mit.edu, Dragos Florin Ciocan, Hamid Nazerzadeh

We present a *fast* scheme for dynamic ad allocation. The scheme is based on model predictive control. It enjoys constant factor performance guarantees in the face or arbitrary demand volatility but is essentially optimal when volatility is low. Simultaneously, the scheme can be implemented with constant (practically negligible) computational cost per allocation decision.

■ SC14

C - Room 208A

Optimization in Smart Grid

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Andrew Liu, Assistant Professor, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, andrewliu@purdue.edu

1 - The Effects of Energy Management Controllers on Smart Grid with Real-time Pricing

Jingjie Xiao, PhD Student, Purdue University, School of Industrial Engineering, 315 Grant St., West Lafayette, IN, 47907, United States of America, xiaoj@purdue.edu, Andrew Liu, Joseph F. Pekny, Gintaras V. Reklaitis

Energy Management Controller (EMC) can automatically schedule household energy-intensive activities such as Electric Vehicle chargings by reacting to real-time price signals. An approximate dynamic programming problem is solved to optimize hourly power dispatches over the daily horizon when the intermittent renewable energy is present. The results show the impact of the EMC adoption on the smart grid both in avoiding/deferring capacity acquisition costs and in reducing reserve expenses.

2 - Simulating Customer Behavior for Effective Demand Response

Tolga Seyhan, PhD Candidate, Lehigh University, Industrial and Systems Eng. Department, 200 W Packer Avenue, Bethlehem, PA, 18015, United States of America, tolgaseyhan@lehigh.edu, Larry Snyder

More than ever, electricity sector needs tools to efficiently interpret and manage electricity demand. Smart metering systems make almost real time monitoring and intervention possible. We introduce a customer load simulation model that uses extracted load patterns and economic assumptions characterizing customer demand. We discuss alternatives in modeling customer's load process and price response behavior, and demonstrate intended implementations in demand response mechanisms.

3 - Unit Commitment with Uncertain Demand Response

Jianhui Wang, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL, United States of America, jianhui.wang@anl.gov, Qianfan Wang, Yongpei Guan

In this talk, we present a stochastic unit commitment model with uncertain demand response. The outages of the power system components such as generators and transmission lines are modeled by a large number of scenarios. Demand response is used as a remedy to reduce the curtailed load when contingencies occur. The uncertainty of the demand elasticity is controlled by chance-constrained programming.

4 - The Role of Advanced Analytics in the Intelligent Utility Network

Jeremy Bloom, Sr. Product Marketing Manager, ILOG Optimization, IBM, San Jose, CA, 95134, United States of America, bloomj@us.ibm.com

Advanced predictive and prescriptive analytics technologies can have a significant impact on the performance of power grids. In addition to automating complex decision processes involving numerous trade-offs and constraints, they can also identify novel modes of operation to address the challenges arising in restructured markets. This presentation discusses some of these applications in order to illustrate the role of advanced analytics in the intelligent utility network.

■ SC15

C - Room 208B

Portfolio Decision Analysis I

Sponsor: Decision Analysis

Sponsored Session

Chair: Jeff Keisler, Associate Professor, University of Massachusetts-Boston, College of Management, 100 Morrissey Blvd., Boston, MA, 02125-3393, United States of America, Jeff.Keisler@umb.edu

Co-Chair: Alec Morton, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, A.Morton@lse.ac.uk

Co-Chair: Ahti Salo, Professor, Aalto University, Systems Analysis Laboratory, Aalto, 00076, Finland, ahtisalo@cc.hut.fi

1 - Exploratory Study on a Pharmaceutical Company's Portfolio Decision Process

Jeff Stonebraker, Assistant Professor, North Carolina State University, Poole College of Management, Raleigh, NC, United States of America, jsstoneb@gw.ncsu.edu, Jeff Keisler

This exploratory study analyzes cross-sectional project data from an enterprise information system from a large pharmaceutical company to gain insight into the company's portfolio decision process and determinants of the ways in which decision analytic tools were applied in practice. Statistical measures based on number of scenarios and economic parameters describe aspects of the portfolio decision process. We will discuss study results and next steps in generalizing the results.

2 - Disinvestment in Healthcare: A Case Study

Alec Morton, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, A.Morton@lse.ac.uk, Mara Airoldi, Nikos Argyris, Gwyn Bevan

A challenge faced by many public sector organisations is how to reduce costs. Disinvesting is more challenging than allocating additional spend, because the staff who know the service best do not see honest presentation of the options as being in their interest. We show how a decision conferencing approach was used to help a health authority make critical decisions about the reconfiguration of an eating disorders service in order to secure cost savings, and discuss lessons learned.

3 - Portfolio Decision Analysis for the Cost-efficiency Evaluation of Weapon Systems

Ahti Salo, Professor, Aalto University, Systems Analysis Laboratory, Aalto, 00076, Finland, ahtisalo@cc.hut.fi, Jussi Kangaspunta, Juuso Liesiö

We develop a portfolio modeling framework for identifying which combinations of weapon systems are cost-efficient at different budget levels in recognition of multiple mission objectives and different operating situations. Our framework captures interactions among weapon systems by building on impact assessment results obtained from combat simulators or experts. It also admits incomplete information about the relative importance of mission objectives.

■ SC16

C - Room 209A

Panel Discussion: Analytics Applications in Railroads I

Sponsor: Railway Applications

Sponsored Session

Chair: Pooja Dewan, General Director Decision Systems, BNSF Railway, Fort Worth, tx, 76131, United States of America, Pooja.Dewan@bnsf.com

1 - Panel Discussion: Analytics Applications in Railroads I

Moderator: Pooja Dewan, General Director Decision Systems, BNSF Railway, Fort Worth, tx, 76131, United States of America, Pooja.Dewan@bnsf.com, Panelists: Michael Gorman, Jeff Day, Shiwei He

This year's round table goes well with the conference theme of TransfORmation. As you know our profession is trying to transform itself as Analytics in the hope to be more appealing to general audience, especially industry. We have put together panel of experts from academics, practitioners (railroads and consultants) and analytics software vendor. There will be two sessions in which we expect to hear their opinions on what this transformation means to the railroad industry in the near term and long term future.

■ SC17

C - Room 209B

New Developments in Benefit-risk Evaluation of Medicinal Products

Sponsor: Decision Analysis

Sponsored Session

Chair: Lawrence Phillips, London School of Economics, Department of Management, Houghton Street, London, NW3 1AH, United Kingdom, larry_phillips@msn.com

1 - Benefit/risk Assessments in the Drug Development Process

Marilyn Metcalf, GlaxoSmithKline, P.O. Box 13398, Five Moore Drive, Durham, NC, 27709, United States of America, marilyn.a.metcalf@gsk.com

Drug companies are striving to provide greater transparency in their evaluations of their products, both internally and externally, so benefit/risk assessments at critical stages in the drug development cycle are crucial. How to measure outcomes and make clinical implications for patients explicit are key issues, with standardized graphs, specialized evaluations and visualizations offering additional insights to evaluators.

2 - Systematic Assessment of the Benefit-risk Profile of Drugs

Rebecca Noel, Research Scientist, Eli Lilly and Company, Lilly Corporate Center, Indianapolis, IN, 46285, United States of America, Noel_Rebecca_A@Lilly.com

Benefit-risk assessment of drugs has traditionally been based on qualitative judgment. However, more systematic and quantitative approaches are coming to the fore, such as representational models based on multicriteria decision analysis. These models can incorporate both evaluative judgments from different perspectives (e.g., physician, patient) and quantitative data to inform tradeoffs between multiple benefit and multiple risk elements in a logically consistent and transparent manner.

3 - How Quantitative Modeling can Assist Regulators of Medicinal Products to Make Smart Decisions

Lawrence Phillips, London School of Economics, Department of Management, Houghton Street, London, NW3 1AH, United Kingdom, larry_phillips@msn.com

The first decision-analytic models for balancing benefits and risks of new drugs were successfully completed this year by the team of the Benefit-Risk Project sponsored by the European Medicines Agency. The value of the models, as judged by the assessors and regulators, derives from three factors: a quantitative model, group participation of the key players and impartial facilitation.

■ SC18

C - Room 210A

Scheduling Models and Applications

Cluster: Scheduling and Project Management

Invited Session

Chair: Chung-Lun Li, Hong Kong Polytechnic Univ, Hung Hom, Kowloon, Hong Kong - PRC, lgtclli@polyu.edu.hk

1 - Particle Swarm Optimization based Approach for Divergent Production Scheduling

George Huang, Professor, University of Hong Kong, Room 813, Haking Wong Building, HKU, Pokfulam Road, Hong Kong, Hong Kong - PRC, gqhuang@hku.hk, Hao Luo

This research considers a scheduling problem in a divergent production system (DPS). Through a real-life DPS problem in an aluminum manufacturing company, this paper addresses two important challenges. One is multiple process routes. The other is limited inventory space. A particle swarm optimization based approach is proposed to solve the problem. The computational results show that the proposed solution is appropriate and advantageous for the DPS problem in the collaborating company.

2 - Simultaneous and Sequential Price Quotations for Uncertain Order Inquiries

Liang Lu, Hong Kong University of Science and Technology, Department of IELM, Clear Water Bay, Kowloon, Hong Kong - PRC, nicowish@gmail.com, Xiangtong Qi, Zhixin Liu

This paper studies the coordination between pricing and production scheduling decisions of a manufacturer who faces a set of order inquiries. Each inquiry may be either cancelled or converted to a firm order based on certain probability distribution that depends on the price quotation. Production scheduling cost will be incurred to all firm orders. We investigate and compare two types of price quotation schemes, namely, simultaneous and sequential quotations.

3 - Suppliers' Coordination of Production and Delivery Decisions

Mohamed Ali Aloulou, Assistant Professor, Université Paris-Dauphine, Place du MarechalL de LAattre de Tassigny, Paris, 75016, France, Mohamed-Ali.Aloulou@dauphine.fr, Safia Kedad-Sidhoum, Ammar Oulamara, Asma Ghaffari

Different suppliers are coordinating production and delivery of a set of products ordered by a retailer. They have to decide on the delivery batch sizes under minimum and maximum size limits. Each supplier is incurring an inventory cost during the product processing until its shipping date, and a fixed delivery cost per loaded truck. We study the centralized batch sizing problem when the suppliers are considering joint shipments. We present analytical results about the benefit of coordination.

4 - Coordinated Scheduling of Production and Delivery with Production Window and Delivery Capacity Constant

Yumei Huo, Associate Professor, CUNY at Staten Island, Staten Island, NY, 10314, United States of America, yumei.huo@csi.cuny.edu, Bin Fu, Hairong Zhao

This paper considers the coordinated production and delivery scheduling problem, where there are z delivery times each with a delivery capacity and a set of jobs each with a committed delivery time, processing time, production window, and profit. The objective is to maximize the total profit. Suppose the given set of jobs are k-disjoint, when k is a constant, we developed a PTAS for both the single delivery time case and multiple delivery times case.

5 - Coordination Issues for Timely Processing of Outsourced Operations

Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Eugene, 97403, United States of America, tolga@uoregon.edu, George Vairaktarakis, Xiaoqiang Cai

We consider a dynamic capacity booking problem faced by manufacturers outsourcing to a single third-party. Each manufacturer has the objective of jointly minimizing the earliness, tardiness and capacity booking costs. While reserving capacity a manufacturer considers either booking remaining capacity at the third-party or forming a coalition with a subset of manufacturers who booked earlier. We model this relationship as a cooperative savings game and present a core allocation.

■ SC19

C - Room 210B

JFIG Paper Competition II

Sponsor: Junior Faculty Interest Group (JFIG)

Sponsored Session

Chair: Dionne Aleman, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca

The JFIG paper competition aims to encourage research among junior faculty and increase the visibility of research conducted by junior faculty within the fields of operations research and management science. Papers are submitted for this year's competition, and each one is evaluated based on the importance of the topic, appropriateness of the research approach, and the significance of research contribution. In this session the finalists-selected in two rounds of review, will present their papers. For all the selected finalists and the abstracts of the selected papers, please refer to the online program.

1 - The Relational Advantages of Intermediation

Elena Belavina, INSEAD, Boulevard De Constance, Fontainebleau 77305, France, elena.belavina@insead.edu, Karan Girotra

This paper provides a novel explanation for the use of supply chain intermediaries such as Li & Fung Ltd. We find that even in the absence of the well-known transactional and informational advantages of mediation, intermediaries improve supply chain performance. In particular, intermediaries facilitate responsive adaptation of the buyers' supplier base to their changing needs while simultaneously ensuring that suppliers behave as if they had long-term sourcing commitments from buying firms.

2 - Sensitivity Analysis for Diffusion Processes Constrained to an Orthant

Ton Dieker, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, School of ISyE, Atlanta, GA 30332, United States of America, ton.dieker@isye.gatech.edu, Xuefeng Gao

We study optimization and sensitivity analysis for stochastic networks (e.g., to make staffing decisions). Our initial results are for a heavy traffic setting, and we investigate changes with respect to the drift of a given diffusion approximation. Our main results are: (1) the process and its infinitesimal-change process jointly satisfy a dynamic linear complementarity problem, and (2) the steady-state distribution of the joint process satisfies a linear equation akin to the basic adjoint relation.

■ SC20

C - Room 211A

Recent Advances in Global Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Andrew Trapp, Assistant Professor, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA, 01609, United States of America, atrapp@wpi.edu

1 - Stochastic Decomposition for Large-scale Linear Quadratic Tracking (LQT) Problems

Pengbo Zhang, PhD Student, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195-2650, United States of America, pbzhang@u.washington.edu, Zelda Zabinsky, Wolf Kohn

Global dynamic optimization problems can be formulated as large-scale LQT problems. This formulation classically requires the solution of a Ricatti equation of large dimension. We propose a stochastic decomposition algorithm that reduces the complexity of the problem by creating approximation sub-problems. We replace deterministic coupling terms with Gaussian processes whose covariance matrix reflect the error due to the approximation. The sub-problems are convex LQT Gaussian problems.

2 - A New Global Algorithm for Indefinite Separable Quadratic Knapsack Problems

Jaehwan Jeong, PhD candidate, University of Tennessee, 1300 Clinch Avenue APT3, Knoxville, TN, 37916, United States of America, jjeong3@utk.edu, Chanaka Edirisinghe

We present a global algorithm for indefinite separable quadratic knapsack problems with bounds on variables. Earlier, we developed a specialized method to determine the global optimum when upper bounds on variables are not present. In this talk, this method is extended to the case of finite upper bounds on concave pieces of the problem. The problem is transformed to an integer framework and we develop an iterative solution scheme based on dynamic programming coupled with enumerating KKT points.

3 - A New Lagrangian Decomposition Based Approach for Quadratic Binary Programs

Zhen Zhu, Purdue University, West Lafayette, IN, 47906, United States of America, zzhu@purdue.edu, Nan Kong, Oleg A. Prokopyev

We present a new Lagrangian decomposition based method to solve quadratic binary problems. We introduce auxiliary variables and additional quadratic constraints. We obtain a Lagrangian relaxation bound by solving several unconstrained and one constrained linear binary problems. A feasible solution is attainable when computing each dual. Our method also preserves the constraint structure of the original problem and is able to utilize fast specialized solution techniques for certain problems.

4 - Using Constraint Aggregation to Solve a Class of Two-stage Stochastic Integer Programs

Andrew Trapp, Assistant Professor, Worcester Polytechnic Institute, 100 Institute Road, Worcester, MA, 01609, United States of America, atrapp@wpi.edu, Oleg A. Prokopyev

Two-stage stochastic IPs with random right-hand sides can be solved through a value function reformulation and global branch-and-bound together with bounds derived from the value function. As this approach is limited in computer memory by the row dimension, one possibility to accommodate a larger number of rows is via constraint aggregation. The associated value function can be completely stored in memory and bounds the original. We discuss their use in the context of global branch-and-bound.

■ SC21

C - Room 211B

Stochastic Programming I

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Merve Unuvar, PhD Candidate, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States of America, merveunuvar@gmail.com

1 - Stochastic Network Design Problem with Probabilistic Constraint

Andras Prekopa, Professor, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854-8003, United States of America, prekopa@rutcor.rutgers.edu

Single commodity networks are considered, where demands at the nodes are random and optimal node and arc capacities are to be found, subject to constraints. One of them is a probabilistic constraint ensuring that all demands should be met by large probability. The number of feasibility inequalities is reduced by elimination. The concept of p-efficient point is used, in a smart way to convert the problem into an LP that is solved by specially designed, efficient algorithm.

2 - Solution of the Probabilistic Constrained Problem by a Hybrid (inner and upper bound) Method

Olga Myndyuk, graduate student, RUTCOR, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States of America, olgamyn@eden.rutgers.edu, Andras Prekopa

The probabilistic constrained problem with continuously distributed right hand side random variable is solved using a combination of the supporting hyperplane (outer) and a cutting plane (inner) method. At each iteration we have both lower and upper bounds for the optimum value. A smart way of handling multivariate quantiles allows us to solve problem with large number of random variables in special cases. Numerical results will be presented for multivariate normal and uniform distributions.

3 - Solution of Probabilistic Constrained Problems with Compound Poisson Distributions

Anh Ninh, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854-8018, United States of America, anhninh@eden.rutgers.edu, Andras Prekopa

We prove that the compound Poisson distribution is log-concave, under some conditions for the distribution of the terms. Then formulate and solve probabilistic constrained stochastic programming problems, for both the discrete and continuous distribution cases, regarding the compound Poisson random variables. Applications in insurance and finance will be mentioned.

■ SC22

C - Room 212A

Stochastic Conic Programming: Applications and Algorithms

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Baha Alzalg, PhD Candidate, Washington State University, Department of Mathematics, Pullman, WA, 99164-3113, United States of America, baha2math@gmail.com

1 - A Distributionally Robust Two-Stage Stochastic Programming Model and its Tractability

Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu, He Zhang

In this paper, we propose a two-stage distributionally robust stochastic optimization model with probability ambiguity set defined by the first two moments. Each stage solves a moment robust optimization problem. The parameters used to define the ambiguity set of the second stage problem will depend on some random information. We also show that this general two-stage framework can be solved to any precision in polynomial time.

2 - A Stochastic Second Order Cone Model for a Single-facility Location Problem

Francesca Maggioni, Lecturer, University of Bergamo, Via dei Caniana n.2, Bergamo, 24127, Italy, francesca.maggioni@unibg.it, Luca Bertazzi

We consider a location problem for a transportation company in which a single-facility has to be placed in a given area. A set of clients whose location is unknown have to be supplied by means of a fleet of vehicles. The problem is to determine the zone where the firm expects to find the clients; the model is as a stochastic second order cone program. The advantage of such a kind of approach, versus the classical node formulation, is the inclusion of a high number of clients with low complexity.

3 - Optimal Covering of Random Ellipses

Yuntao Zhu, Assistant Professor, Arizona State University, P. O. Box 37100, Phoenix, AZ, 85069-7100, United States of America, Yuntao.Zhu@asu.edu

In this talk we consider the stochastic version of the Minimum Covering Ellipsoid problem. We model the problem as a Stochastic Semidefinite Program. The solving algorithms are also addressed.

4 - On Recent Trends in Stochastic Conic Optimization

Baha Alzalg, PhD Candidate, Washington State University, Department of Mathematics, Pullman, WA, 99164-3113, United States of America, baha2math@gmail.com, Ari Ariyawansa

In this talk we introduce the two-stage stochastic symmetric programs (SSPs) with recourse. We use tools from Jordan algebras to indicate briefly how stochastic linear, second-order cone, and semidefinite programs can be viewed as special cases of SSPs. Polynomial-time decomposition algorithms for solving this problem are also addressed.

■ SC23

C - Room 212B

Joint Session Homeland/MAS/Law: Advances in Risk Analysis at the Local, State and Federal Level III

Cluster: Homeland Security – Emergency Prep/Military Applications Society/Law, Law Enforcement and Public Policy

Invited Session

Chair: Barry Ezell, Associate Research Professor, Old Dominion University's VMASC, 1030 University Blvd., Suffolk, VA, 23435, United States of America, bezell@odu.edu

1 - A Decision-Support Model to Address Risks Related to Sea Level Rise

Mike Robinson, Assistant Research Professor, VMASC/Old Dominion University, 1030 University Blvd, Suffolk, VA, 23435, United States of America, rmrobins@odu.edu, Jose Padilla, Saikou Diallo

Rising sea levels pose significant risks to communities' infrastructures, services, and economies. Decision made by communities to mitigate these risks must consider many factors (transportation mobility and survivability, health care access, social equity, etc.). The conceptual model for an agent based decision-support model to assist in making choices is developed.

2 - RAPID 2011: An Update on OR Modeling to Inform Policy and Budgetary Decisions at DHS

Tony Cheesebrough, Deputy Assistant Director, U.S. Department of Homeland Security, Office of Risk Management and Analysis, Washington, DC, United States of America, Tony.Cheesebrough@dhs.gov, Debra Elkins, Julie Waters

Risk Assessment Process for Informed Decision-making (RAPID) is a probabilistic risk assessment conducted within the Department of Homeland Security (DHS) Office of Risk Management and Analysis (RMA) that supports strategic policy and budgetary decision-making. This presentation will highlight 2011 progress, ongoing development of OR models, tools, and capabilities, and provide an opportunity for the OR/MS community to continue to provide input and suggestions for enhancing the impact of RAPID.

3 - Dynamics in Early Warning and Crisis Management

David Blum, Stanford University, Department of MS&E, Huang Engineering Center, 475 Via Ortega, Stanford, CA, 94305, United States of America, dmblum@stanford.edu, Elisabeth Pate-Cornell

Early warning is one of the central functions of crisis management. A problem with early warning models employing inference is that they mischaracterize the underlying hypothesis by fixing it, when 'ground truth' actually changes with time. We use a Partially Observable Markov Decision Processes to incorporate a hypothesis that evolves with time into the traditional Bayesian inference approach to early warning. We thereby capture dynamics inherent in a crisis and allow for lead time estimation.

■ SC24

C - Room 213A

Advances in Mixed Integer Programming – I

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Santanu S. Dey, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30318, United States of America, santanu.dey@isye.gatech.edu

1 - Strength of Cross Cuts

Marco Molinaro, Carnegie Mellon University, 630 Clyde St, Apt 302, Pittsburgh, PA, United States of America, molinaro@cmu.edu, Oktay Gunluk, Sanjeeb Dash

Split cuts are among the most important cuts in practice, and modern heuristics can essentially harness their full power. Aiming at improving over split cuts, we study their most natural generalization, cross cuts. We present a theoretical comparison of the strength of the cross-closure and the second split-closure. We also analyze the strength of cross cuts from the important 2-row and basic relaxations and resolve two open questions posed by Dash, Dey and Gunluk (2010).

2 - Experiments with Two-row Cuts

Ricardo Fukasawa, Assistant Professsor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, rfukasaw@math.uwaterloo.ca

We present our recent findings on some experiments on generating cuts based on two rows of the simplex tableaux.

3 - Mixing n-step MIR Inequalities

Sujeevraja Sanjeevi, Texas A&M University, 3017 ETED, 3131 TAMU, College Station, TX, 778433131, United States of America, sujeevraja@tamu.edu, Kiavash Kianfar

We present a generalization of the mixing procedure, called n-step mixing, that mixes the n-step MIR inequalities. We show that the n-step mixing inequalities define facets for mixing sets with n integer variables in each row. We also show that the n-step mixing procedure generates new multi-row valid inequalities for general MIPs as well as MIPs with special structure, such as lot-sizing, capacitated facility location and capacitated network design.

4 - An Integer Programming Approach to Some Problems in Numerical Semigroups

Victor Blanco, Universidad de Granada, Departamento de Algebra, Facultad de Ciencias, Granada, Spain, vblanco@ugr.es

A numerical semigroup is a set of nonnegative integers, closed under addition, containing zero and such that its complement with the set of nonnegative integers is finite. Numerical semigroups were first considered while studying the set of nonnegative solutions of Diophantine equations. We show here a common framework for numerical semigroups and discrete optimization: the Kunz-coordinates vectors of a numerical semigroup, and we apply IP tools to solve some algebraic problems over them.

■ SC25

C - Room 213BC

Retail Operations and Assortment Planning

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Felipe Caro, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Suite B420, Los Angeles, CA, 90095, United States of America, fcaro@anderson.ucla.edu

1 - Configuring Optimal Pre-packs for Retail Supply Chains

Stephen Smith, Professor, Santa Clara University, OMIS Department, 500 El Camino Real, Santa Clara, CA, 95053-0382, United States of America, SSmith@scu.edu, Narendra Agrawal

We present a dynamic programming approach for determining optimal pre-pack configurations for retail supply chains. Results from Markov Decision Processes are used to develop an algorithm for optimizing the set of pre-packs and the corresponding shipping policies in steady state. A data set from a large apparel retailer is used to illustrate the key results and insights.

2 - Learning Consumer Tastes through Dynamic Assortment

Aydin Alptekinoglu, Southern Methodist University, Cox School of Business, 6212 Bishop Blvd., Dallas, TX, 75205, United States of America, aalp@cox.smu.edu, Dorothee Honhon, Canan Ulu

We study dynamic assortment decisions in a horizontally differentiated product category for which consumers' tastes can be represented as locations on a Hotelling line. The firm knows all possible consumer locations, comprising a finite set, but does not know their probability distribution. We show that one can (partially) order assortments based on their information content and that in any given period the optimal assortment cannot be less informative than the myopically optimal assortment.

3 - Optimal and Competitive Assortments with Endogenous Pricing under Hierarchical Consumer Choice Model

Gurhan Kok, Duke University, The Fuqua School of Business, Durham, NC, United States of America, gurhan.kok@duke.edu, Yi Xu

We study assortment planning and pricing for a category with heterogeneous product types from two brands. We model consumer choice with Nested Multinomial Logit framework under a brand-primary model in which consumers choose a brand first, then a product type, and a type-primary model in which consumers choose a product type first, then a brand within that product type. We find that optimal and competitive assortments and prices have distinctive properties across different models.

4 - The Assortment Packing Problem

Felipe Caro, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Suite B420, Los Angeles, CA, 90095, United States of America, fcaro@anderson.ucla.edu, Victor Martínez-de-Albéniz, Paat Rusmevichientong

We introduce the assortment packing problem where a firm must plan a selling season by determining in which order it will introduce its products to maximize overall market share. Given the complexity of the problem, we present a simple heuristic with a performance guarantee.

■ SC26

C - Room 213D

Inventory and Pricing Models

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Kevin Shang, Duke University, Fuqua School of Business, Durham, NC, United States of America, khshang@duke.edu

Co-Chair: Woonghee Tim Huh, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z4, Canada, tim.huh@sauder.ubc.ca

1 - New Functional Characterizations and Optimal Structural Results for ATO Systems with Lost Sales

Mustafa Akan, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue Posner 381C, Pittsburgh, PA, 15213, United States of America, akan@andrew.cmu.edu, Emre Nadar, Alan Scheller-Wolf

We consider an ATO system with multiple components and products, batch ordering of components, and lost sales. We model the system as an infinite-horizon MDP. Introducing new functional characterizations for convexity and related properties restricted to certain subspaces, we characterize optimal inventory replenishment and allocation via a new type of policy; state-dependent base-stock and lattice-dependent rationing (SBLR), under reasonable assumptions.

2 - Capacitated Multi-echelon Fulfillment System with Different Levels of Service

Juan Li, Cornell University, 296 Rhodes Hall, Cornell University, Ithaca, NY, 14850, United States of America, jl879@cornell.edu, John Muckstadt

We designed a two echelon fulfillment system in a capacitated e-retailing environment. The system is organized to meet the customer's requests efficiently. The fulfillment system has two sets of decisions, acquiring and allocating inventories. The decisions are made under transportation capacity constraints. We present a strategy for operating the fulfillment system that minimizes costs while maintaining the required service levels. Both analytical and simulation results are reported.

3 - A New Robust Optimization Based Inventory Control Policy

Yupeng Chen, Columbia University, Mudd 323, 500W 120th Street, New York, NY, 10027, United States of America, yc2561@columbia.edu, Garud Iyengar

We propose a novel, robust optimization based control policy for a finite horizon, periodic review inventory model. Our policy provides an unified approach to efficiently handle both backlogging and lost sales inventory dynamics. Our policy works with models with fixed ordering cost and positive lead time. Computing the optimal order decision in our policy reduces to solving a small set of LPs. We will also discuss the extension to a joint pricing and inventory model.

4 - A Simple Heuristic for Joint Inventory and Pricing Problems with Lead Time

Yang Li, Duke University:The Fuqua School of Business, 100 Fuqua Drive, Durham, NC, 27708, United States of America, yang.li2@duke.edu, Fernando Bernstein, Kevin Shang

We study a joint inventory and pricing problem in a single-stage system with positive lead time. This problem is, in general, intractable due to its computational complexity. We develop a simple heuristic that resolves this issue. The heuristic first generates a pricing policy which depends on the initial inventory level. We then transform the joint problem into a standard inventory problem. This heuristic enables us to explore the impact of lead time on the joint decision.

■ SC27

C - Room 214

Incentive Issues in Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu

1 - Contract Design for Collaborative Product Development

Vishal Agrawal, Assistant Professor, Georgetown University, 37th and O Streets, McDonough School of Business, Washington, DC, 20057, United States of America, va64@georgetown.edu, Nektarios Oraiopoulos

We investigate optimal contracts between supply-chain partners engaged in collaborative ventures to develop new products. Extant literature has focused on formal contracting mechanisms to ensure alignment of incentives between supply-chain partners. Yet, in practice, such mechanisms are difficult to implement due to the difficulty in outlining all possible contingencies. We analyze the relative effectiveness of assigning control rights versus contracting on renegotiation rights.

2 - Signaling with Performance-based Contracts

Nitin Bakshi, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, nbakshi@london.edu, Sang-Hyun Kim, Nicos Savva

Consider a firm that enters into a performance-based contract (PBC) with the manufacturer of a key component that requires after-sales service support. The manufacturer has superior information about the component's failure distribution. We explore the operational and economic implications of this information asymmetry. We identify conditions under which PBC helps achieve the economically efficient outcome by serving as a signaling mechanism for the manufacturer.

3 - Efficient Supplier or Responsive Supplier? An Analysis of Firms' Sourcing Strategy under Competition

Xiaole Sherri Wu, Washington University in St. Louis, St. Louis, MO, 63130, United States of America, x.wu@wustl.edu, Fuqiang Zhang

This paper studies an outsourcing game where two firms compete by choosing their sourcing mode. The efficient supplier is cheaper, but has a long lead time; the responsive supplier is more expensive, but due to its short lead time, the firm can observe early demand when deciding the order quantity. We examine how different problem parameters affect the equilibrium of the game.

4 - Strategic Reliability Investments in Multi-Indenture Service Supply Chains

Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu

We study a setting in which multiple firms providing different components of a product face decisions on investing in reliability improvement during the product design stage. Because of the product-level service requirement demanded by the customer, an externality is created which drives strategic behaviors among the firms. This results in an inefficient allocation of product life cycle cost, which may in fact be inflated when contracts are used to coordinate the supply chain.

■ SC28

C - Room 215

Managing Service Systems

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Ramandeep Randhawa, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States of America, Ramandeep.Randhawa@marshall.usc.edu

Co-Chair: Achal Bassamboo, Northwestern University, Evanston, IL, United States of America, a-bassamboo@kellogg.northwestern.edu

1 - Skill and Capacity Management in Large-scale Service Marketplaces

Eren Cil, University of Oregon, 1208 University of Oregon, Eugene, OR, 97403-1208, United States of America, erencil@uoregon.edu, Gad Allon, Achal Bassamboo

We consider a large-scale marketplace where the ability of a service provider to cater customers, who can be of two classes, varies. The firm moderating the marketplace can constitute a screening mechanism assessing agents' abilities. We show that when the values that a service provider generates for each customer class are independent, the firm may need to refuse some of the service providers via its screening mechanism whereas this is never optimal when these values are perfectly correlated.

2 - Coordinating Marketing Promotions and Staffing Policies for a Call Center

Mojtaba Araghi, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto ON M5S 3E6, Canada, Mojtaba.Araghi08@Rotman.Utoronto.Ca, Philipp Afeche, Opher Baron

We study the problem of optimizing marketing promotions and staffing policies for a profit-generating inbound call center. The provider makes staffing decisions and controls the level and timing of promotions, which generate time-varying demand responses with rates that decay over time. We analyze this problem in the framework of a deterministic fluid model, characterize optimal periodic policies, and discuss how the decisions depend on system parameters.

3 - Learning Quality from Service Outcomes

Senthil Veeraraghavan, The Wharton School, 3730 Walnut Street, Suite 500, Jon M Huntsman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Laurens Debo

We study a service provider whose quality is unknown to arriving customers (such consultants, house repair, realtor). Service outcomes can be positive or negative with some probability. Customers decide whether to join the setvice or to renege from the service based on limited service outcomes/reports that they observe. We consider how learning and social welfare is improved by service discipline.

4 - Capacity Sizing under Parameter Uncertainty: Safety Staffing Principles Revisited

Achal Bassamboo, Northwestern University, Evanston, IL, United States of America, a-bassamboo@kellogg.northwestern.edu, Ramandeep Randhawa, Assaf Zeevi

We study the capacity sizing problem in a service system faced with an uncertain arrival rate. In a large system setting, we first characterize the solution to the first order fluid problem. We show that the fluid prescription can have an Order-1 optimality property. That is, its optimality gap does not increase with system size.

■ SC29

C - Room 216A

Machine Learning in Health Care

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations

Sponsored Session

Chair: Donald Lee, Yale University, School of Management, New Haven, CT, United States of America, donald.lee@yale.edu

1 - Data-driven Decision Making in Healthcare Systems

Mohsen Bayati, Assistant Professor of Operations, Information and Technology, Stanford University, 655 Knight Way, Stanford, CA, 94305, United States of America, bayati@stanford.edu

Nearly 1 in every 5 patients is rehospitalized within 30 days of their discharge and the estimated cost of that to Medicare in 2004 was 17.4 billion dollars. Hospitals aim to avoid rehospitalizations in a number of ways; for example, through follow-up home visits by nurses. However, proper allocation of these resources is challenging. We propose a cost-effective solution via applying statistical learning methods to patient data. Joint work with M. Braverman, M. Gillam, M. Smith, E. Horvitz

2 - Outcomes Matter: Estimating Pre-transplant Survival Rates of Kidney-transplant Candidates

Inbal Yahav, University of Maryland, RH Smith School of Business, College Park, MD, 20742, United States of America, iyahav@rhsmith.umd.edu, Galit Shmueli

We propose a simulation based method for correcting selection bias in predicting survival rates of patients with kidney failure. Existing approaches assume that selection to transplant is based on candidates' pre-transplant information, irrespective of the potential allocation outcome. We show that anticipated allocation outcome is in fact a major factor in selection to transplant and ignoring it increases the prediction bias rather than decreasing it.

3 - Discovery and Prediction from Clinical Temporal Data

Suchi Saria, Assistant Professor, Johns Hopkins University, School of Public Health, Baltimore, MD, United States of America, suchi.saria@gmail.com

We propose a nonparametric Bayesian method for discovering informative representations in continuous physiologic time series to aid exploratory data analysis. When applied to data from premature infants in the neonatal ICU (NICU), our model obtains novel clinical insights. Based on these patterns, we devised Physiscore, a novel risk prediction score to predict infants at risk for developing major complications in the NICU. Physiscore outperforms previous scoring systems including the Apgar.

■ SC30

C - Room 216B

Real Option Management of Commodity and Energy Operations

Sponsor: Manufacturing & Service Oper Mgmt/ IFORM SIG

Sponsored Session

Chair: Nicola Secomandi, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ns7@andrew.cmu.edu

Co-Chair: Guoming Lai, Professor, University of Texas-Austin, 1 University Station, B6500, CBA 5.202, Austin, TX, 78705, United States of America, Guoming.Lai@mccombs.utexas.edu

1 - Dynamic Risk Management of Commodity Operations

Amitabh Sinha, University of Michigan, Stephen M. Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, amitabh@umich.edu, Sripad Devalkar, Ravi Anupindi

We model the dynamic risk management problem for a commodity processor in a multi-period setting. We use the concept of conditional risk mappings to propose a time-consistent risk measure based on the conditional value at risk (CVaR) and obtain the optimal operational and financial hedging policy. We quantify the value of excess procurement capacity, relative to processing capacity, and develop efficient heuristics to compute the optimal policy.

2 - Does Sharing Inventoy Benefit Firms When There is a Commodity Market?

Seung Jae Park, University of Texas at Austin, Austin, TX, United States of America, Seung-Jae.Park@phd.mccombs.utexas.edu, Guoming Lai, Sridhar Seshadri

We consider two firms that need a commodity to satisfy their demands. Beyond buying and selling in the spot and forward markets, we explore the value of sharing inventory. We show that inventory sharing always reduces firms' costs and estimate the maximum expected cost reduction. The inventory sharing option changes the procurement policy; in particular, the order-up-to level may both increase and decrease in different scenarios. We conduct a numerical analysis about the comparative statics.

3 - Managing Wind-based Electricity Production with Storage

Yangfang Zhou, PhD student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, yangfang@andrew.cmu.edu, Alan Scheller-Wolf, Nicola Secomandi, Stephen Smith

We consider a wind-based electricity system that combines production, storage, and transmission elements. It trades electricity in a wholesale market with uncertain, and possibly negative price. We provide an appealing characterization of the system-optimal operating policy when the system does not buy. We also numerically assess the values of (i) price and wind uncertainty, and future information when designing an operating policy, (ii) the ability to buy from the market, and (iii) storage.

4 - Valuation and Hedging of Commodity Storage in the Presence of Term Structure Model Error

Guoming Lai, Professor, University of Texas-Austin, 1 University Station, B6500, CBA 5.202, Austin, TX, 78705, United States of America, Guoming.Lai@mccombs.utexas.edu, Nicola Secomandi, Francois Margot, Alan Scheller-Wolf, Duane Seppi

We quantify the impacts of price model errors on the valuation and hedging of the real option to store a commodity. For valuation, price model error does not seem to be significant. For hedging, bucket hedging performs remarkably well, while a naive implementation of factor hedging can perform disastrously, being extremely sensitive to small amounts of price model error. We develop a fine-tuned factor hedging that optimizes the futures contracts traded and performs similarly to bucket hedging.

■ SC31

C - Room 217A

Recent Advances in Radiation Treatment Planning Optimization

Sponsor: Health Applications

Sponsored Session

Chair: Gino J. Lim, Associate Professor, University of Houston, E211, Egr. Bldg 2, 4008, Houston, TX, 77004, United States of America, ginolim@uh.edu

Co-Chair: Wenhua Cao, University of Houston, Houston, TX, 77004, United States of America, wcao@mail.uh.edu

1 - Uncertainty Incorporated Beam Angle Optimization in IMPT Treatment Planning

Wenhua Cao, University of Houston, Houston, TX, 77004, United States of America, wcao@mail.uh.edu, Gino J. Lim

We used a worst-case approach to account for systematic uncertainties and errors of intensity modulated proton therapy (IMPT) delivery in our optimization model. The model set the dose calculation constraints in the most conservative way so that the deviation between planned and delivered dose distribution could be diminished at most. A linear programming based neighborhood search was used to find robust beam angles. Quality treatment plans were demonstrated for our selected real patient cases.

2 - A Convex Quadratic Model for Sector-duration Problem in PerfexionTM Treatment Planning

Hamid Ghaffari, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, ghaffari@mie.utoronto.ca, Mark Ruschin, Kimia Ghobadi, David Jaffray, Dionne Aleman

In this presentation, we present a convex quadratic optimization (QP) model to the sector duration optimization (SDO) problem arising in the Leksell Gamma Knife(R) Perfexion(TM) treatment planning which is originally considered as a non-linear piece-wise differentiable (NL) problem. While the QP model is faster, it increases the dimension of the problem significantly. We present a numerical comparison between the solution time and the quality of the plans created by the two forms.

3 - Geometric Isocentre Selection for Gamma Knife Perfexion Using Grassfire and Sphere-packing

Kimia Ghobadi, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, kimia@mie.utoronto.ca, Dionne Aleman, Mark Ruschin, David Jaffray, Hamid Ghaffari

We present a fast algorithm to select isocentres for both radiotherapy and radiosurgery plans for Gamma Knife Perfexion. The isocentre selection is based on a hybrid grassfire and sphere-packing approach. Shot durations for the selected isocentres are optimized using our existing sector duration optimization. The resulting treatment plans meet clinical criteria with good conformity. This isocentre selection provides a basis for irradiation over a continuous path to achieve better homogeneity.

4 - Organ Function Based Radiation Treatment Planning

Hao Howard Zhang, University of Maryland School of Medicine, 22 S Greene St, Baltimore, United States of America, hzhan001@umaryland.edu, Warren D'Souza, Nilesh Mistry, Robert Meyer

Recent advances in functional imaging modalities provide clinicians high-resolution functional heterogeneity information of organs-at-risk. We present the first step to utilize this information in treatment planning: reformulate the treatment planning optimization problem by directly incorporating tissue geometry and spatial function heterogeneity derived from anatomical and physiological images.

■ SC32

C - Room 217BC

Large-Scale Data Manipulation for Scenario-Building and Optimization Applications

Sponsor: Military Applications Society

Sponsored Session

Chair: David Myers, University at Buffalo (SUNY), 339B Bell Hall, Buffalo, NY, 14261, United States of America, djmyers2@buffalo.edu

1 - Data Farming and the Exploration of Military "What If?" Questions

Gary Horne, Research Professor, Naval Postgraduate School, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, gehorne@nps.edu, Steve Anderson, Ted Meyer

Data farming uses simulation modeling, high performance computing, and analysis to examine questions of interest with large possibility spaces. And it is being used to examine the plethora of What-If? questions that result when examining potential scenarios that our forces may face in the uncertain world of tomorrow. Here we will describe data farming and illustrate it in the context of application of future ship-to-shore and other capabilities to questions inherent in military decision-making.

2 - Optimizing Semester Assignment of United States Air Force Academy Cadets

Gerardo Gonzalez, Major, US Air Force, 17004 Park Trail Dr., Monument, CO, 80132, United States of America, gegonzal@mines.edu

We present an integer program that searches for optimal times to offer courses and then schedules students into those courses. The model accepts course offerings and students' course requirements and seeks to find a feasible schedule for the greatest number of students while minimizing the penalties associated with breaking any of the flexible (f) constraints. Constraints include: classroom size, instructor availability and preferences (f), and student military and athletic responsibilities (f).

3 - Optimizing Marine Security Guard Assignments

Emily Craparo, Research Assistant Professor, Naval Postgraduate School, Monterey, CA, United States of America, emcrapar@nps.edu, Maro Enoka

The Marine Corps Embassy Security Group (MCESG) assigns Marine security guards to embassy detachments worldwide. The assignment process considers a number of hard and soft constraints at the billet and detachment level. This works describes the Marine Security Guard Assignment Tool (MSGAT), a decision support tool designed to assist in the assignment process. MSGAT has resulted in an 80% reduction in workload while improving assignment quality in all measures of effectiveness.

4 - Policy Set Optimization for Synchronous Data Flow Nation-building Models

David Myers, University at Buffalo (SUNY), 339B Bell Hall, Buffalo, NY, 14261, United States of America, djmyers2@buffalo.edu, Mark Karwan

Synchronous data flow (SDF) simulation models made for the purpose of representing a nation-state are complex, dynamic systems. Traditional methods of simulation optimization require much computation time for the many runs and replications needed. Utilizing a graph-based meta-model that is based on the data flow simulation, allows an optimization framework to be developed. Several objectives (single and multiple criteria) and their associated solution methods will be explored and analyzed.

■ SC34

C - Room 218A

Emerging Topics in Public Health

Sponsor: Health Applications

Sponsored Session

Chair: Nan Liu, Assistant Professor, Columbia University, 600 W 168th Street, 6th Floor, New York, NY, 10032, United States of America, nl2320@columbia.edu

1 - Challenges Modeling Gastric Cancer Screening for High Risk Populations

David Hutton, University of Michigan, Ann Arbor, MI, United States of America, dwhutton@umich.edu, Kristie Lee

Gastric cancer screening has not been found to be cost-effective for the general US population. However, incidence is much higher in certain neglected populations. We have built a model to evaluate cost-effectiveness of gastric cancer screening for high-risk populations. This talk focuses on modeling challenges associated with this analysis, specifically estimating incidence for this population and estimating the effectiveness of interventions without randomized controlled trial data.

2 - Driving the Road Toward Obesity: Can Transportation Help the United States Change Course?

Sheldon Jacobson, Professsor, University of Illinois, 201 N. Goodwin Avenue, MC258, Urbana, IL, 61801, United States of America, shj@illinois.edu, Rong Yuan, Douglas King

Vehicle travel and obesity rates in the United States have surged in recent decades. This talk investigates the close relationship between trends in miles driven per licensed driver and adult obesity rates using linear regression. High correlation between these trends supports an interdisciplinary approach to tackle increased driving and obesity.

3 - The Cost-effectiveness of an HIV Vaccine with Exponentially Declining Efficacy

Elisa Long, Yale University, Yale School of Management, New Haven, CT, United States of America, elisa.long@yale.edu, Douglas Owens

With 56,000 new HIV infections occurring annually in the US, additional prevention efforts are needed. Results from a 2009 clinical trial in Thailand showed an HIV vaccine with rapidly waning efficacy. We estimated a parametric function for vaccine efficacy and applied this to a dynamic HIV transmission model to estimate potential HIV infections prevented and the cost-effectiveness of a mass vaccination program in the US. We also considered the effects of booster strategies on health outcomes.

4 - Capacity and Clinical Consequences of Variation in Obstetric Delivery Methods

Nan Liu, Assistant Professor, Columbia University, 600 W 168th Street, 6th Floor, New York, NY, 10032, United States of America, nl2320@columbia.edu, Linda Green

It has been widely recognized that elective obstetrics procedures (i.e. cesareans and inductions) are vastly overused. Based on 2 years of data from 42 NYC hospitals, we use statistical methods and queuing models to explore practice variation in NYC obstetrics units and analyze the implications for clinical outcomes and capacity needs.

■ SC35

C - Room 218B

Modeling and Prediction for Service and Energy Market

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Patrick McSharry, Research Fellow, Smithschool, University of Oxford, Hayes House, 75 George Street, Oxford, Un, OX1 2BQ, United Kingdom, patrick.mcsharry@smithschool.ox.ac.uk

Co-Chair: Abe Zeid, Northeastern University, Room 334SN, Boston, MA, United States of America, zeid@coe.neu.edu

1 - The Power of Twitter on Predicting Box Office Revenues and Financial Markets

Joo Young Jeon, Junior Research Fellow, Smithschool, University of Oxford, Hayes House, 75 George Street, Oxford, OX1 2BQ, United Kingdom, joo.jeon@smithschool.ox.ac.uk, Patrick McSharry

Recent years have witnessed an extraordinary surge of social networking and microblogging services. The Twitter data stream allows access to tweets, timestamps and locations. Efficient time series models and sentiment analysis techniques are required to process this high volume datafeed and to provide real-time public mood analysis. We found evidences that frequencies of contemporaneous tweets and public sentiments are useful for predicting box-office revenues and variables in financial markets.

2 - Analysis of Ultra-short Term and Short Term Forecasting of Wind Power

Xinxin Bai, IBM research- China, diamondBuilding,ZhongguancunSoftwarePark, Beijing, China, baixx@cn.ibm.com, Meng Zhang, Xiaoguang Rui, Haifeng Wang, Wenjun Yin, Jun Zhang, Yuhui Fu, Jin Dong

Wind power forecasting is vital for the scheduling and the safe-stable operation of power grid. In this paper, the ultra-short term prediction is made through an linear combination of the lternative competing models, where the weights for each model are based on their forecasting performance. The physical approach and data mining method are used for short term prediction on the basis of NWP . Results of the forecasting system application will be presented and analyzed.

3 - A Dated Routing Model for Airline Schedule Planning

Kumar Abhishek, United Airlines, 233 S Wacker Drive, Chicago, IL, 60606, United States of America, kumar.abhishek@united.com

A Dated routing model developed at United Airlines that creates maintenance feasible routes for any number of days. The model adheres to all maintenance requirements of checks, sequence length and day limits. The solution methodology for this integer programming model is the string based formulation that uses column generation and constrained shortest path method. Computational results are presented to discuss the efficiency of the algorithm.

4 - Aircraft Maintenance Routing Using Detailed Maintenance Program

Nima Safaei, Postdoctoral Fellow, University of Toronto, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, safaei@mie.utoronto.ca

For the most part, the literature on Aircraft maintenance routing problem (AMRP) has ignored the full range of maintenance requirements. A comprehensive mixed-integer mathematical formulation is proposed to solve AMRP over a short planning horizon, considering the detailed maintenance tasks for each individual aircraft. The objective is to minimize the maintenance costs in all maintenance bases as well as cost of undesirable positioning flights and to maximize maintenance opportunities for fleet.

■ SC36

C - Room 219A

Telecommunication Network Optimization

Sponsor: Telecommunications

Sponsored Session

Chair: Si Chen, Assistant Professor, Murray State University, Murray, KY, 42071, United States of America, si.chen@murraystate.edu

1 - Spanning Trees with Generalized Degree Constraints Arising in the Design of Wireless Networks

Luis Gouveia, Professor, University of Lisbon, Faculty of Sciences, DEIO-CIO, Cidade Universitària, Campo Grande, Lisbon, Portugal, legouveia@fc.ul.pt, Pedro Moura

We describe a minimum spanning tree problem with generalized degree constraints. On wireless networks, the signal strength on the receiver side of a link decreases with the distance transmitter/receiver. For each node we impose a degree constraint that depends on the length of the links adjacent to that node. Increasing the strength of a link increases the cost of the link but it also reduces the maximum degree on its end nodes. We create two models and relate the corresponding LP relaxations.

2 - Piecemeal P2P for Content Distribution

Jun Shu, Pennsylvania State University, State College, PA, United States of America, junshu@psu.edu, Susan Xu

We will present a model to investigate whether a Commercial P2P service model combining the necessary incentives for end users, technical design (security, performance, scalability, etc.), and management tools can deliver broadcast content over a point-to-point infrastructure. Our model looks as the demand volume increases, the supply capacity also increases with a moderate resource commitment from the service provider.

3 - An Access Network Optimization Problem with Hierarchical QoS Constraints

Gigyoung Park, Korea University, Sungbuk Ku Anam Dong, Seoul, Korea, Republic of, shadowpp@korea.ac.kr, Youngho Lee

We deal with an access network design problem arising from the deployment of broadband convergence networks. A nonlinear mixed integer model of the problem seeks to minimize the total cost while satisfying QoS constraints. We demonstrate the computational effectiveness of the proposed algorithm that implements the reformulation-linearization technique (RLT).

■ SC37

C - Room 219B

Condition Monitoring and Prognostics I

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Nagi Gebraeel, Associate Professor, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, nagi@isye.gatech.edu

1 - Joint Optimization of Sampling and Control of Partially Observable Failing Systems

Michael Kim, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, kimmi@mie.utoronto.ca, Viliam Makis

Stochastic control problems that arise in reliability and maintenance typically assume that information for decision-making is sampled at equidistant time points. We formulate and analyze the joint optimization of sampling and maintenance as a partially observable Markov decision process. The optimality of a stationary policy characterized by three critical thresholds is established, which have intuitive interpretation and give new insight into the value of condition-based maintenance programs.

2 - Modeling of Acoustic Emission Count Data for Fault Diagnosis of Mechanical Components

Haitao Liao, Assistant Professor, University of Tennessee, 211 Pasqua Building, Knoxville, TN, 37996, United States of America, hliao4@utk.edu, Seyed Niknam

Acoustic emission count data is an important source for detecting latent damage during the operation of a mechanical system or component. This research is focused on acoustic emission count data with a large portion of zero counts. To deal with such data, different statistical models are investigated with the objective of detecting incipient failures in their early stage.

3 - Predicting the Residual Life Distribution of Engineering Systems with Dependent Components

Linkan Bian, Georgia Institute of Technology, 765 Ferst Dr, Main 309, Atlanta, GA, 30332, United States of America, linkanbian@gatech.edu, Nagi Gebraeel

In many engineering systems, e.g., power grids, computer networks, etc., the degradation of one component may affect lifetimes of other interconnected components. We develop a stochastic model to capture the interactions among components as increments in their degradation rates. The proposed model is validated with simulation study and real-world bearing data. It shows that our prediction of RLD is more accurate than other benchmark models which do not consider the interactions among components.

4 - A Functional Time-Warping Approach for Degradation Modeling

Rensheng Zhou, Georgia Institute of Technology, 1903 Drew Dr. NW Apt 1202, atlanta, GA, 30318, United States of America, rzhou8@gatech.edu, Nagi Gebraeel, Nicoleta Serban

In this presentation, we discuss a functional time-warping methodology for modeling truncated degradation signals, i.e., signals that can only be observed up to a prespecified failure threshold. Historical degradation signals are used to estimate the model. In-situ signals from partially degraded units are then used to update the model and predict the residual life distributions of these units. We investigate the model performance using simulated signals and real world bearing signals.

■ SC38

H- Johnson Room - 4th Floor

Continuous Location Models and Applications

Sponsor: Location Analysis

Sponsored Session

Chair: Alper Murat, Assistant Profesor, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States of America, amurat@wayne.edu

1 - A Heuristic Procedure for the Integrated Facility Layout Design and Flow Assignment Problem

Alper Murat, Assistant Profesor, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States of America, amurat@wayne.edu, Ali Taghavi

We present an efficient iterative heuristic for integrated layout design and product flow assignment problem. Layout decisions involve planar location of unequal-area machines with duplicates. Product flows assigned to machines given routes. Integrated decision problem is NLPMIP that cannot be efficiently solved. We propose a novel heuristic based on alternating heuristic, perturbation and sequential location heuristics that is efficient and effective for solving small- to large-sized problems.

2 - Dividing a Territory Among Several Facilities

John Carlsson, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, jgc@isye.umn.edu

We give some exact algorithms for dividing a continuous geographic region into sub-regions so as to balance the workloads of a collection of facilities or vehicles over that region. As a side result we construct an explicit solution for various "mixed" cases of the Monge-Kantorovich transportation problem in the plane where one density is continuous and the other is a point mass.

3 - A Sequential Heuristic Approach for Solving Layout Design Problems

Mehmet Burak Senol, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, senolmehmet81@hotmail.com, Alper Murat, Ratna Chinnam, Ali Taghavi

We present a sequential heuristic procedure for solving continuous layout design problems. Rather than locating all free items at the same time, the procedure first group items in suitable clusters in a way that will best represent the tradeoffs and then locate items in each cluster sequentially. This approach discovers high-quality trade off relationships between optimality, efficiency and solution times depending on the number of clusters even for very large size problems.

■ SC39

H - Morehead Boardroom -3rd Floor

Health IT

Sponsor: Information Systems Society

Sponsored Session

Chair: Gordon Gao, Assistant Professor, University of Maryland, 4325 Van Munching Hall, College Park, 20742, United States of America, ggao@rhsmith.umd.edu

1 - Health IT Use Configurations and Hospital Performance

Nirup Menon, Associate Professor, George Mason University, 4400 University Drive, MS 5F4, Fairfax, VA, 20120, United States of America, nmenon@gmu.edu, Pankaj Setia, Sankara Srinivasan

This research examines the configurations of information technology use in hospitals. It seeks to determine the relationship between IT use configurations and performance. Data from two states in the US and the American Hospital Association are combined to create a dataset containing the level of use of different types of health IT and different measures of financial and operational performance measures at the hospital level.

2 - The Information Value of Online Physician Ratings

Gordon Gao, Assistant Professor, University of Maryland, 4325 Van Munching Hall, College Park, 20742, United States of America, ggao@rhsmith.umd.edu, Jeffrey McCullough, Ritu Agarwal, Brad Greenwood

Online physician ratings by patients have spread widely on the Internet these days, however little is known about their value in informing patients. This study examines the informativeness of physician ratings. Specifically, we seek to estimate the magnitude of two potential biases: (1) selection of physicians to rate; and (2) selection of opinions to express.

3 - An Empirical Study of Patients' Online Activities and Their Health Beliefs

Lu Yan, University of Washington, Foster School of Business, Seattle, WA, United States of America, lucyyan@uw.edu, Yong Tan

Healthcare related online communities have become more and more popular among patients. In this paper, we study whether patients' perceived treatment efficacy (PTE) could be affected by their online communications and treatment experience exchange. We find evidence for social influence among patients. The empirical results indicate that online social interactions can influence patients' PTE. The implications of these findings on pharmaceutical marketing and public policies are also discussed.

■ SC40

H - Walker Room - 4th Floor

Innovation in Platform Systems

Sponsor: Technology Management

Sponsored Session

Chair: Edward Anderson, Associate Professor, University of Texas-Austin, IROM Department, 1 University Station B6500, Austin, TX, 78712, United States of America, Edward.Anderson@mccombs.utexas.edu

1 - An Early Look at Large Numbers of Software Apps Developers and Patterns of Innovation

Kevin Boudreau, London Business School, Regent's Park, London, United Kingdom, kboudreau@london.edu

I study software producers building applications for leading handheld computer platforms. I find a lock-step link between numbers of producers and varieties of software titles as well as pronounced specialization and heterogeneity. I also find that adding producers stimulates investment incentives consistent with network effects, but also crowds out innovation incentives. Overall, innovation became more dependent on population-level diversity and variation rather than individual innovators.

2 - Internal Knowledge Markets

Marshall Van Alstyne, Boston University, Boston, MA, United States of America, mva@bu.edu, Hind Benbya

Internal markets can improve sharing, forecasting, innovation, and productivity. Despite their popularity, firms have struggled to implement them. We provide a platform framework that applies standard economic theories - on prices, money supply, and networks - to design information exchanges inside firms. Much prior work on "knowledge management" has been atheoretical such that management practice can benefit from theories that have much to say about movement and value of information.

3 - Adoption of a Two-tier Internet

Barrie R. Nault, University of Calgary, 2500 University Avenue NW, Calgary, AB, T2N 1N4, Canada, nault@ucalgary.ca, Steffen Zimmermann

An open and uncontrolled public Internet is subject to congestion and security threats, imposing negative externalities on users. The evolution to a two-tier (public and private) Internet is effectively a technology adoption and conversion problem. We develop a model of technology conversion towards a two-tier Internet that captures benefits and costs facing firms with choices of public versus private, the impact on industry profitability and social welfare, and the role of a planner.

4 - Integration Investment in Emerging Complementary Markets through Cospecialization

Edward Anderson, Associate Professor, University of Texas-Austin, IROM Department, 1 University Station B6500, Austin, TX, 78712, United States of America, Edward.Anderson@mccombs.utexas.edu, Geoffrey Parker

Using system dynamics, we explore the decisions an immature startup must make when entering a market with strong complementarities: financing structure, overall investment level in cospecializing to complementary technologies, and allocation of that investment. All technological trajectories are uncertain. Monte Carlo analysis is used to determine general trends. One trend that stands out is a preference for investing in at most one complementary technology rather than multiple technologies.

■ SC41

H - Waring Room - 4th Floor

How Organization and Network Structure Impact Innovation

Cluster: New Product Development

Invited Session

Chair: Raul Chao, University of Virginia, Darden School of Business, Charlottesville, VA, 22903, United States of America, ChaoR@darden.virginia.edu

1 - How to Exterminate Bugs Fast: Architecture, Experience and Bug Fixing Times

Jürgen Mihm, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, jurgen.mihm@insead.edu, Manuel Sosa, Tyson Browning

The interplay between product characteristics and organizational characteristics influences product performance, yet this is not well understood. Based on a sample of open-source software projects, we study how the architecture of the product and the experience of the developing team affect the time to fix product defects.

2 - Resource Allocation for New Product Development and the Value of Strategic Buckets

Jeremy Hutchison-Krupat, Georgia Insitute of Technology, C ollege of Management, Atlanta, GA, United States of America, Jeremy.Hutchison-Krupat@mgt.gatech.edu, Stylianos Kavadias

Firms wishing to pursue strategic NPD initiatives, face several key challenges. Such initiatives are implemented within the context of an organizational hierarchy where strategic portfolio decisions are made at the top, but critical specialized knowledge resides lower down, with functional managers. Given this information asymmetry, we characterize when it is in the firm's best interest to maintain decision rights over project budgets or delegate such rights to functional managers.

3 - Product Evolution and Platform Strategy: A Study of the Smartphone Industry

Rahul Basole, Georgia Institute of Technology, Tennenbaum Institute, Atlanta, GA, 30332, United States of America, rahul.basole@ti.gatech.edu

We examine how network structure, technology characteristics, and business model of a platform shapes interfirm coordination of smartphone launches in the global mobile device industry using a primary data set of 784 launches between 2003-2011. We complement our analysis with a visualization of the product-platform network evolution.

4 - Equity Alliances in the Pharmaceutical Industry: Joint Ventures vs. Licensing Agreements

Niyazi Taneri, PhD Student, University of Cambridge, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, n.taneri@jbs.cam.ac.uk, Arnoud De Meyer

We build a model of equity licensing with a view of understanding the choice between joint ventures and equity licensing contracts when forming alliances. The predictions of the model and two further hypotheses are tested with data from the pharmaceutical industry. The findings also shed light on the debate in the law literature on the enforceability of IP laws in emerging countries.

■ SC42

H - Gwynn Room - 4th Floor

Online Markets: Participation and Performance

Sponsor: Information Systems Society

Sponsored Session

Chair: Ashish Agarwal, Assistant Professor, University of Austin at Texas, CBA 5.234, Austin, TX, 78759, United States of America, Ashish.Agarwal@mccombs.utexas.edu

1 - Social Influences and Technology Use: Social Computing in an Organizational Context

Sunil Wattal, Temple University, 1810 N 13th Street, Philadelphia, PA, 19122, United States of America, swattal@temple.edu, Doug Schutz, Munir Mandviwalla

In this paper, we draw from theories of social influence, technology adoption, and network externalities to develop and test a model to study two different types of uses of social media: sharing and seeking information. Using survey data collected from a large multi-national company, we propose that the multiple dimensions of use by others create a rich depth of social influences which have varied impact on the use of social computing tools by an individual.

2 - Certifications in Online Labor Markets

Mingfeng Lin, Assistant Professor, University of Arizona, 1130 E. Helen St, Tucson, AZ, 85721, United States of America, mingfeng@eller.arizona.edu, Paulo Goes

Third-party certification is a popular form of information disclosure. Drawing on related information economics literature, we exploit several natural experiments in an online market to test a series of hypotheses regarding vendors' certification behavior and its consequences.

3 - Lipstick on Pigs: How Informative Are Online Reviews of Credence Goods?

Shannon Lantzy, PhD Student, University of Maryland, 3330 Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, slantzy@rhsmith.umd.edu, Siva Viswanathan

Online word of mouth (WOM) has grown significantly in the past few years. We argue that, in the market for credence goods such as expert services, online WOM is a measurement of amenities rather than true quality. We empirically test the information value of online WOM for doctors, a classic credence good.

4 - Pure Play Online Retailer vs. Click and Mortar Retailer:

Ashish Agarwal, Assistant Professor, University of Austin at Texas, CBA 5.234, Austin, TX, 78759, United States of America, Ashish.Agarwal@mccombs.utexas.edu, Prabhudev Konanna, Alvin Leung

We take a market valuation approach to evaluate the relative merit of the pure online model vs the dual channel model for retailers. We consider a panel of publicly traded US retailers following a pure-play and dual channel approach We find that the dual channel retailers receive a market premium for their sales revenue as compared to the pure-play retailers. This higher valuation can be associated with higher customer satisfaction.

■ SC43

H - Suite 402 - 4th Floor

Planning and Decision Making for Electric Vehicles

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Timothy Sweda, Northwestern University, 2145 Sheridan Rd., Rm. C210, Evanston, IL, 60208, United States of America, tsweda@u.northwestern.edu

1 - Optimal Design and Allocation of Electrified Vehicles and Charging Infrastructure for GHGs and Cost

Elizabeth Traut, Graduate Research Assistant, Carnegie Mellon University, Scaife Hall, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, etraut@cmu.edu, Erica Klampfl, Yimin Liu, Chris Hendrickson, Jeremy Michalek

We pose an MINLP model and solution technique to study factors affecting greenhouse gas (GHG) emissions and cost reduction potential of electrified vehicles by the design and allocation of plug-in hybrid electric vehicles (PHEVs), battery electric vehicles, and charging infrastructure over multiple scenarios. We find that hybrid-electric vehicles and PHEVs provide the greatest reduction in GHGs under most scenarios and that the effects of workplace charging availability are small.

2 - The Electric Vehicles and Development of An Optimal Strategy for German Car Makers

Fikret Korhan Turan, Assistant Professor, Istanbul Kemerburgaz University, Department of Industrial Engineering, Mahmutbey Dilmenler Caddesi, No:26, 34217, Istanbul, Turkey, korhan.turan@kemerburgaz.edu.tr, Selcuk Goren, Akiner Tuzuner

Different than previous approaches, using simulation and optimization techniques simultaneously, we develop a decision model that will assist German car makers to minimize their increasing costs due to tight regulations set by the European Commission and Federal German government such as CAFE, supercredits and CO2 emissions fees. We propose various optimal strategies under different regulatory frameworks, and simulate the diffusion of electric vehicles to the German car market.

3 - An Agent-based Decision Support System for Electric Vehicle Charging Infrastructure Deployment

Timothy Sweda, Northwestern University, 2145 Sheridan Rd., Rm. C210, Evanston, IL, 60208, United States of America, tsweda@u.northwestern.edu, Diego Klabjan

The current scarcity of public charging infrastructure is a major barrier to mass household adoption of electric vehicles (EVs). Drivers are reluctant to purchase EVs without convenient charging access away from home, but investors are hesitant to build charging stations without knowledge of EV demand realization. We present an agent-based decision support system for identifying patterns in residential EV ownership and usage to enable strategic deployment of new charging infrastructure.

■ SC44

H - Suite 406 - 4th Floor

Asymmetric Effects in Supply Chain Disruption

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Alan Johnson, Associate Professor, Air Force Institute of Technology, Department of Operational Sciences, Wright-Patterson AFB, OH, United States of America, Alan.Johnson@afit.edu

1 - Dynamic Effect of Inland Port Supply Chain Disruptions on Interdependent Economic Systems

Raghav Pant, PhD Candidate, University of Oklahoma, School of Industrial Engineering, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, rpant@ou.edu, Kash Barker, Thomas Landers

We present a model that divides inland waterway port supply chain into four processes: commodity arrival, yard storage, crane operations, and commodity departure. We investigate disruptive scenarios affecting the daily commerce in port supply chain and combine these with a dynamic interdependency model to quantify the adverse impacts of disruptions on industry resilience and inoperability across multiple regions. A case study of ports on Arkansas River Navigation System illustrates the model.

2 - Stealthy River Navigation in Jungle Combat Conditions

Alan Johnson, Associate Professor, Air Force Institute of Technology, Department of Operational Sciences, Wright-Patterson AFB, OH, United States of America, Alan.Johnson@afit.edu, Fabio Cardoso

A problem for the Brazilian military is to support jungle warfare in the Amazon. The jungle's heat, humidity, and dense vegetation put significant demands on the supply chain. Further, water transport is the best sustainment option. Planners must select watercourses that provide stealthy navigation to a combat force location where supplies can be safely unloaded. We propose a method of determining a path through a river network that blends short transit times with maximal forest shade.

3 - Strategic Behavior of Suppliers in the Face of Production Disruptions

Suleyman Demirel, PhD Candidate, University of Michigan, Ross School of Business, 701 Tappan Avenue, Ann Arbor, MI, 48109-1234, United States of America, sdemirel@umich.edu, Ching-Hua Chen-ritzo, Roman Kapuscinski

We consider a manufacturer choosing to source from a reliable supplier, an unreliable one, or both. The suppliers compete, but can set prices depending on the manufacturer's sourcing policy. In the equilibrium, the buyer could be sole-sourcing from either of the suppliers, or use the reliable one only as a backup supplier (flexible sourcing). We find that, compared to single sourcing, there may be no benefit of flexible sourcing for the manufacturer, while suppliers may benefit.

■ SC45

H - Suite 407 - 4th Floor

Spectrum Auctions

Cluster: Auctions

Invited Session

Chair: Bob Day, Assistant Professor, University of Connecticut, 2100 Hillside Rd, Unit 1041, Storrs, CT, 06269-1041, United States of America, bob.day@business.uconn.edu

1 - The Use of Optimization Modeling to Repack Broadcasters in an Incentive Auction for Spectrum

Karla Hoffman, Professor, George Mason University, 4400 University Drive, Mail Stop 4A6, Fairfax, VA, 22030, United States of America, khoffman@gmu.edu, Antony Coudert, Rudy Sultana, Dinesh Menon

The FCC proposes to incentivize incumbent broadband licensees to vacate spectrum voluntarily. Broadcasters provide prices at which they are willing to either give up their licenses, move to VHF channels or co-share an existing channel. An optimization then determines the best way to repack broadcasters to create a contiguous block of cleared spectrum. Thw cleared spectrum would then be auctioned to new licensees according to an FCC-specified band plan. We present our work on this problem.

2 - Incentive Auctions

Peter Cramton, Professor of Economics, University of Maryland, Economics Department, Tydings Hall, College Park, MD, 20742, United States of America, pcramton@gmail.com

An incentive auction is proposed. It enables the exchange of spectrum from a low-value use to a high-value use. The auction has three stages: a reverse auction to determine the supply curve for spectrum, a repacking stage for freeing contiguous spectrum nationwide, and a forward auction for determining the demand curve. The auction determines the parties that are giving up spectrum, reorganizes the remaining parties to free-up spectrum, and determines the assignment and pricing of the new band.

3 - Approximating Optimal Combinatorial Auctions for Complements Using Restricted Welfare Maximization

Tuomas Sandholm, Professor, Carnegie Mellon University, Pittsburgh, PA, United States of America, sandholm@cs.cmu.edu, Pingzhong Tang

We introduce an avenue for increasing revenue where we curtail the allocation space based on bids and then maximize welfare. In this first step down this avenue, we introduce a new form of "reserve pricing" into combinatorial auctions. Levin's optimal revenue can be 2-approximated by using "monopoly reserve prices" to curtail the space, followed by welfare maximization and Levin's payment rule. We achieve a 6-approximation if the "reserve pricing" has to be symmetric across bidders.

■ SC46

H - Suite 403 - 4th Floor

Case Competition II

Sponsor: INFORM-ED

Sponsored Session

Chair: Mike Racer, University of Memphis, 334 Fogelman, Memphis, TN, 38152, United States of America, mracer@memphis.edu

1 - FLORA (A) and (B): National

Anton Ovchinnikov, Assistant Professor, University of Virginia, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, Ovchinnikov@darden.virginia.edu, Samuel E. Bodily

The (A) case addresses the decision to open a "pilot" production facility in a single city (Miami). The key decision is which online customer acquisition strategy to use: premium strategy or a discount strategy. Each strategy has its own benefits and risks, but the overall economics can be improved if Josh figures out how to proactively switch strategies as he learns about some of the main uncertainties. The (B) case addresses the decision about national expansion (building production facilities in all major metro areas). The decision between the premium and discounted strategies is now even more complicated because of the possible competitive response.

2 - Designing a Malaria Intervention Supply Chain: A Case Study and Interactive Game

Jacqueline Griffin, PhD Candidate, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332-0205, United States of America, jackie.griffin@gatech.edu, Hannah Smalley, Pinar Keskinocak, Mallory Soldner

This case study and corresponding computer game simulate real world decisions made in the design of malaria indoor residual spraying (IRS) operations including the location of distribution centers, scheduling of spray team deployment, and allocation of scare resources. The purpose of this case study, and accompanying game, is to reinforce skills in mathematical model development and provide a real world example of the application of operations research methodology including mathematical programming and heuristic development.

■ SC47

H - Dunn Room - 3rd Floor

Vehicle Routing: Real-life Applications

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Tom Van Woensel, Professor of Freight Transport and Logistics, Eindhoven University of Technology, School of Industrial Engineering, Eindhoven, BR, Netherlands, t.v.woensel@tue.nl

1 - The Dynamic Shortest Path Problem: Hybrid Routing Policies with Disruptions at the Network

Derya Sever, Technical University of Eindhoven, 5600 MB, Eindhoven, Netherlands, d.sever@tue.nl, Ton de Kok, Tom Van Woensel, Nico Dellaert

Travel time disruptions lead to significant increases in transportation costs. We develop hybrid routing policies to respond to the stochasticity in networks. Hybrid routing policies are developed off-line where the actual policy is selected according to real-time information. The hybrid routing policies use different levels of network knowledge and disruption information. Furthermore, we investigate the conditions when the various routing strategies perform better under various network data.

2 - Vehicle Routing and Scheduling for Blood Collection

Ali Ekici, Assistant Professor, University of Houston, Department of Industrial Engineering, Houston, TX, 77204, United States of America, aekici@central.uh.edu, Orsan Ozener

In many countries, people still die because of inadequate supply of blood products. Blood is needed for several types of treatments including organ transplants, cancer and anemia treatments. In blood supply management, an important step is processing donated blood within a certain amount of time after donation. In this research, motivated by the practices in blood supply management, we study a variant of the Vehicle Routing Problem and develop heuristic algorithms to find good solutions.

3 - Vehicle Routing Problem with Stochastic Travel Times and Time Windows

Duygu Tas, Doctoral Candidate, Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513 5600 MB, Eindhoven, Netherlands, d.tas@tue.nl, Nico Dellaert, T om Van Woensel, Ton de Kok

Consider a vehicle routing problem with soft time windows and stochastic travel times with a known probability distribution leading to stochastic arrival times. We propose a model constructing efficient routes to service the different customers as reliable as possible in their delivery time windows. We describe our model and solution methods, and present our results based on well-known problem instances.

4 - A Parallel GRASP for the Therapist Routing and Scheduling Problem

Jonathan Bard, Professor, The University of Texas, Operations Research Group, Austin, TX, 78712, United States of America, jbard@mail.utexas.edu, Ahmad Jarrah, Yufen Shao

This talk presents a parallel GRASP for solving a weekly routing and scheduling problem for therapists. The problem contains both fixed and flexible patients with respect to appointment times, and two grades of therapists. In Phase I, feasible solutions are constructed day by day by solving a series of assignment problems. In Phase II, a high-level neighborhood search is proposed to obtain local optima. Performance is demonstrated using real and randomly generated data sets.

5 - An Exact Approach to the VRPTW and Break Scheduling

Tom Van Woensel, Professor of Freight Transport and Logistics, Eindhoven University of Technology, School of Industrial Engineering, Eindhoven, BR, Netherlands, t.v.woensel@tue.nl, Said Dabia, Ton de Kok, Nico Dellaert, Anna Franceschetti

We consider restrictions such as driving hours regulations in the VRPTW. We demonstrate a Branch and Bound and Cut approach to the proposed problem. Numerical results are given for realistic settings and benchmarked to previous work in the literature.

■ SC48

H - Graham Room - 3rd Floor

Advances in Traffic Equilibrium

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: N. Nezamuddin, University of Texas at Austin, 1 University Station C1761, ECJ 6.512, Austin, TX, 78712, United States of America, nezam@mail.utexas.edu

1 - Investigating the Performance of Path-based Algorithms for the Static User Equilibrium Traffic Assignment Problem

Amit Kumar, Graduate Research Assistant, Purdue University, Nextrans Center, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, kumar44@purdue.edu, Srinivas Peeta, Yu (Marco) Nie

This study investigates the relative performance of path-based algorithms for the static user equilibrium problem for networks of different size using three approaches: simultaneous approach, one origin to all destinations approach, and the sequential approach. Computational experiments are performed to compare the noise in the solution at the same level of convergence using the three approaches for each algorithm.

2 - A Combinatorial Algorithm and Warm Start Method for Multi-destination Dynamic User Optimal Problem

N. Nezamuddin, University of Texas at Austin, 1 University Station C1761, ECJ 6.512, Austin, TX, 78712, United States of America, nezam@mail.utexas.edu, Travis Waller

A polynomial combinatorial algorithm for multi-destination dynamic user optimal problem is developed. The algorithm is stated on a time-expanded cell transmission model (CTM) network; CTM ensures that traffic dynamics are adequately captured. Output of the combinatorial model is used to warm start a simulation-based dynamic traffic assignment (DTA) model. The combinatorial model complements simulation-based DTA models in implementing various policy measures and active traffic control strategies.

3 - Shipment Dispatching on Capacitated Networks

Chinmoy Mohapatra, University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, chinmoym@mail.utexas.edu, Anantaram Balakrishnan, Brian Roth

Motivated by shipment dispatching decisions in transportation, we address the problem of assigning shipments to scheduled transport services that share common capacitated resources so as to minimize total transit time. At each node, shipments that use the same outbound service are dispatched in first-in first-out order. We discuss modeling and algorithmic enhancements to effectively solve this large-scale integer program, and present computational results for actual problem instances.

4 - Road Network Privatization: Alternative Approaches and a Hybrid Modeling System

Lei Zhang, Assistant Professor, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu, Shanjiang Zhu, Dilya Yusufzyanova

This research develops a hybrid modeling system to analyze alternative approaches for road network privatization. The hybrid method synergizes the strengths of mathematical programming models in representing optimizing behavior and the advantages of rule/agent-based techniques in simulating dynamic interactions on dissimilar time scales in large complex systems. Two popular road privatization schemes, namely private-sector takeover of existing roads and new private toll roads, are analyzed.

5 - Empirical Validation of Traffic Oscillation Growth under Nonlinear Car-following Behavior

Xiaopeng Li, University of Illinois, Department of Civil Environmental Engineering, Urbana, IL, United States of America, xli2@illinois.edu, Yanfeng Ouyang, Xin Wang

This paper presents an empirical framework that uses observed vehicle trajectory data to validate the analytical method in Li and Ouyang (2011) for predicating traffic oscillation properties (i.e., dominating frequency and amplitude growth) under nonlinear car-following laws. Empirical experiments with real-world trajectory data show that the prediction nicely matches with simulation and field observations.

■ SC49

H - Graves Room - 3rd Floor

Joint Session Simulation/QSR: Design of Experiments and Statistical Analysis for Simulation

Sponsor: Simulation/Quality, Statistics and Reliability

Sponsored Session

Chair: Hong Wan, Assistant Professor, Purdue University, 315 N. Grant Street, GRIS 327, West Lafayette, IN, 47907, United States of America, hwan@purdue.edu

Co-Chair: Bruce Ankenman, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America

1 - Stochastic Kriging Metamodels Plus: Exploiting Gradient Estimates

Xi Chen, PhD Candidate, Northwestern University, Department of IEMS, 2145 Sheridan Road, Room C229, Evanston, IL, 60208-3119, United States of America, xichen2013@u.northwestern.edu, Barry L. Nelson, Bruce Ankenman

Stochastic kriging is a new metamodeling technique proposed for effectively representing the mean response surface implied by a stochastic simulation; it takes into account both stochastic simulation noise and uncertainty about the underlying response surface of interest. We show that incorporating gradient estimates into stochastic kriging tends to enforce known properties of the response surface and significantly improves surface prediction.

2 - Quoting Manufacturing Due Dates via Simulation-based Statistical Methods

Feng Yang, Assistant Professor, West Virginia University, P.O. Box 6070, Morgantown, WV, 26506, United States of America, Feng.Yang@mail.wvu.edu, Minqi Li, Jingang Liu

This work is concerned with quoting a due date for each customer order to achieve a target service level. The key to the due date quotation lies in the accurate and precise estimation of the flow time of an order through the manufacturing system. In this work, a simulation-based statistical method was developed which is able to timely predict the flow time distribution of an order while taking into account the shop status at the arrival of the order.

3 - Optimal Supersaturated Design for Penalized Variable Selection Methods

Dadi Xing, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States of America, dxing@purdue.edu, Yu Zhu, Hong Wan

In the supersaturated design(SSD)study, most existing criteria for constructing optimal SSD are motivated and further justified from the estimation perspective. We will propose a number of optimality criteria for the construction of SSD from the perspective of penalized variable selection methods. The properties of these criteria will be discussed. A computing algorithm will be used to construct such optimal SSD, examples of simulation and an application of tue algorithm will also be presented.

4 - Relative Error Stochastic Kriging

Mustafa Tongarlak, Northwestern University, Kellogg School of Management, Evanston, IL, 60208, United States of America, mtongarlak@u.northwestern.edu, Barry L. Nelson, Bruce Ankenman

We use stochastic kriging to build predictors with bounded relative error over the design space. We propose design strategies that guide sequential algorithms with and without adaptation to the data to make allocation and stopping decisions such that a prespecified relative precision is realized with some confidence.

■ SC50

H - Ardrey Room - 3rd Floor

Data Mining for Business

Sponsor: Data Mining

Sponsored Session

Chair: Lian Duan, the University of Iowa, 523 Hawkeye Ct, Iowa City, 52246, United States of America, lian-duan@uiowa.edu

1 - Bayesian Embedding of Co-occurrence Data for Query-based Visualization

Mohammad Khoshneshin, University of Iowa, Iowa City, IA, 52246-1769, United States of America, mohammad-khoshneshin@uiowa.edu, Nick Street, padmini srinivasan

We propose a generative probabilistic model for visualizing co-occurrence data. We propose a Bayesian approach to infer the latent variables. Furthermore, we propose a method to embed a filtered number of entities for a queryóquery-based visualization. Our experiments show that our proposed models outperform the state-of-the-art model for visualizing co-occurrence data.

2 - Dynamic Pricing in Reputation-based Group Buying E-commerce

Zongze Chen, the University of Iowa, 101 Hawk Ridge Drive, Apt 1115, Iowa City, IA, 52246, United States of America, zongze-chen@uiowa.edu

Dynamic pricing is an important and useful way to generate profit for business. It changes price over time period due to different factors. Our concerning to generate a optimal policy here is to consider the reputation as one important determinant. The reputation includes the ratings and the social influence factors inside a group buying ecommerce business.

3 - Community Detection through Correlation

Lian Duan, the University of Iowa, 523 Hawkeye Ct, Iowa City, 52246, United States of America, lian-duan@uiowa.edu, Nick Street

Community detection is an important task for social networks. It helps us understand the functional modules on the whole network. However, different methods provide different results, and we will investigate how correlation search help the community detection method.

■ SC51

H - Caldwell Room - 3rd Floor

Transit Systems

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Steve Boyles, University of Wyoming, 1000 E. University Avenue, Laramie, WY, 82071, United States of America, sboyles@uwyo.edu

1 - Searching for Parking on a Network: A Stochastic Shortest Path Approach

Sadegh Safaripoor, University of Wyoming, WY, United States of America, msafarip@uwyo.edu, Steve Boyles

Parking is a significant component of urban transportation system, and searching for parking is resopnsible for a surprising proportion of vehicle traffic and emissions. This research develops a parking search model reflecting parking availability as a stochastic process on a network. Numerical tests show that this approach scales better to larger scale networks than existing approaches.

2 - Robust Route Selection for Transit Networks

Steve Boyles, University of Wyoming, 1000 E. University Avenue, Laramie, WY, 82071, United States of America, sboyles@uwyo.edu, Yanfei Sui

This research considers a stochastic transit network design problem, where certain roadway links may become unusable due to weather, maintenance, or other events. The goal is to choose transit routes which are robust to potential disruptions both in user costs and operating costs due to these closures. Simulated annealing is applied to solve this model in several networks.

3 - Solving the Bus Rapid Transit (BRT) Route Design Problem with Multiple Corridors

Jaime E. Gonzàlez, Instructor, Universidad de los Andes, Departamento de Ingenierìa Industrial, COPA, Bogotà, Colombia, je.gonzalez30@uniandes.edu.co, Andrés L. Medaglia, Leonardo Lozano, Jose L. Walteros

The Bus Rapid Transit Route Design Problem (BRTRDP) consists of finding a set of routes and frequencies that minimizes the total travel time. We present a mathematical formulation for the multi-corridor BRTRDP and an exact solution scheme based on simultaneous column and cut generation.

4 - A Stochastic Programming Approach for Robust Vehicle Scheduling in Public Bus Transport

Marc Naumann, DS&OR Lab - University of Paderborn, Warburger Strasse 100, Paderborn, 33098, Germany, naumann@dsor.de, Leena Suhl, Stefan Kramkowski

Vehicle schedules in public transport are usually planned several weeks before their execution. On the day of operations, the real driving times might vary due to disruptions. These cause penalty fees and increase operational costs. We present a new SP-approach for an intelligent insertion of buffer times between service trips. We show that our method significantly decreases total expected costs and that it outperforms the simple approach of adding fixed buffer times between service trips.

5 - Modeling Transit in Regional Dynamic Travel Models: FAST-TrIPs

Mark Hickman, Associate Professor, University of Arizona, 1209 E. Second Street, Bldg. 72, Tucson, AZ, 85721-0072, United States of America, mhickman@email.arizona.edu, Hyunsoo Noh, Neema Nassir, Alireza Khani

We have developed a model called FAST-TrIPs (Flexible Assignment and Simulation Tool for Transit and Intermodal Passengers) that serves as an add-in to regional dynamic traffic assignment (DTA) models. The model handles the assignment and simulation of transit passengers, as well as the assignment for intermodal (auto + transit) trips. This presentation emphasizes tools for intermodal assignment with activity-based travel demand models.

■ SC52

H - North Carolina - 3rd Floor

Internal Boundaries of the Firm

Sponsor: Organization Science

Sponsored Session

Chair: William Mitchell, Professor, Duke University, Fuqua School of Business, & Rotman School, University of Toronto, Durham, NC, 27708, United States of America, willm@duke.edu

1 - How Firms' Capital Budgeting Methods Differ as Knightian Uncertainty and Controversy Vary

Richard Burton, Professor, Duke University, Fuqua School of Business, 100 Fuqua Drive, 90120, Durham, NC, 27708, United States of America, rich.burton@duke.edu, Hyounggoo Kang, William Mitchell

Capital budgeting is a contentious subject in research and managerial practice. We reconcile competing views by extending the behavioral theory of the firm to encompass capital budgeting methodologies. In doing so, we develop a more general organizational capital budgeting model (OCBM) that incorporates traditional capital budgeting theories along with considering the degree of uncertainty and controversy underlying the assumptions that firms must make in their capital budgeting activities.

2 - What does Corporate Social Responsibility Mean in Russia?

Olga Hawn, PhD Candidate in Strategy, The Fuqua School of Business, Duke University, 1 Towerview Drive, Durham, 27708, United States of America, olga.hawn@duke.edu

Awareness of differences in understanding and hence, implementing of management concepts is critical in doing research across international boundaries. This qualitative study examines definition and scope of corporate social responsibility (CSR) in Russia, comparing it to western understanding of CSR, and developing theory and guidance for research in emerging markets.

3 - The Organization of R&D in American Corporations: Determinants and Consequences of Decentralization

Luis A. Rios, Duke University, 1 Fuqua Drive, Durham, NC, 27708, United States of America, luis.rios@duke.edu

Using a novel dataset on 1,290 corporations, we explore the tension between centralization and decentralization of R&D. We develop two measures of decentralization, and find centralized R&D to be more scientific, broader in scope, and have more technical impact. Additionally, we find that firms with a more decentralized structure, on average, invest more in R&D, generate more patents per R&D, and exhibit greater sales growth and higher market value.

4 - Learning Within Hierarchies: Corporate Structure and Business Unit Adaptation through Feedback

John Joseph, Assistant Professor, Duke University, 1 Towerview Rd, Durham, NC, 27718, United States of America, john.e.joseph@duke.edu, Vibha Gaba

This study examines the effects of the corporate structure on business unit adaptation through performance feedback. Empirically, we examine the effects of corporate and BU feedback on BU adaptation through new product introductions. The study contributes to the organizational learning literature by linking performance feedback theory with theories of attention and M-form organizations and emphasizes both cognitive and structural drivers of attention in business unit adaptation.

■ SC53

H - South Carolina - 3rd Floor

Supervised Learning for System Analysis

Sponsor: Data Mining

Sponsored Session

Chair: George Runger, Professor, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, George.Runger@asu.edu

1 - Multiple Instance Learning Based Time Series Classification

Mustafa Baydogan, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, mbaydoga@asu.edu, George Runger

This work presents a multiple instance learning framework to classify time series data. We propose a method to extract local features that have the potential of defining a pattern. Local features are summarized using a vector quantization then using local and the global information about the time series, we train a classification algorithm to find out exact labels. Our results show that the method performs consistently well.

2 - Effective and Interpretable Time Series Classification

Houtao Deng, Arizona State University, Computing, Informatics, Systems Eng., Tempe, AZ, United States of America, hdeng3@asu.edu, George Runger, Eugene Tuv

System data are often represented as time series (univariate or multivariate) and classification for such data is important. Previous work has considered diverse methods (such as nearest neighbors or feature extraction). An interpretable model is useful and features also need to consider the length and location of time segments. Time series classifiers are summarized and research with modified objective functions for feature extraction is described and compared on benchmark data.

3 - Feature Selection for High-dimensional, Disparate Data

George Runger, Professor, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, George.Runger@asu.edu, Eugene Tuv

Feature selection for high-dimensional data is important for interpretability and performance. The complexity of modern data (disparate, noisy, missing, nonlinear, etc.) challenges traditional methods. Tree-based ensembles are modified to account for effects such as relevance and redundancy, variable cardinality, secondary predictors, etc. Statistical criteria are incorporated to quantify risks. Our latest algorithms are described and compared to alternatives with illustrative examples.

■ SC54

H - Charlotte Hall - 3rd Floor

Joint Session Doing Good/SPPSN: Doing Good with Good OR Competition: Finalist Presentations I

Cluster: Doing Good with Good OR Competition/Public Programs, Service and Needs

Invited Session

Chair: Michael Johnson, Associate Professor, University of Massachusetts Boston, 100 Morrissey Boulevard, McCormack Hall, Room 3-428A, Boston, MA, 02125-3393, United States of America, Michael.Johnson@umb.edu

1 - REACH: An OR-based HIV Resource Allocation Tool for Decision Makers

Sabina Alistar, Stanford University, 475 Via Ortega, Stanford, CA, 94305, United States of America, ssabina@stanford.edu, Margaret Brandeau, Eduard Beck

HIV continues to infect and kill millions each year, yet funds to control it are scarce. The Resource Allocation for Control of HIV (REACH) model is a planning tool for decision makers to evaluate the impact and identify the best use of funds for prevention and treatment of HIV. Developed in collaboration with UNAIDS, REACH is user friendly and flexible.

2 - Improving Patient Flow in Emergency Departments

Soroush Saghafian, PhD Candidate, University of Michigan, Ann Arbor, MI, United States of America, soroush@umich.edu, Wallace Hopp, Mark Van Oyen, Jeffrey Desmond, Steven Kronick

Emergency Departments (ED's) are experiencing crisis levels of overcrowding, long delays and elevated risks of adverse events. We propose methods based on patient streaming and prioritization to improve patient flow. We develop OR models and perform analyses and simulations to show that our proposed approaches can substantially improve responsiveness and patient safety in ED's.

3 - Gwinnett County Public Schools: OR/MS Drives Improvements in Bus Logistics

Kathleen Hendrix, Georgia Institute of Technology, 765 Ferst Dr., GA, 30332, United States of America, khendrix7@gatech.edu, Dana Lupuloff, Doug Meagh, Jeffrey Phillips, Michael Vallecoccia, Julie Swann, Morgan Doty, Bryce Dykes, Ralph Long

Gwinnett County Public Schools must provide transportation to its 161,000 students. In 2012, GCPS will experience a decreased budget and an increased projected enrollment. We created multi-level heuristics for assigning buses and start times, informed by regression models, compared with optimization models, and integrated methods into a Java-based tool.Our approach saved more than 2,000,000 dollars annually. The approach could be implemented in school systems around the nation to help education.

■ SC55

H - Mecklenburg Hall - 3rd Floor

Joint Session CPMS/Analytics: Edelman Reprise I

Sponsor: CPMS, The Practice Section of INFORMS/Analytics

Sponsored Session

Chair: Doug Samuelson, President, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

Co-Chair: Stephen C. Graves, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Avenue E62-579, Cambridge, MA, 02139, United States of America, sgraves@mit.edu

1 - Tax Collections Optimization for New York State

Naoki Abe, Manager, Analytics Algorithms and Architecture, Business Analytics and Mathematical Sciences, IBM T. J. Watson Research Center, P. O. Box 218, Yorktown Heights, NY, 10598, United States of America, nabe@us.ibm.com, Gary Anderson, Brent Cooley, Prem Melville, Cezar Pendus, Gerard Miller, Melissa Weatherwax, Timothy Gardinier, David Jensen, Vince Thomas, James Bennett, Shaun Barry, Chandan Reddy

In a collaborative work between New York State Department of Taxation and Finance (NYS DTF), IBM's Research and Global Business Services divisions, a novel tax collections optimization solution was developed to address this challenge. The solution is a unique combination of data analytics and optimization based on the unifying framework of constrained Markov Decision Processes (C-MDP).

2 - Retail Price Optimization at InterContinental Hotels Group

Dev Koushik, Director, Global Revenue Optimization, IHG, 3 Ravinia Drive, Suite 100, Atlanta, GA, 30346, United States of America, dev.koushik@ihg.com, Jon Higbie, Craig Eister

PERFORM with Price Optimization is the first large scale, enterprise implementation of price optimization in the hospitality industry. This module determines optimal room rates based on occupancy, price elasticity and competitive prices. The approach is a major advancement over existing revenue management systems which assume demands by rate segments are independent of each other and of price. A 2.7% revenue increase has been verified and acknowledged in the IHG 2009 annual review.

3 - A Strategic Empty Container Logistics Optimization in a Major Shipping Company

Andres Weintraub, Professor, University of Chile, Department of Industrial Engineering, Rep'blica 701, Santiago, Chile, aweintra@dii.uchile.cl, Alex Beiza, Fernando Valenzuela, Andres Neely, Gustavo Angulo, Sergio Hurtado, Jaime Catalan, Fernando Alarcon, Cristian Gonzalez, Guillermo Gonzalez, Mauricio Naveas, Florencio Infante, Rafael Epstein, Cristian Berner, Daniel Yung

Compañia Sud Americana de Vapores (CSAV) developed a system to manage empty container repositioning worldwide. A multi-commodity, multi-period model manages the repositioning problem, while an inventory model determines safety stocks. Also, a hybrid forecasting system was developed and a collaborative web-based optimization framework allowed agents to interact in decision making. The system led to direct savings of $81 million and was an important component for improving the efficiency.

■ SC56

H - Biltmore Boardroom - 2nd Floor

Newsvendor in Supply Chain

Contributed Session

Chair: Zohar Strinka, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, zstrinka@umich.edu

1 - Supply Chain Governance and the Risk-Averse News-vendor

Timothy Sprock, The Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, tsprock3@gatech.edu, Leon McGinnis

The governance of a supply chain directly impacts its risk structure. We generalize the parameter space of the supply chain to capture the cost structure and risk ownership in order to select an optimal contract from a portfolio of common contracts for both the risk-neutral and risk-averse news-vendor models.

2 - Comparative Statics Analysis of Multi-product Newsvendor Networks

Xin Zeng, Virginia Tech, 349 New Kent, Blacksburg, VA, 24060, United States of America, xzeng@vt.edu, Ebru Bish, Juqi Liu, Douglas Bish

We propose a novel and scalable analytic approach for the comparative statics analysis of multi-product multi-resource newsvendor networks under responsive pricing. We exploit properties of the primal mathematical programming formulation and of the dual variables, and link those properties to the concept of convex orders. We utilize this approach to study how the multi-product newsvendor's expected profit and optimal capacity changes with risk exposure.

3 - Contract Efficiency: Demand Uncertainty, Price Sensitivity, and Information Asymmetry

Xiang Fang, Assistant Professor, University of Wisconsin-Milwaukee, 3202 N Maryland Avenue, Milwaukee, WI, 53211, United States of America, fangx@uwm.edu, Yunzeng Wang

Consider a powerful supplier who whole-sells products to a downstream newsvendor retailer. We compare three popular contracts: buy-back, revenue-sharing, and fixed payment that the supplier offers to the retailer. We show that the effectiveness or robustness of each of these contracts depends critically on the presence of three characteristics that define the complexity of the operating environment: demand uncertainty, demand price-sensitivity, and information asymmetry.

4 - The Selective Newsvendor Facing General Demand Distributions

Zohar Strinka, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, zstrinka@umich.edu, Edwin Romeijn

We develop an approximation algorithm for a cost-minimization formulation of a selective newsvendor problem that is concerned with selecting a set of markets to serve, where the vector of market demands has a distribution with nonnegative support and finite first and second moments. The solution obtained by our algorithm has cost that is, with high probability, bounded by an affine function of the cost of the optimal solution. We use sampling and a rounding algorithm to obtain this result.

■ SC57

W - Providence I- Lobby Level

AAS Dissertation Prize Finalists and AGIFORS Anna Valicek Finalists

Sponsor: Aviation Applications

Sponsored Session

Chair: Laurie Garrow, Associate Professor, Georgia Institute of Technology, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, laurie.garrow@ce.gatech.edu

1 - AAS Dissertation Prize Finalists and AGIFORS Anna Valicek Finalists

This session will feature finalists for the Aviation Applications dissertation prize and finalists for the AGIFORS Anna Valicek competition. The Aviation Applications dissertation finalist will be announced in the business meeting at INFORMS.

■ SC58

W - Providence II - Lobby Level

Military Vehicle Routing Problems – Risk & Uncertainty

Sponsor: Military Applications Society

Sponsored Session

Chair: Michael Hirsch, Raytheon, 3323 Pelham Road, Orlando, FL, 32803, United States of America, mjh8787@ufl.edu

1 - Optimizing Placement of Stationary Radiation Monitors

Andrew Romich, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, aromich222@gmail.com, Guanghui Lan, J. Cole Smith

The potential for an adversary to attempt transportation of illicit radiological material through an area of interest is a prevalent risk. We examine the problem of strategically placing stationary radiation monitors to minimize the adversary's maximum probability of evasion. A two-stage MINLP formulation of the problem is presented. Exploiting properties of this formulation, other formulations are constructed and a heuristic is proposed.

2 - Using Simulation Optimization with Bayesian Updates for Unmanned Aerial System Design

Belleh Fontem, University of Alabama, Tuscaloosa, AL, United States of America, bafontem@crimson.ua.edu, Emily Evans, Sharif Melouk

Unmanned aerial systems (UASs) are used extensively in missions to identify and pursue targets in challenging environments. We employ a new Bayesian updating policy to investigate the proper design configuration of a UAS fleet to maximize mission effectiveness. We compare our approach to an expected improvement criterion method for Bayesian global optimization and to black-box simulation optimization approaches. We experiment with varying mission conditions and offer decision-making insights.

3 - Incorporating Human-factors Considerations in Unmanned Aircraft Routing

Chase Murray, Assistant Professor, Auburn University, 3301 Shelby Center, Auburn, AL, 36830, United States of America, ccm0022@auburn.edu, Woojin Park

Although uninhabited, the current generation of unmanned aerial vehicles (UAVs) still require significant human involvement. This human element of UAV deployment has been largely ignored by models seeking to optimize the allocation of these aircraft to tasks. To address these concerns, an integer programming model is proposed that incorporates human factors considerations in the tasking of UAVs. This model may be used to establish schedules for both the aircraft and support personnel.

4 - Adaptive Pursuit-Evasion under Adversarial Confrontations: Risk-Averse & Efficient Pareto Strategies

Khanh Pham, Senior Aerospace Engineer, Air Force Research Laboratory, Space Vehicles Directorate, Building 472 - Room 240, Kirtland Air Force Base, NM, 87117, United States of America, Khanh.Pham@kirtland.af.mil

Adaptive decisions for a class of stochastic multi-player pursuit-evasion games are proposed with major theoretical advances: i) effective utilization of performance-measure statistics to directly address other higher-order uncertainties beyond statistical averaging; ii) risk-value tradeoffs for performance values and risks to anticipatively ensure closed-loop performance robustness; and iii) risk-averse and efficient Pareto decision strategies to effectively handle adversarial confrontations.

5 - Route Optimization under Uncertainty for Unmanned underwater Vehicles

Jacob Cates, MIT, 77 Massachusetts Avenue, Building E-40, Cambridge, MA, 02139, United States of America, jcates@alum.MIT.EDU

An Unmanned Underwater Vehicle (UUV) is a unique platform in the autonomous vehicle family, and has particular constraints which must be met. We formulate a route planning problem for a UUV which handles time windows, stochastic parameters, and provides solutions which are robust. We then present an efficient heuristic which provides near optimal solutions.

■ SC59

W - Providence III - Lobby Level

Service Productivity

Sponsor: Service Science

Sponsored Session

Chair: Kaan Kuzu, Assistant Professor of Production & Operations Management, University of Wisconsin-Milwaukee, Madison, WI, United States of America, kuzu@uwm.edu

1 - Analysis of Transactional Ticket Queue Data for Staffing Decisions

Kaan Kuzu, Assistant Professor of Production & Operations Management, University of Wisconsin-Milwaukee, Madison, WI, United States of America, kuzu@uwm.edu

We consider the staffing policy for a multi-server Ticket Queue with multiple service types. Using the transactional data from a bank, we estimate system input parameters such as customers' patience times and abandonment rates. We propose an algorithm to facilitate dynamic staffing decisions and benchmark the current bank policy with the proposed policy.

2 - Human Resource Analytics for Services

Nanda Kambhatla, Senior Manager, Human Language Technologies, IBM Research - India, Embassy Manyata Business Park, Nagawara Outer Ring Road, Bangalore, 560045, India, kambhatla@in.ibm.com, Mayank Sharma, Gyana Parija

Effectiveness and efficiency of human resources is critical for services companies that are now embracing human resource analytics to respond more nimbly to supply/demand shifts and to tap into the vast talent pool out there. We describe several research projects focused on increasing the efficiency and effectiveness of the workforce: e.g. optimal resource allocation, optimal seat utilization, better and more efficient hiring, connecting job seekers with job providers using Spoken Web, etc.

3 - Hierarchy and Efficiency in the Japan IT Sector

Hiroshi Sasaki, Professor, Rikkyo University, 3-34-1 Nishi Ikebukuro, Toshima-ku, Tokyo, 171-8501, Japan, sasaki-h@rikkyo.ac.jp

This study focuses on IT services companies in Japan. Some empirical studies have demonstrated that productivity in the Japan IT sector is low, because the sector has rigid hierarchies. To capture the productivity, we define an "RPE cascade" which is comprised of a set of indicators according to a SG&A cost structure, propose using RPE-LCP (Revenue Per Employee-Labor Cost Percentage) scatter plot charts with curve regression analysis, and analyze all listed companies in the sector.

■ SC60

W - College Room - 2nd Floor

Network Design

Sponsor: Optimization/Networks

Sponsored Session

Chair: Mauricio Resende, AT&T Labs Research, 180 Park Avenue, Bldg. 103, Room C241, Florham Park, NJ, 07932, United States of America, mgcr@research.att.com

1 - Designing Metropolitan Ethernet Networks with a Biased Random-key Genetic Algorithm

Mauricio Resende, AT&T Labs Research, 180 Park Avenue, Bldg. 103, Room C241, Florham Park, NJ, 07932, United States of America, mgcr@research.att.com, Robert Doverspike, Rodrigo Toso, Dongmei Wang

We present a tool based on a biased random-key genetic algorithm (BRKGA) to design three-layer metropolitan communication networks. We first review basic concepts of a BRKGA. This is followed by a description of the design problem and some implementation details. We conclude with some experimental results illustrating some solutions obtained with the tool.

■ SC63

W - Tryon North - 2nd Floor

MCDM Algorithms and Applications

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Mark Karwan, Professor, University at Buffalo (SUNY), 305 Bell Hall, Buffalo, NY, 14260, United States of America, mkarwan@buffalo.edu

1 - Multiobjective Lines Design Problems Using a Fuzzy Logic Genetic Algorithm

Hicham Chehade, University of Technology of Troyes, 12 Rue Marie Curie, Troyes, 10010, France, hicham.chehade@utt.fr, Farouk Yalaoui, Lionel Amodeo

A multiobjective line design problem which consists of equipment selection and buffers sizing is considered with cost minimization and throughput rate maximization. For that, a non-dominated sorting genetic algorithm coupled to a fuzzy logic controller is developed. The fuzzy logic is used to better set the two main parameters which are the crossover and the mutation probabilities. Experimental results, carried out on different lines structures, show the efficiency of the proposed approach.

2 - Intermodal Route Planning with Green Consideration: A Multiple-objective Programming Approach

Ho Cheung Brian Lee, The Chinese University of Hong Kong, Department of Syst Eng & Eng Mgmt, Shatin, NT, Hong Kong - PRC, lee.ho.cheung.brian@gmail.com, Chun-Hung Cheng

Although intermodal is widely accepted as a cleaner solution to transportation, very few literature discuss how to help the decision-makers choose among different routes with environmental consideration. We aid the decision-makers by implementing different multiobjective programming approaches namely posteriori method, priori method, interactive method. Computational experience will be explored by examining a case study by NAFTA.

3 - Interactive Approaches for MCDM Using a Hybrid Utility Function and Strength of Preference

Mark Karwan, Professor, University at Buffalo (SUNY), 305 Bell Hall, Buffalo, NY, 14260, United States of America, mkarwan@buffalo.edu, Ozgen Ozbey

We consider a multicriteria linear program. Comparison is made among MILP formulations used to estimate a Decision Maker's (DM) utility function during an interactive method employing pairwise comparisons. A utility function is approximated by a Tchebycheff or hybrid Tchebycheff-linear function. We consider a DM's precision and also estimate a "strength of preference" while approximating the utility function. We also combine the hybrid and "strength of preference" concepts and compare results.

4 - A New Decomposition Approach to Determine Efficient Units in Big DEA Models

Banu Soylu, Erciyes University, Department of Industrial Engineering, Talas, Kayseri, 38039, Turkey, bsoylu@erciyes.edu.tr, Gazi Bilal Yildiz

When there are huge number of decision making units and large number of input/output, identifying efficient units via a DEA model could be computationally complex. In this study, we propose a decomposition algorithm, which partitions the original problem into sub-problems. Sub-problems are coordinated with each other. Initially, we apply an elimination procedure. We present our results.

■ SC64

W - Queens Room - 2nd Floor

Pharmaceutical Procurement and Distribution in Africa

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Jeremie Gallien, Associate Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, jgallien@london.edu

1 - Managing Inventory under Variable Funding Availability

Jayashankar Swaminathan, University of North Carolina at Chapel Hill, McColl Building, Chapel Hill, NC, United States of America, msj@unc.edu, Karthik Natarajan

Motivated by the the ready-to-use therapeutic food (RUTF) supply chain in Africa, we study the problem of managing inventory of a nutritional product under variable budget constraints. We present results related to the structure of the optimal policy and computationally analyze the impact of alternative funding flows on the operating costs and potential number of children impacted.

2 - Modeling Fairness in the Last Mile of Health Delivery in Developing Regions

Jessica McCoy, Stanford University, 665 Roble Ave, Unit J, Menlo Park, CA, 94025, United States of America, jhmccoy@stanford.edu, Hau Lee

The "last mile" of health delivery presents a number of practical challenges. Organizations addressing the last mile can influence not only the efficiency but also the equity of health delivery. We develop analytical models of fairness to quantify the tradeoffs between equity and efficiency based on our work with Riders for Health, an NGO that addresses last-mile issues by providing transportation solutions to health workers.

3 - A Data-Driven Model of Drug Stockouts in Global Fund Grant Recipient Countries

Iva Rashkova, PhD student, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, irashkova.phd2009@london.edu, Prashant Yadav, Jeremie Gallien

Central stockouts of AIDS, tuberculosis and malaria-related drugs still occur in some low income countries despite substantial financial procurement support from the Global Fund. Focusing on procurement and financial delays, we develop a data-driven model to predict the likely extent of future drug stockouts in a given country and use it to evaluate the potential impact of various financing and inventory replenishment policies.

4 - Improving the Public Distribution of Essential Medicines in Sub-Saharan Africa: The Case of Zambia

Zachary Leung, Massachusetts Institute of Technology, Operations Research Center, 77 Massachusetts Avenue Bldg. E40-149, Cambridge, MA, 02139, United States of America, zacleung@MIT.EDU, Jeremie Gallien, Prashant Yadav, Anastasia Chen, Romain Davroux

Despite remarkable and successful improvements efforts by the government and its partners, the current public distribution system of essential medical drugs in Zambia still results in low availability to patients relative to private sector standards. We present an alternative design involving mobile devices and optimization and evaluate this proposal via a simulation model built with field data. Our results suggest that this proposal would improve drug availability and reduce inventory costs.

■ SC65

W - Kings Room - 2nd Floor

Cloud Computing Service

Sponsor: Service Science

Sponsored Session

Chair: Karuna Joshi, University of Maryland, Baltimore Co, CSEE Department, 1000 Hilltop Circle, Baltimore, MD, 21250, United States of America, kjoshi1@umbc.edu

1 - Automating Service Negotiation and Acquisition on the Cloud

Karuna Joshi, University of Maryland, Baltimore Co, CSEE Department, 1000 Hilltop Circle, Baltimore, MD, 21250, United States of America, kjoshi1@umbc.edu, Anupam Joshi, Tim Finin, Yelena Yesha

We present a novel framework for automating the configuration, negotiation and procurement of services in a cloud computing environment using semantic web technologies. We have divided the service lifecycle into five phases of requirements, discovery, negotiation, composition, and consumption. We present the ontologies and the reasoning mechanisms that automate the phases of this lifecycle specially negotiation. We also describe a prototype system that we have developed for this framework.

2 - Cloud Computing Services in Finance: Ready for Ubiquitous Computing?

Alexander Yap, Elon University, MIS and E-Business Department, Elon, NC, 27244, United States of America, yap@elon.edu, Claudia Loebbecke

The Financial Sector increasingly needs ubiquitous applications for trading stocks anywhere anytime. E-Trade, NASDAQ, etc. have created basically thin client applications for iPad and iPhone, where data/content is pushed through the cloud to display real-time changes in the financial markets, allowing for ubiquitous commerce/computing for financial trading and stock monitoring. We investigate the readiness for such apps from the provider and the user perspective.

3 - Availability, At What Cost?
Vijay Naik, IBM T. J. Watson Research Center, 19 Skyline Drive, Hawthorne, United States of America, vkn@us.ibm.com, Francesco Longo, Kishor Trivedi, Rahul Ghosh

Is it more economical to use cheaper but less reliable servers or to use costlier but more reliable servers for insuring the same availability characteristics for an Infrastructure-as-a-Service (IaaS) cloud? In this work, we describe an approach to answer this question. For the analysis we assume an IaaS cloud with physical servers with multiple states of readiness having different failure-repair characteristics.

■ SC66

W - Park Room - 2nd Floor

Simulation and Other Models in Data Envelopment Analysis

Cluster: Data Envelopment Analysis

Invited Session

Chair: Paul Rouse, Associate Professor, The University of Auckland, Private Bag 92019, Auckland, 1142, New Zealand, p.rouse@auckland.ac.nz

1 - DEA and the Stochastic Frontier: A Two-stage Model
John Ruggiero, University of Dayton, Dayton, OH, United States of America, John.Ruggiero@notes.udayton.edu, Trevor Collier, Ole Bent Olesen

Recently, Collier, Johnson and Ruggiero (2011) provided a two stage model to measure efficiency for production characterized by multiple inputs, multiple outputs and stochastic noise. In the first stage, DEA was applied to to measure aggregate output. The aggregate output measure was then incorporated into a second stage stochastic frontier model. In this paper, we extend this model and evaluate performance using simulated data.

2 - Data Envelopment Analysis with Partial Input-to-output Impacts
Wade Cook, Professor, York University, Schulich School of Business, Toronto, ON, Canada, wcook@schulich.yorku.ca, Joe Zhu

In the conventional formulation of data envelopment analysis it is assumed that the output bundle is impacted by all members of the input bundle. There are, however, many situations involving efficiency measurement wherein some inputs may not impact certain outputs. This paper extends the conventional DEA methodology to allow for the measurement of technical efficiency in situations where only partial input-to-output impacts exist.

3 - The Environment, Input Consumption, and Managerial Efficiency in DEA
Julie Harrison, University of Auckland, Department of Accounting & Finance, 12 Grafton Road, Auckland, 1142, New Zealand, j.harrison@auckland.ac.nz, Paul Rouse

The environment can influence technical efficiency either by affecting the amount of output produced or the amount of input consumed or some combination thereof. We use simulated data to model the environmental impact where it is separate from managerial inefficiency and results in higher levels of input consumption. We compare the performance of alternative DEA models to determine their accuracy under these conditions.

4 - Persistence of Top Performers - Using DEA to Evaluate Ten Years of CABG Surgery
Mitchell Glavin, Assistant Professor, Stonehill College, Duffy 289, 320 Washington Street, Easton, MA, 02357, United States of America, mglavin@stonehill.edu, Jon Chilingerian

We used data envelopment analysis to identify the most efficient hospitals performing CABG surgeries in Pennsylvania over the 1994-95 and 2003-04 periods. A DEA model with 2 inputs (lengths of stay & ancillary charges) and 4 outputs (patients in 4 severity categories) was used to determine best practice production frontiers. We identified hospitals staying top performers in both periods, and examined characteristics of these persistent top performers vs. hospitals that declined in performance.

Sunday, 4:30pm - 6:00pm

■ SD01

C - Room 201A

Leadtime Management in Inventory Systems

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Victor Martìnez-de-Albéniz, Associate Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu

1 - Symmetry of Information Delay and Lead Times in Inventory Systems
Alp Muharremoglu, University of Texas-Dallas, Richardson, TX, United States of America, alp@utdallas.edu, Annabelle Feng, Suresh P. Sethi

We study inventory systems with stochastic lead times, where demand and inventory information come with some delay. We show that there is symmetry between information delay and lead times, and that they can be "substitutes" for each other, under a variety of conditions.

2 - A Two-stage Assembly System with Random Yield
Ton de Kok, Professor of Operations Planning and Control, Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513 5600 MB, Eindhoven, Netherlands, A.G.d.Kok@tue.nl

The context of this presentation is a high-tech company that assembles complex modules into customer-specific manufacturing equipment. The modules may be defect, but this can only be identified in the assembly process. Upon detection of a defect a replacement module is ordered at the supplier of the module. We present a basic model for this situation and discuss possible control policies, dependent on the information assumed to be available. We discuss related models from literature.

3 - Optimal Speed in a Continuous Supply Chain
Peter Berling, Assistant Professor, Lund University, Box 118, Lund, SC-22100, Sweden, Peter.Berling@iml.lth.se, Victor Martìnez-de-Albéniz

We analyze the optimal speeds in a continuous-time, continuous-stage serial supply chain facing stochastic demand. Using the unit tracking approach the problem is decomposed into a set of one-dimensional subproblems that can be easily characterize and solved. Under quite general assumptions regarding the cost of holding and moving the goods the optimal policy is that a unit accelerates upstream, and slows down downstream. A numerical study of the benefits of variable speed will also be provided.

4 - Optimizing Replenishment Intervals for Two-echelon Distribution Systems with Stochastic Demand
Sean Zhou, Chinese University of Hong Kong, Hong Kong - PRC, zhoux@se.cuhk.edu.hk, Kevin Shang

We consider a distribution system in which non-identical retailers replenish inventory from a warehouse. Each location implements a base-stock, reorder interval policy. We develop an algorithm to find the optimal policy. Our study suggests that the optimal reorder intervals tends to follow integer-ratio relations and that the deterministic power-of-two solution may perform poorly.

5 - Mixture Distributions for Modeling Demand During Lead Time
Barry Cobb, Virginia Military Institute, 334 Scott Shipp Hall, Lexington, VA, 24450, United States of America, cobbbr@vmi.edu

Closed form approximations to the distributions for lead time and demand per unit time combine to form a mixture distribution that approximates the compound distribution for demand during lead time in a continuous-review inventory model. Using this approach, both lead time and demand per unit time can follow state-dependent distributions.

■ SD02

C - Room 201B

Optimization in Finance I

Cluster: Optimization in Finance

Invited Session

Chair: J E Beasley, Brunel University & JB Consultants, United Kingdom, john.beasley@brunel.ac.uk

1 - Calibration of Shrinkage Estimators for Portfolio Optimization
Alberto Martin-Utrera, University Carlos III of Madrid, C/ Madrid, 126 - 28903, Getafe, Spain, amutrera@est-econ.uc3m.es, Francisco J. Nogales, Victor DeMiguel

Shrinkage estimators is an area widely studied in statistics. In this paper, we contemplate the role of shrinkage estimators on the construction of the investor's portfolio. We study the performance of shrinking the sample moments to estimate portfolio weights as well as the performance of shrinking the naive sample portfolio weights themselves. We provide a theoretical and empirical analysis of different new methods to calibrate shrinkage estimators within portfolio optimization.

2 - Markowitz Principles for Multi-period Portfolio Selection Problems with Wealth Constraints
Thamayanthi Chellathurai, Enterprise Risk and Portfolio Management, Bank of Montreal, Toronto, ON, M5L1A2, Canada, Thamayanthi.Chellathurai@bmo.com

The multi-period portfolio selection problem is formulated as a Markowitz mean-variance optimization problem in terms of time-varying means, covariances, higher order and inter-temporal moments. The constraints on wealth are enforced approximately in the mean-square sense. The expected return of the portfolio depends on the means and higher order moments of the asset prices. Numerical results are presented for some test problems.

3 - Reliable Enhanced Indexation Using Game Theory
Miguel Lejeune, George Washington University, 2201 G Street NW, Washington, DC, 20052, United States of America, mlejeune@gwu.edu

A game theoretical model for enhanced indexation model is proposed. The goal is to maximize the excess return that can be attained with high probability, while ensuring that the relative risk does not exceed a given threshold. We consider that only limited information about the probability distribution of the index return is available. We show that the game theoretical model can be recast as a convex programming problem, and present numerical results.

4 - Large-scale Portfolio Optimization with Proportional Transaction Costs
Zhen Liu, Engineering Management & System Engineering, University of Missouri-Rolla, Rolla, MO, 65409, United States of America, zliu@mst.edu

We study the portfolio optimization problem with proportional transaction costs under Markov processes with multiple risky assets with infinite time horizon. The value function can be written as the solution to an infinite-dimensional linear program. We approximate the value function based upon simulation-based optimization methods. Numerical experiments will be carried out to confirm our results.

5 - Portfolio Rebalancing with Fixed and Variable Transaction Costs
J E Beasley, Brunel University & JB Consultants, United Kingdom, john.beasley@brunel.ac.uk, Cormac Lucas, Maria Woodside Oriakhi

We consider the problem of rebalancing an existing financial portfolio, where transaction costs have to be paid if we have a trade in an asset. These transaction costs can be fixed (so paid irrespective of the amount traded provided a trade occurs) and/or variable (related to the amount traded). We model the problem as a mixed-integer quadratic program with a constraint on total transaction cost. We extend our model to incorporate cardinality constraints. Computational results are presented.

■ SD03

C - Room 202A

Panel Session: Can We Do Anything About Women Dropping Out of Academia?

Sponsor: Women in OR/MS

Sponsored Session

Chair: Yael Grushka-Cockayne, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, GrushkaY@darden.virginia.edu

Co-Chair: Nicole DeHoratius, University of Portland, 5000 N. Willamette Blvd, Portland, OR, United States of America, dehorati@up.edu

1 - Can We Do Anything About Women Dropping Out of Academia?
Moderator: Yael Grushka-Cockayne, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, GrushkaY@darden.virginia.edu, Panelists: Cynthia Barnhart, Cheryl Gaimon, Mor Armony, Linda Whitaker, Ann Marucheck

This panel addresses the causes and consequence of women dropping out of academic careers. In spite of the same level of interest and ability at the high school level, women are far less likely to pursue careers in science, math, and engineering. And, those that do, are more likely to drop-out than others of similar backgrounds. Our panel of academic and industry experts explore causes of this phenomenon as well as specific actions our institutions and colleagues can do to prevent it.

■ SD04

C - Room 202B

Topics in Linear and Integer Programming

Sponsor: Computing Society

Sponsored Session

Chair: Santanu S. Dey, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30318, United States of America, santanu.dey@isye.gatech.edu

1 - Lower Bounds for Randomized Pivoting Rules for the Simplex Algorithm
Thomas Dueholm Hansen, PhD student, Aarhus University, Finlandsgade 18A, 1.-1, Aarhus N, 8200, Denmark, tdh@cs.au.dk, Oliver Friedmann, Uri Zwick

The simplex algorithm is among the most widely used algorithms for solving linear programs in practice. Most deterministic pivoting rules are known, however, to need an exponential number of steps to solve some linear programs. No non-polynomial lower bounds on the expected number of steps were known, prior to this work, for randomized pivoting rules. We provide the first superpolynomial lower bounds for the two most natural, and most studied, randomized pivoting rules suggested to date.

2 - Continuing Work on Lifted Formulations
Daniel Bienstock, Columbia University, 342 S. W. Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States of America, dano@columbia.edu

We describe continuing work on extended formulations for simple mixed-integer sets.

3 - Improving the Accuracy of Optimization Software
Daniel E. Steffy, Zuse Institute Berlin, Takustr. 7, Berlin, 14195, Germany, steffy@zib.de, Thorsten Koch, Kati Wolter, Ambros Gleixner

We discuss some issues related to improving the accuracy of computational LP and MIP results, where the use of inexact floating-point computation can lead to errors. We consider pre- and post-processing techniques to improve the quality of approximate solutions without relying heavily on exact or extended precision computation.

■ SD05

C - Room 203A

One-off Modeling with Excel

Cluster: Tutorials

Invited Session

Chair: Harvey Wagner, Professor, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, hmwagner@email.unc.edu

1 - One-off Modeling with Excel

Harvey Wagner, Professor, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, hmwagner@email.unc.edu

Many real applications of analytic modeling are efforts described by short time spans of use, model development by only one or two non-expert staff, and reliance on Excel to provide computational implementation. This tutorial session surveys Excel modeling techniques that facilitate building medium-scale one-off models that encompass competition, uncertainty, combinatoric options, and dynamic feedback.

■ SD06

C - Room 203B

Reinforcement Learning

Cluster: Tutorials

Invited Session

Chair: Benjamin Van Roy, Professor, Stanford University, Stanford, CA, United States of America, bvr@stanford.edu

1 - Reinforcement Learning

Benjamin Van Roy, Professor, Stanford University, Stanford, CA, United States of America, bvr@stanford.edu

This tutorial will provide an overview of some past and ongoing research on algorithms for reinforcement learning in Markov decision processes, with an emphasis on efficient exploration and generalization through value function approximation. Some important unresolved issues will also be discussed. Aside from learning, these algorithms can be used to optimize fully specified Markov decision processes, so ideas we will discuss are also relevant to approximate dynamic programming.

■ SD07

C - Room 204

Queueing Network Asymptotics

Sponsor: Applied Probability

Sponsored Session

Chair: John Hasenbein, Associate Professor, University of Texas at Austin, ETC 5.128B, Department of Mechanical Engineering, Austin, TX, 78712-1063, United States of America, jhas@mail.utexas.edu

1 - Queues in Series with Firm Global Deadline Times

Josh Reed, Assistant Professor, New York University, 44 West 4th Street, New York, NY, 10012, United States of America, jreed@stern.nyu.edu, Kavita Ramanan

We study N FIFO queues in series where each customer arriving to the system is assigned a random deadline time by which they must exit from the system. We analyze this system as the traffic intensity at each station approaches one. Our main results are to develop approximating diffusions for both the N-dimensional queue length and workload processes. For the case where the deadline times is compact, our limiting diffusions are shown to be solutions to the extended Skorokhod problem.

2 - Regime Differentiation for an overloaded, Multiclass, Abandonment Queue: ED, QD, and QED Service

Otis Jennings, Duke University, 100 Fuqua Dr, Durham, NC, 27708, United States of America, otisj@duke.edu

Consider an overloaded, multiclass queueing system with abandonment. The single server visits the queues in a cyclic, round robin fashion and processes a class-specific number of jobs at each visit, if possible. We prove a limit theorem for the K-dimensional queue length process. Classes are grouped by whether capacity relative to them is effectively over-, under-, or critically-loaded. Equivalence is shown between generalized round robin and generalized processor sharing policies.

3 - On Optimality Gaps in the Halfin-Whitt Regime

Itai Gurvich, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60201, United States of America, i-gurvich@kellogg.northwestern.edu, Baris Ata

We consider the control of a multi-class queue in the Halfin-Whitt regime, and revisit the notion of asymptotic optimality and the associated optimality gaps. Existing results provide gaps that grow with the number of servers at a rate that is smaller than its square root. We construct a sequence of controls where the optimality gap grows logarithmically with the system size. We rely on a sequence of Brownian control problems, whose refined structure helps us achieve the improved gaps.

4 - Staffing in the H-W Regime with Random Arrival Rates and Joint QoS Constraints

John Hasenbein, Associate Professor, University of Texas at Austin, ETC 5.128B, Department of Mechanical Engineering, Austin, TX, 78712-1063, United States of America, jhas@mail.utexas.edu

We consider service systems with multiple customer classes which require service from dedicated agent pools. The arrivals rates of the customer classes are uncertain and only the distribution of arrival rates is known in advance. In the Halfin-Whitt regime, we derive asymptotically optimal policies which minimize staffing costs and satisfy joint QoS constraints.

■ SD08

C - Room 205

Decomposition Algorithms

Sponsor: Computing Society/ Large-Scale Computation

Sponsored Session

Chair: Siqian Shen, Assistant Professor, University of Michigan, Industrial & Operations Engineering, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, siqian@umich.edu

1 - On a Sampling-based Decomposition Algorithm under Aggregate Inter-stage Dependency Model

Anderson Rodrigo de Queiroz, Phd Student, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, ar_queiroz@yahoo.com.br, Jinho Lee

We discuss a sampling-based decomposition algorithm and its ability to handle interstage dependent models. We model a hydrothermal scheduling problem with aggregate reservoir representation (ARR). The ARR has been used in the literature with time series forecasts of energy inflows. Instead, we prefer to have the time series model forecast water inflows. This requires that we extend existing methods to compute valid cuts for the algorithm under the resulting form of interstage dependence.

2 - Optimal Edge Search Problem with Imperfect Detection Probability

Shantih Spanton, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, sspanton@ufl.edu, J. Cole Smith, Joseph Geunes

The problem of detecting an immobile hider on a network with a single searcher is considered. A weight corresponding to the likelihood of finding the hider on an arc exists for each arc in the network. Upon the traversal of an arc, the weight of the arc is decreased at a rate proportional to a detection probability. We consider the searcher's objective of maximizing the probability of finding the hider subject to a time limit.

3 - Feasible Path Enumeration for Directed Acyclic Graphs Limiting Path Length and Nodes Visited

Hector Vergara, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hvergara@uark.edu, Sarah Root

The motivation for this research is to develop an efficient algorithm that can simultaneously enumerate paths in a graph while explicitly considering constraints that limit total path length and the total number of nodes visited. Algorithms are presented for the case of directed acyclic graphs. We consider a case study in which these algorithms are applied. Computational results are presented as well as directions for future research.

■ SD09

C - Room 206A

Economic Models in Operations

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Ilan Lobel, New York University, New York, NY, United States of America, ilobel@stern.nyu.edu

1 - Monitoring the Market or the Salesperson? The Value of Information in a Multi-layer Supply Chain

Ying-Ju Chen, University of California- Berkeley, 4121 Etcheverry Hall, Berkeley, CA, 94720, United States of America, chen@ieor.berkeley.edu, Ling-Chieh Kung

We consider a manufacturer selling its products through a salesperson. To better motivate the salesperson, the manufacturer may delegate to either a reseller who can predict the market condition or one who can monitor the sales effort. We show that including the latter is always better under various scenarios.

2 - Stability and Complementarities in Matching Markets

Itai Ashlagi, Assistant Professor, Massachusetts Insitute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, iashlagi@mit.edu, Mark Braverman, Avinatan Hassidim

It is well-known that due to the presence of complementarities a stable matching may not exist. We study large matching markets with couples. We show that if the number of couples grows at a sub-linear rate, a stable matching exists with high probability. However, if the number of couples grows at a linear rate, then with a constant probability no stable matching exists.

3 - A Simple Optimal Mechanism for Selling Goods in Dynamic Environments

Ilan Lobel, New York University, New York, NY, United States of America, ilobel@stern.nyu.edu, Sham Kakade, Hamid Nazerzadeh

We study the problem of designing optimal selling mechanisms for environments with dynamic private information and propose a mechanism that is profit-maximizing in a class of environments that we call separable. We show that the mechanism can be implemented by offering a family of single-priced contracts, which are independent of the evolution of the private valuations.

■ SD10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - Ziena Optimization LLC - New Developments in the KNITRO 8.0 Optimization Solver

Richard Waltz, President, Ziena Optimization LLC, 1801 Maple Avenue, Ste. 6320, Evanston, IL, 60201, United States of America, waltz@ziena.com

This software demonstration will highlight new features in the 8.0 release of the KNITRO optimization solver. In particular we will focus on the new presolver, new parallel features and improvements in mixed-integer programming and infeasibility detection.

■ SD11

C - Room 207A

Decentralized Decision Making and Multi-agent Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Andrew Lim, Associate Professor, University of California Berkeley, 4177 Etcheverry Hall, Berkeley, CA, 94720-1777, United States of America, lim@ieor.berkeley.edu

1 - Decentralized Merton Problem

Huaning Cai, University of California-Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States of America, huaning@berkeley.edu, Andrew Lim

Many financial institutions, such as pension funds and investment banks, operate with multiple trading desks or agents, each specializing in a different market or class of assets. While centralized portfolio/risk management is ideal, it is often not possible because agents are individually endowed with valuable market information that they prefer to keep private. In this talk, we show that how decentralized agents can be coordinated with the aid of an internal system of swap contracts.

2 - Systemic Risk and Decentralization

Chen Chen, Columbia University, Rm 313, S. W. Mudd Building, 500 W. 120th Street, New York, NY, United States of America, cc3136@columbia.edu, Garud Iyengar, Ciamac Moallemi

We propose an axiomatic framework for systemic risk, which allows for a specification of a functional of the cross-sectional outcomes across firms and a functional of the profile of aggregated outcomes across scenarios. This class captures many proposed forms of systemic risk as special cases. Our axioms yield a decentralized decomposition, which attributes risk to individual firms. A shadow price for each firm also accounts for the externalities of the firm's individual decision-making.

3 - Approximate Equilibria of Priority Pricing for Resource Sharing Systems

Yu Wu, Stanford University, 91 Thoburn Ct Apt 104, Stanford, CA, 94305, United States of America, yuwu@stanford.edu, Loc Bui, Ramesh Johari

We consider a game-theoretic priority service model where a single server allocates its capacity to users in proportion to their payment to the system; users aim to minimize the sum of their processing time and payment. We study two approximations to users' processing time that are asymptotically correct in heavy traffic. Further, we define novel notions of equilibrium based on these approximations, which provide a more tractable approach to analyzing strategic behavior than Nash equilibrium.

■ SD12

C - Room 207BC

Panel Discussion: Computational Biology and Bioinformatics

Cluster: Computational Biology (Joint cluster ICS)

Invited Session

Chair: Russell Schwartz, Associate Professor, Carnegie Mellon University, 4400 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, russells@andrew.cmu.edu

Co- Chair: Ming-Ying Leung, Professor, University of Texas at El Paso, 500 W. University Avenue, El Paso, TX, 79968, United States of America, mleung@utep.edu

1 - Computational Biology and Bioinformatics

Moderator: Ming-Ying Leung, Professor, University of Texas at El Paso, 500 W. University Avenue, El Paso, TX, 79968, United States of America, mleung@utep.edu, Panelists: Allen Holder, Joe Song, Carl Kingsford, Russell Schwartz, Cynthia Gibas

A panel of researchers will lead an interactive discussion on the challenges, opportunities, and future for computational biology and bioinformatics (CBB). Topics include (1) major contributions to CBB from operations research (OR); (2) current views of the role of CBB in the biological, health, and medical sciences; and (3) ways to attract more professionals and students in OR to apply their expertise to CBB. The audience will be encouraged to offer opinions and raise questions for discussion.

■ SD13

C - Room 207D

Model Selection From General Classes

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Srikanth Jagabathula, Massachusetts Insitute of Technology, 32D-672 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, jskanth@mit.edu

1 - Approximate Group Context Tree: Applications to Dynamic Programming and Dynamic Choice Models

Alexandre Belloni, Duke University, 100 Fuqua Drive, Durham, NC, United States of America, abn5@duke.edu, Roberto Oliveira

We consider a variable length Markov chain model associated with a group of stationary processes that share the same context tree but with different conditional probabilities. We propose a new model selection and estimation method and develop oracle inequalities. We analyze the estimation of the value function for discrete dynamic programming and of the dynamic marginal effects for dynamic discrete choice models. The analysis accounts for possible mispecification from imperfect model selection.

2 - Graph Theoretic Formulations for Learning Problems
Garud Iyengar, Professor, Columbia University, Mudd 314, 500W 120th Street, New York, NY, 10027, United States of America, garud@ieor.columbia.edu

In this talk we introduce graph theoretic formulations for characterizing Dirichlet processes, the Beta-Bernoulli process and other related "clustering" inducing stochastic processes. We show that how to use convex optimization based methods to compute approximately optimal solutions for these graph problems. These convex optimization-based solutions can be used as good starting points for Monte-Carlo Markov Chain methods.

3 - Inferring Sparse Preference Lists from Partial Information
Srikanth Jagabathula, Massachusetts Insitute of Technology, 32D-672 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, jskanth@mit.edu, Vivek Farias, Devavrat Shah

We consider the problem of finding the `simplest' choice model consistent with the given sales data. We model choice using a distribution over all preference lists, and its support size is taken to be a measure of its complexity. By exploiting the underlying combinatorial structure, we propose an approximation method that finds the distribution with the smallest support size that is consistent with the given marginal data. We support our method with theoretical and empirical evaluation.

■ SD14

C - Room 208A

Modeling Strategic Behavior in the Energy Sector I

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Sonja Wogrin, Assistant Researcher, Institute for Research in Technology, Universidad Pontificia Comillas, C/ Alberto Aguilera 23, Madrid, Spain, sonja.wogrin@iit.upcomillas.es

1 - Modelling Competition in Electricity Markets with AC Power Flows
Guillermo Bautista Alderete, Senior Power System Technology Specialist, CAISO, 250 Outcropping Way, Folsom, CA, 95630, United States of America, bautista.guillermo@gmail.com

Linear approximations of power flows in the modeling and analysis of competition in electricity markets are ubiquitous in the technical literature. Although the nonlinear AC power flows are more complex to deal with, they provide a greater degree of realism of the transmission system when modeling competition. In this presentation, an equilibrium problem with equilibrium constraints that uses AC power flows is introduced. The shortcomings of DC models are also illustrated through comparisons.

2 - Electricity Market Equilibrium Models under Time of Use Pricing
David Fuller, Professor, University of Waterloo, Dept. of Management Sciences, Waterloo, ON, N2L 1J7, Canada, dfuller@uwaterloo.ca, Emre Celebi

We formulate variational inequality models of electricity markets with time of use (TOU) pricing, under different market structures — perfect competition, Cournot, and mixtures of these. The players are the generation firms, and the ISO, which ensures that transmission constraints are satisfied, and that demand is satisfied at all hours within each block of hours defined by the TOU pricing scheme. We illustrate using data for Ontario.

3 - Assessing Market Power in the EU Gas Market: Cooperative vs. Non Cooperative Approaches
Yves Smeers, Université Cathoique de Louvain, CORE, Voie du Roman Pays 34, Louvain-la-Neuve, 1348, Belgium, yves.smeers@uclouvain.be, Andreas Ehrenmann

We consider stylized models of the European gas market where we compare cooperative and non-cooperative game approaches. The former underlies a short-term view of the market underlying many EU texts; the latter is more in line with often expressed long term objectives of the industry.

4 - Market Power and Investment Decisions in Electricity Markets: Open vs Closed Loop Equilibria
Sonja Wogrin, Assistant Researcher, Institute for Research in Technology, Universidad Pontificia Comillas, C/ Alberto Aguilera 23, Madrid, Spain, sonja.wogrin@iit.upcomillas.es, Benjamin Hobbs, Daniel Ralph, Efraim Centeno, Julián Barquín

We compare two equilibrium models for the generation capacity expansion game: an open loop (OL) model where investment and operation decisions are simultaneous, and a closed loop (CL) model, where decisions are sequential. For one load period, the CL equilibrium equals the OL Cournot equilibrium for any market behavior between Bertrand and Cournot. Surprisingly, for multiple load periods, more competition in the spot market may lead to less market efficiency and consumer surplus in the CL model.

■ SD15

C - Room 208B

Adaptive Adversary Decision Analysis

Sponsor: Decision Analysis

Sponsored Session

Chair: Richard John, Associate Professor, University of Southern California, Department of Psychology, SGM 621; MC-1061, Los Angeles, CA, 90089-1061, United States of America, richardj@usc.edu

1 - Adaptive Adversary Risk Analysis: Linking Models to Primary Data on Terrorist Behavior
Brian Jackson, Senior Physical Scientist, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States of America, bjackson@rand.org, David Frelinger, Bryce Loidolt, Jessica Hart, Jennifer Kavanagh, Brett Wallace

Addressing adversary adaptation in risk analysis requires understanding the ways they can respond to new defensive or other changes. They have a variety of options, each with distinct direct and indirect risk effects. We demonstrate how adversary preferences among those options can be assessed through illustrative analyses of open source descriptions of past group behavior, content analysis of jihadist internet communications, and declassified seized al-Qa'ida documents.

2 - Modeling Adaptive Adversaries with Plural Models
Dennis Buede, President, Innovative Decisions Inc, 1945 Old Gallows Rd., Suite 207, Vienna, VA, 22182, United States of America, dbuede@innovativedecisions.com, Suzanne Mahoney, Barry Ezell, John Lathrop

This paper addresses the wide range of uncertainties associated with modeling terrorists as adaptive adversaries. Then it motivates the use of multiple or plural models for producing probability distributions over the decision outcomes of the adversaries. Finally it provides a brief overview of computational and validation issues.

3 - What's the Name of the Game? Terrorist-counterterrorist Interactive Modeling with MAIDs
Kari Sentz, Los Alamos National Laboratory, P.O. Box 1663, MS F609, Los Alamos, NM, 87545, United States of America, ksentz@lanl.gov, Dennis Powell, John Ambrosiano, Todd Graves

The unique sophistication of an intelligent adaptive agent in terrorist risk assessment requires a novel methodology to model adversarial decision-making in response to offensive, defensive, and mitigative measures. The Multi-Agent Influence Diagram (MAID) furnishes a promising approach by synthesizing multi-agent modeling, game theory, and probabilistic decision networks. We augment the MAID with an architecture that incorporates agent beliefs, values, and goals into the model structure.

4 - Modeling Effects of Counterterrorism Initiatives on Reducing Adversary Threats
Richard John, Associate Professor, University of Southern California, Department of Psychology, SGM 621; MC-1061, Los Angeles, CA, 90089-1061, United States of America, richardj@usc.edu, Heather Rosoff, Anthony Barrett, Vicki Bier

We describe a general methodology for evaluating counter-terrorism alternatives that accounts for an adaptive adversary planning an attack on the U.S.. We construct a model of adversary objectives and values using a proxy multi-attribute utility model. Several attack modes and targets are identified and evaluated from the perspective of an adaptive adversary, assuming different counter-terrorism policies on the part of the U.S.

■ SD16

C - Room 209A

Forestry: Multiobjective Modeling

Sponsor: Energy, Natural Resources and the Environment/ Forestry

Sponsored Session

Chair: Marc McDill, Associate Professor, Pennsylvania State University, 310 Forest Resources Bldg, University Park, PA, 16802, United States of America, mem14@psu.edu

1 - The Steiner Multigraph Problem: Wildlife Corridor Design for Multiple Species
Katherine Lai, Cornell University, Computer Science Department, Ithaca, NY, 14853, United States of America, klai@cs.cornell.edu, Carla Gomes, Michael Schwartz, Kevin McKelvey, David Calkin, Claire Montgomery

Conserving wildlife corridors between habitat areas is important for combating the effects of habitat fragmentation. We introduce the Steiner Multigraph Problem to model min-cost corridor design for multiple species with different

landscape requirements. It generalizes the Steiner tree network design problem used to model single-species corridors. We propose exact and heuristic algorithms that do well on both synthetic and real-world instances.

2 - Temporal Connectivity in Spatially Explicit Harvest Scheduling Models

Nóra Könnyu, University of Washington, School of Forest Resources, Box 352100, Seattle, WA, 98195, United States of America, nk6@uw.edu, Sàndor Tóth

Harvest scheduling models can address wildlife management objectives by requiring contiguous forest patches of minimum size and age. However, models have not addressed the temporal dimension or lifespan of forest patches so far. We introduce an exact model along with two improvements that guarantee connectivity of forest patches over time. As a secondary contribution, we present an age-discriminative cluster enumeration algorithm that can significantly reduce formulation time.

3 - Selling Forest Ecosystem Services with ECOSEL – A Case Study at Pack Forest, Washington

Sándor Tóth, University of Washington, School of Forest Resources, Box 352100, Seattle, WA, 98195, United States of America, toths@uw.edu, Gregory Ettl, Sergey Rabotyagov, Luke Rogers, Nóra Könnyu, Svetlana Kushch

ECOSEL is a web-based auction where people use real money to bid competitively or collaboratively to influence forest management on private or public land over a given time period. Alternative management plans for bidding are generated using multi-criteria optimization. The auction is successful if a plan attracts sufficient net bids over the plan's costs. The proceeds go the landowner who implements the plan with the greatest net value of bids. We discuss a case study at Pack Forest, WA.

4 - Cost-effective Conservation Planning for Improving Landscape Connectivity

Bistra Dilkina, PhD Candidate, Cornell University, 5151 Upson Hall, Ithaca, NY, 14853, United States of America, bistra@cs.cornell.edu, Katherine Lai, Carla Gomes

Maintaining good landscape connectivity, i.e. low resistance paths to animal movement, has become a major conservation priority. We introduce the Upgrading Shortest Paths Problem, a new network improvement problem with many applications. The goal is to choose a set of upgrade actions to minimize the resistance of paths between pairs of terminals, subject to a budget limit. We evaluate our exact approach and two greedy algorithms on synthetic and real-world habitat conservation instances.

■ SD17

C - Room 209B

Decision Analysis Practice Awards Finalists

Sponsor: Decision Analysis

Sponsored Session

Chair: Robert Bordley, Booz-Allen, 101 West Big Beaver Suite #505, Troy, MI, 48085, United States of America, Bordley_robert@bah.com

1 - How HP used Decision Analysis to Launch 15 New Businesses

David Matheson, President and CEO, SmartOrg, Inc., 855 Oak Grove, Suite 202, Menlo Park, CA, 94025, United States of America, dmatheson@smartorg.com

Since 2005, HP has analyzed 30 potential new businesses and launched 15, 70% involving disruptive innovation. In an explicit "formulation" step in their new business development process, they apply key tools adapted from the decision analysis toolkit to guide group learning in focusing on creating new wealth and proving out an innovative idea.

2 - Integrated Decision Analysis: The Systems Engineering and Integrated Capabilities Analysis System

John Tindle, Senior Decision Analyst, TASC, Inc., 1795 Jet Wing Drive, Suite 100, Colorado Springs, CO, 80916, United States of America, john.tindle@TASC.COM, Douglas Owens

An introduction to the SEICAS process and an example of its use in integrated portfolio analysis. We developed an integrated approach for planning and programming that integrates Multi-Attribute Utility, Cost/Benefit prioritization, Programmatic Roadmapping to provide capability metrics projected over time with cost profiles, Capability Sensitivities to portray the interrelations and impacts on utility, and Risk assessment.

3 - PRIME: Portfolio Risk and Investment Management Engine

Dharmashankar Subramanian, Research Staff Member, IBM T. J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, bonnier@us.ibm.com, Shanchi Zhan, Himanshu Sekhar, Paul Huang, Sanjay Tripathi

The PRIME decision analysis tool consists of a risk elicitation and quantification component and a risk measure-based optimization component, and associated UI. The tool was developed to help business managers maximize the chance of achieving financial and strategic targets by optimizing investments under uncertainty. It has been used by multiple organizations across IBM to provide executive guidance on risk-adjusted allocation decisions, resulting in documented business impact exceeding $20M.

■ SD18

C - Room 210A

Scheduling Models and Algorithms

Cluster: Scheduling and Project Management

Invited Session

Chair: Alessandro Agnetis, Universit‡ di Siena, Dipartimento di Ingegneria, dell'Informazione, Siena, 53100, Italy, agnetis@dii.unisi.it

1 - Preemptive Scheduling on Two Identical Parallel Machines with a Single Transporter

Hans Kellerer, University of Graz, Universitätstrafle 15, Graz, A-8010, Austria, hans.kellerer@uni-graz.at, Vitaly Strusevich, Alan Soper

We consider a scheduling problem on two identical parallel machines, in which the jobs are moved between the machines by an uncapacitated transporter. In the processing preemption is allowed. The objective is to minimize the time by which all completed jobs are collected together on board the transporter. We identify the structural patterns of an optimal schedule and design an algorithm that either solves the problem to optimality or in the worst-case behaves as an FPTAS.

2 - Exponential Algorithms for the Two Parallel Machine Scheduling Problem

Vincent T'Kindt, Full Professor, Université Francois Rabelais Tours, 64 Avenue Jean Portalis, Tours, 37200, France, tkindt@univ-tours.fr, Christophe Lenté, Ameur Soukhal

We study the solution of the two parallel machine problem with makespan minimization by exponential algorithms. Using the standard three-field notation in scheduling, this problem can be referred to as P2||Cmax. We present DP formulations and give a new exponential algorithm based on the Sort & Search technic. Complexity bounds on the worst-case time and space complexities are stated. We also focus on the experimental solution and show that very large instances can be solved.

3 - The Lockmaster's Problem

Frits Spieksma, K.U.Leuven, Naamsestraat 69, Leuven, 3000, Belgium, frits.spieksma@econ.kuleuven.be, Sofie Coene

Inland waterways form a natural network that is an existing, congestion free infrastructure. A bottleneck for transportation over water are the locks that manage the water level. The lockmaster's problem studies the problem of finding an optimal strategy for operating a lock. We show a connection with batch scheduling, and present algorithmic results for different variants of the problem.

4 - Quantifying the Impact of Layout on Productivity: An Analysis from Robotic-Cell Manufacturing

Tharanga Rajapakshe, University of Texas at Dallas, TX, United States of America, tharanga@utdallas.edu

When evaluating competing layouts for a manufacturing system, the tradeoff between their relative benefits and their relative costs underlines the need for a reasonably accurate comparison of the productivity offered by these potential layouts. We argue for this approach by comparing the productivity of two well-known layouts in robotic-cell manufacturing: circular and linear.

5 - Planning the Production of a Fleet of Domestic Combined Heat and Power Generators

Johann Hurink, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, J.L.Hurink@utwente.nl, Maurice Bosman, Albert Molderink, Vincent Bakker, Gerard Smit

We consider a scheduling problem arising in the energy supply chain dealing with the planning of the production runs of micro Combined Heat and Power appliances installed in houses, cooperating in a fleet. The goal is to focus on the mutual electricity output of the whole fleet while still considering the local heat demand in the individual households. The problem is solved using a search method, based on a dynamic programming formulation of the scheduling problem for a single house.

■ SD19

C - Room 210B

Tutorials in Financial Services

Sponsor: Financial Services Section

Sponsored Session

Chair: Chanaka Edirisinghe, Professor, University of Tennessee, 610 Stokely Management Center, 916 Volunteer Blvd, Knoxville, TN, 37996, United States of America, chanaka@utk.edu

1 - An overview of News Analytics in Finance

Gautam Mitra, Professor, Brunel University, Kingston Lane, Uxbridge, London, UB83PH, United Kingdom, gautam.mitra@brunel.ac.uk

It is widely recognised that news plays a key role in the financial markets. New technologies that enable automatic and semi-automatic news collection, extraction, aggregation and categorisation are emerging. In this tutorial, we present the current state of research results and discuss the applications in trading, investment management and risk control.

2 - An Introduction to Credit Risk

Kay Giesecke, Assistant Professor, Stanford University, Huang Engineering Center, 475 Via Ortega 307, Stanford, CA, 94305, United States of America, giesecke@stanford.edu

This tutorial will provide an introduction to the modeling and valuation of credit risk. Topics will include stochastic models of default timing, point processes, corporate bonds, credit default swaps, and collateralized debt obligations. Numerical examples will be given and market data will be analyzed.

■ SD20

C - Room 211A

Global Optimization in Networks

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Sergiy Butenko, Associate Professor, Texas A&M University, TAMU-3131, College Station, TX, 77843, United States of America, butenko@tamu.edu

1 - Maximum Clique Problem in Very Large-scale Networks

Anurag Verma, Texas A & M University, 241 Zachry,3131 TAMU, College Station, TX, United States of America, anuragverma@tamu.edu

We explore scale reduction techniques that use the knowledge of common neighbors to obtain the maximum clique on very large-scale real life networks (a million nodes). Experimental results on graphs from the SNAP database (Collaboration networks, P2P networks, Social networks, etc) show our procedure to be much more effective than a regular peeling approach in helping us obtain the maximum clique in all the test cases. The technique has been shown to be very effective on graphs with low density.

2 - 2-Cliques on Unit Disk Graphs

Jeffrey Pattillo, Ph.D. Candidate, Texas A&M University, Department of Mathematics, College Station, TX, 77843, United States of America, jeff.pattillo@gmail.com, Sergiy Butenko, Yiming Wang

We explore the problem of finding the largest 2-clique in a Unit Disk Graph. To do this, we prove properties about the domination number of 2-cliques in Unit Disk Graphs and use these to create a solution with a .5-approximation ratio.

3 - Heuristic Algorithms for Solving the Maximum k-club Problem in Graphs

Shahram Shahinpour, Graduate student, Texas A&M University, 241 Zachry,3131 TAMU, College Station, TX, 77843, United States of America, shahinpour@neo.tamu.edu, Sergiy Butenko

We address k-club maximality testing and develop a sufficient condition for a given k-club to be maximal. We also propose heuristic algorithms for finding a maximum k-club in a given undirected graph. Computational results show that the proposed algorithms outperform the existing results in many cases.

4 - An Efficient Heuristic Method to Calculate the NNI Distance between Two Evolutionary Trees

Shirin Shirvani, Graduate Student, Texas A&M University, 3131 TAMU, Zachry 224A, College Station, TX, 77843, United States of America, shirvani@tamu.edu

We propose a fast heuristic, practical, and accurate method for computing the NNI-distance between two trees. We leverage fast computation of RF distances to filter the search space. We test our algorithm with artificial data sets containing between 8 and 50 taxa.

■ SD21

C - Room 211B

Stochastic Programming II

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Andras Prekopa, Professor, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854-8003, United States of America, prekopa@rutcor.rutgers.edu

1 - Solution of Stochastic Multidimensional Knapsack Problems with Probabilistic Constraints

Kunikazu Yoda, PhD student, RUTCOR, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854-8003, United States of America, kyoda@rutcor.rutgers.edu, Andras Prekopa

We study probabilistic constrained stochastic programming models of the multidimensional knapsack problem (and also the multiple knapsack problem) with random item weights. We present convexity of the relaxed feasible set of the problem and offer a solution to the problem under some special continuous and discrete logconcave probability distributions including normal, gamma, Poisson, and binomial.

2 - Bounding Piecewise Higher Order Convex Functions of Random Variables and Their Application

Mariya Naumova, Rutgers University, 640 Bartholomew Rd, Piscataway, NJ, 08854-8003, United States of America, mnaumova@rci.rutgers.edu, Andras Prekopa

A univariate function is said to be convex of order n if its nth order divided differences are nonnegative. Many univariate functions in economic and engineering applications are of this type. Lower and upper bounds are constructed on the expectation of such a function of a random variable under moment information. The bounds are optimum values of LP's or results of specially designed numerical integration. Some of them are given by formulas, others by algorithms.

3 - Properties and Calculation of MVaR and MCVaR

Jinwook Lee, PhD Student, Rutgers Center for Operations Research, 640 Bartholomew Rd., Piscataway, NJ, 08854, United States of America, jinwook@eden.rutgers.edu, Andras Prekopa

Multivariate Value at Risk(MVaR) and Multivariate Conditional Value at Risk(MCVaR) were introduced and discussed in a recent paper by PrÉkopa (Annals of OR, 2010). In this paper we explore further properties of these risk measures and compare them to those defined for the univariate case. Methods for the calculation of the MVaR already exist in the literature but not for the MCVaR. In this paper we present a numerical method for that, using ideas from univariate and multivariate moment problems.

■ SD22

C - Room 212A

Joint Session Optimization/ENRE: Stochastic Programming and Wind Energy

Sponsor: Optimization- Stochastic Programming/Energy, Natural Resources and the Environment- Energy

Sponsored Session

Chair: Yongpei Guan, University of Florida, Weil Hall 413, Gainesville, FL, United States of America, guan@ise.ufl.edu

1 - Transmission Swtiching Considering Static Security

Jianhui Wang, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL, United States of America, jianhui.wang@anl.gov, Cong Liu, James Ostrowski

In this talk, we present a transmission switching model that considers the static security of the power system. The power flow constraints before and after the transmission line switching operation are modeled by disjuctive programming. The problem is reformulated as a mixed-integer programming problem. The results show the improvement of the proposed model over the existing ones.

2 - Multi-stage Stochastic Unit Commitment via Accelerated Progressive Hedging

Jean-Paul Watson, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185, United States of America, jwatson@sandia.gov

We consider computational aspects of solving large-scale stochastic unit commitment problems, using Rockafellar and Wets' Progressive Hedging as a baseline heuristic algorithm. We examine the impact of asynchronous sub-problem solves and scenario bundling, the combination of which can dramatically accelerate algorithm convergence rates in practice. We describe computational results on benchmark problem instances, focusing on quantification of the extensive form optimality gap.

3 - A Branch-and-Cut Algorithm for the Multi-stage Stochastic Unit Commitment Problem

Yongpei Guan, University of Florida, Weil Hall 413, Gainesville, FL, United States of America, guan@ise.ufl.edu, Ruiwei Jiang, Jean-Paul Watson, Ming Zhao

Due to the uncertainty from both supply and demand sides, power grid operation is generally a stochastic nonlinear problem for regulated electricity market. In this talk, we propose a Multi-stage Stochastic Unit Commitment (MSUC) model to address this problem, where we approximate the nonlinear fuel cost functions by piecewise linear functions. Furthermore, we employ a branch-and-cut algorithm to solve MSUC by constructing strong inequalities for the substructures of the constraints.

4 - Dynamic Pricing Strategies for Power Grid Problem

Cherry Zhao, University of Florida, Gainesville, FL, United States of America, cherryzhao09@ufl.edu, Yongpei Guan

This paper addresses how to find the best pricing policy for System Operator to maximize the social welfare. In this paper, we propose a two-stage robust integer programming approach to address the dynamic pricing problems under the worst case demand scenario. We use a price-elastic demand curve to calculate social welfare and use Bender's Decomposition to solve this problem.

■ SD23

C - Room 212B

Joint Session Homeland/SPPSN/MAS: Sensors in Homeland Security

Cluster: Homeland Security - Emergency Prep/Public Programs, Service and Needs/Military Applications Society

Invited Session

Chair: Gary Gaukler, Texas A&M University, TAMU 3131, College Station, TX, 77843, United States of America, gaukler@tamu.edu

1 - A Framework for Modeling the Detection of Smuggled Nuclear Materials

Gary Gaukler, Texas A&M University, TAMU 3131, College Station, TX, 77843, United States of America, gaukler@tamu.edu, Chenhua Li, Yu Ding

In this talk, we will discuss a set of layered container inspection policies for detecting illicit nuclear materials at ports-of-entry such as sea ports and land border crossings. We develop a set of new inspection policies, which are designed to allow for improved defense against sophisticated adversaries. We will discuss the performance of these policies in the context of a general framework for nuclear materials detection, as well as some implications for worldwide shipping.

2 - Stochastic Optimization Models for Rapid Detection of Viruses in Cell-phone Networks

Jinho Lee, University of Texas at Austin, Graduate Program in ORIE, Austin, TX, 78712-0292, United States of America, jinholee@utexas.edu, John Hasenbein, David Morton

We describe a family of models for the dynamics of a virus spreading in a cell-phone network. Based on the resulting dynamics, we formulate optimization models to detect the virus, subject to resource limitations. Submodularity and sample-path analysis are used to develop heuristic solution techniques for large problem instances. We use data from a cell phone company to test our solution methods.

3 - Nuclear Threat Analysis with Machine Learning

Simon Labov, Physicist, Lawrence Livermore National Laboratory, P.O. Box 808, L-181, Livermore, CA, 94551, United States of America, labov1@llnl.gov, Jaroslaw Tuszynski, Justin Briggs, Karl Nelson, Artur Dubrawski, Saswati Ray, Dov Cohen

One of the most critical challenges in national security is the detection of a nuclear or radiological weapon in the midst of common radioactive materials. We are developing a unique approach that combines features from contextual information (e.g., location, goods description, etc.) and multiple radiation sensors to provide threat determination analysis. We use machine learning algorithms and physics-based techniques for text enumeration, feature extraction and threat classification.

■ SD24

C - Room 213A

Network Games

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Nicolas E. Stier-Moses, Columbia University, 3022 Broadway Avenue, New York, NY, 10027, United States of America, stier@gsb.columbia.edu

1 - Existence and Uniqueness of Equilibria for Flows over Time

Jose Correa, Universidad de Chile, Department of Industrial Engineering, Santiago, Chile, joser.correa@gmail.com, Roberto Cominetti, Omar Larre

Network flows that vary over time arise naturally when modeling rapidly evolving systems such as the Internet. In this paper, we continue the study of equilibria for flows over time in the single-source single-sink deterministic queuing model proposed by Koch and Skutella. We give a constructive proof for the existence and uniqueness of equilibria for the case of a piecewise constant inflow rate, through a detailed analysis of the static flows obtained as derivatives of a dynamic equilibrium.

2 - Stochastic Selfish Routing

Evdokia Nikolova, Massachusetts Insitute of Technology, 32 Vassar St, Cambridge, MA, United States of America, eddie.nikolova@gmail.com, Nicolas E. Stier-Moses

We embark on an agenda to investigate how stochastic delays and risk aversion transform traditional models of routing games and the corresponding equilibrium concepts. We provide equilibrium existence and characterization. We also show that succinct representations of equilibria always exist and we prove that under exogenous stochastic delays, the price of anarchy is exactly the same as in the corresponding game with deterministic delays.

3 - A Facility Location Problem under Competition

Yonatan Gur, Columbia University, 3022 Broadway Avenue, New York, NY, 10027, United States of America, ygur14@gsb.columbia.edu, Nicolas E. Stier-Moses

Considering a discrete facility location game, we provide a complete and efficient characterization of equilibria in a broad class of structures, focusing on two players competition. We provide conditions that guarantee that removing arcs from the network increases consumer cost, and show these conditions hold in a broad class of structures, which implies that the the worst possible equilibria are achieved in trees. We conclude by providing some applications to product design.

4 - Learning in Games and Social Welfare Maximization

Ozan Candogan, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, candogan@mit.edu, Asuman Ozdaglar, Pablo Parrilo, Daron Acemoglu

We consider the social welfare maximization problem of a system planner, who can observe strategy updates of agents, but does not have any prior information about their preferences. We first provide a framework for studying the limiting behavior of adaptive learning dynamics in finite games. We then show that the system planner can implement the social welfare maximizing strategy profile by using pricing and control strategies that only depend on choices revealed by strategy updates of agents.

■ SD25

C - Room 213BC

Operations and Marketing

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: John Turner, Assistant Professor, University of California, Irvine, The Paul Merage School of Business, SB 338, Irvine, CA, 92697-3125, United States of America, john.turner@uci.edu

1 - Negative Advertising Strategies

Sasa Pekec, Duke University, Fuqua School of Business, Durham, NC, United States of America, pekec@duke.edu, Changrong Deng

A multi-period model of dynamically evolving market shares is developed. Firms choose long-run investments that determine customer retention and attraction in every period. We investigate equilibrium behavior and analyze negative advertising strategies, i.e., strategies aiming to hurt the competitor's market share more than to increase one's own. Negative strategies are more likely to be triggered by firms that lag behind the market leader, and are unlikely to emerge in the final period.

2 - Do Clickstreams Provide Advance Demand Information? An Empirical Study and Valuation

Tingliang Huang, Assistant Professor, University College London, Gower Street, London, WC1E 6BT, United Kingdom, t.huang@ucl.ac.uk, Jan Van Mieghem

Many firms feature their products on the Internet but take orders offline. Precise customer identification and association with click data on such non-transactional websites is often problematic. Our novel data set contains online clickstream data matched with offline purchasing data. We empirically assess to what extent clickstream tracking of such non-transactional websites provides advance demand information (ADI) and estimate its operational value.

3 - Social Network Advertising Optimization via The Edge-triangle k-Subgraph Clustering Problem

Ihsan Salleh, PhD Student, University of California Irvine, The Paul Merage School Business, SB 332, Irvine, CA, 92697, United States of America, imohdsal@uci.edu, John Turner

We introduce optimization models for advertising in a social network based primarily on the network connections. Given a simple graph, multiple advertisers must each be assigned a dense subgraph with k vertices such that no two advertisers are assigned the same vertex. We define the density of a subgraph based on sociological research. We present computational results on real social networks such as Facebook.

4 - Contract Choice for Targeted Advertising

John Turner, Assistant Professor, University of California, Irvine, The Paul Merage School of Business, SB 338, Irvine, CA, 92697-3125, United States of America, john.turner@uci.edu, Kinshuk Jerath

We study an ad network's optimal contract choice for two classes of campaign contracts that treat audience uncertainty differently — Share-of-Voice (SV) and Guaranteed Targeted Display Advertising (GTDA). We show how the size of the ad network and the extent to which advertisers request tightly-targeted campaigns influences the type of contract which ad networks prefer to offer to advertisers.

■ SD26

C - Room 213D

Operations Management and Marketing

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Xuanming Su, University of Pennsylvania, The Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104, United States of America, xuanming@wharton.upenn.edu

1 - Supply Chain Contracting under Competition: Bilateral Bargaining vs. Stackelberg

Annabelle Feng, University of Texas at Austin, McCombs School of Business, Austin, TX, United States of America, Annabelle.Feng@mccombs.utexas.edu, Lauren Xiaoyuan Lu

The Stackelberg game, in which a manufacturer offers a take-it-or-leave-it contract to a retailer, has become the workhorse of the supply chain contracting literature. The bilateral bargaining game, although better reflecting the power structure in business-to-business transactions, has only limited adoption. The present paper intends to conduct a systematic comparison between the two game structures in terms of contract outcomes and firm preferences.

2 - Strategic Information Management in Competitive R&D Projects

Yi Xu, University of Maryland, Smith School of Business, College Park, MD, 20742, United States of America, yxu@rhsmith.umd.edu, He Chen, Manu Goyal

Firms often form beliefs on how lucrative an R&D project is based on competing firms' R&D spending and success. We analyze such a scenario where a Leader firm's R&D effort is interpreted by a Follower firm to customize its own research foray. Thus the Leader firm strategically distorts its R&D effort in an attempt to mislead the Follower firm the distortion depends crucially on whether the uncertainty is on the technological dimension of the R&D project, or on the market potential.

3 - Dynamic Pricing Competition with Strategic Customers under Vertical Product Differentiation

Dan Zhang, University of Colorado, Leeds School of Business, Denver, CO, United States of America, dan.zhang@colorado.edu., Qian Liu

We consider dynamic pricing competition between two firms offering vertically differentiated products to strategic customers who are inter-temporal utility maximizers. We show that there exists a unique pure strategy Markov perfect equilibrium in the game, which admits explicit recursive expressions. We also study versions of the model where one firm unilaterally commits to static pricing and show that such commitment can be very valuable. We discuss insights from our model.

4 - A Dynamic Level-k Model in Extensive-form Games

Xuanming Su, University of Pennsylvania, The Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104, United States of America, xuanming@wharton.upenn.edu, Teck-Hua Ho

Backward induction is the most widely adopted principle for solving dynamic games. However, people frequently violate backward induction. We propose an alternative decision model that captures systematic ways in which people deviate from backward induction.

■ SD27

C - Room 214

Supply Chain Management - Models and Applications

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Suresh Muthulingam, Assistant Professor of Operations Management, Cornell University, The Johnson School, 401P Sage Hall, Ithaca, NY, 14853, United States of America, sm875@cornell.edu

1 - Organizing for Quality Improvement

Anupam Agrawal, Assistant Professor of Business Administration, University of Illinois at Urbana-Champaign, 363 Wohlers Hall, 1206 South Sixth Street, Champaign, IL, 61820, United States of America, anupam@illinois.edu, Raj Echambadi

We posit that enhanced quality control could be achieved through developing organizational structures dedicated to foster trust and commitment between a buyers and suppliers. Our study shows that over a long period of time, improvement in incoming quality of components in the car division of an automotive firm was significantly better than that in its truck division, and this difference was significantly influenced by the way the car division chose to organize itself for quality improvement.

2 - Optimizing Transportation and Handling Costs in a Retail SC by Setting Replenishment Parameters

Karel Van Donselaar, Assistant Professor, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600MB, Netherlands, k.h.v.donselaar@tue.nl, Rob Broekmeulen

To increase the efficiency of the operations, retailers have to focus now on transportation and handling processes in DCs and stores taking into account weekly demand patterns and in-store replenishment processes due to limited shelf space. With fast approximations for the expected (backroom) inventory and the expected number of order lines we can optimize transportation and handling processes by changing the parameters in the Automated Store Ordering system.

3 - Recommendations for Improving the Milk Supply Chain: A Game-theoretic Approach

Liying Mu, University of Texas at Dallas, Richardson, TX, United States of America, muliying@student.utdallas.edu, Milind Dawande, Vijay Mookerjee, Ramaswamy Chandrasekaran

Quality problems in milk supply (arising primarily from deliberate adulteration by producers) have been widely reported. We discuss the milk supply chain and analyze a game between a milk station and multiple producers who supply milk to the station. We develop several quality testing policies that the station could use to improve both its profit and the quality of milk. Interventions by interested third parties are also discussed.

4 - Role of Learning in Retention in Entrepreneurial Firms

Onesun Steve Yoo, Assistant Professor, University College London, Department of Management Science & Innovation, Gower Street, London, WC1E 6BT, United Kingdom, onesun.yoo@ucl.ac.uk, Dharma Kwon

We present a model illustrating a tension between entrepreneur and employee using a real options game, and provide insights into how intrafirm learning can be used to increase retention.

■ SD28

C - Room 215

Pricing for Service Operations

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Pavithra Harsha, IBM, 1101 Kitchawan Road, Room 34-225, Yorktown Heights, NY, United States of America, pharsha@us.ibm.com

1 - Would the Social Planner Let Bags Fly Free?

Gad Allon, Northwestern University, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Martin Lariviere, Achal Bassamboo

In June 2008, American Airlines became the first major US airline to institute a fee on the first checked bag. Within 18 months, nearly every other major carrier followed suit. Here, we examine whether the fees are socially efficient. We find that the fees are in fact Pareto improving. While customers may dislike the fees, they are a means to alter customer behavior and thus reduce the airline's costs. Customers are compensated by lower base fares.

2 - Efficiency of a Shared Resource in Service Industries with Differentiated Services

Wei Sun, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cmbridge, MA, United States of America, sunwei@mit.edu, Georgia Perakis

We consider a facility where several providers compete with differentiated services and congestion depends on the total number of users. We provide a tight characterization of the relative welfare loss under the Nash setting with respect to a fully efficient setting. Contrary to the conventional wisdom, we show that mergers could lead to higher welfare. Lastly, we propose an alternative implementation of congestion pricing which achieves the optimal social welfare under the Nash setting.

3 - Robust Dynamic Pricing with Two Substitutable Products

Ming Chen, University of Maryland, 3330C Van Munching Hall, College Park, MD, 20742, United States of America, chenming@rhsmith.umd.edu, Zhi-Long Chen

We consider a dynamic pricing problem with two substitutable products which involves a number of business rules commonly seen in practice. Due to limited demand information, we use a set of lower and upper bounds to characterize the underlying demand. The problem is formulated as a dynamic program. We develop a fully polynomial-time approximation scheme which guarantees a proven near optimal solution in a manageable computational time for practically sized problems.

4 - Markdown Optimization for a Fashion e-tailer: The Impact of Returning Customers

Zachary Leung, Massachusetts Institute of Technology, Operations Research Center, 77 Massachusetts Avenue Bldg. E40-149, Cambridge, MA, 02139, United States of America, zacleung@MIT.EDU, Georgia Perakis, Pavithra Harsha

In the context of a fashion e-tailer, we study a model for markdown optimization, i.e. how to set prices to maximize revenues from selling a fashion good. In contrast to shoppers in a brick-and-mortar store, Internet shoppers are extremely well-informed of prices, so we expect a high rate of returning customers. We compare the prices and revenue of a myopic pricing policy, which treats returning customers the same as first-time customers, to the optimal pricing policy.

■ SD29

C - Room 216A

Healthcare Delivery Within and Outside Hospital Environments: Operational Improvements and Patient Outcomes

Sponsor: Manufacturing & Service Oper Mgmt/ Healthcare Operations

Sponsored Session

Chair: Sarang Deo, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, 500032, India, sarang_deo@isb.edu

1 - Physician Workload and Hospital Reimbursement: overworked Servers Generate Lower Income

Sergei Savin, Associate Professor, The Wharton School, University of Pennsylvania, Philadelphia, PA, United States of America, savin@wharton.upenn.edu, Adam Powell, Nicos Savva

We study the impact of physician workload on hospital reimbursement utilizing a detailed data set from the trauma department of a major urban hospital. We find that the proportion of patients assigned a "high-severity" status for reimbursement purposes is substantially reduced as the workload of the discharging physician increases. This effect persists after we control for a number of systematic differences in patient characteristics, condition and time of discharge.

2 - The Relationship between Primary Care Access and ER Visits

Christian Terwiesch, University of Pennsylvania, The Wharton School, 3730 Walnut St., Philadelphia, PA, United States of America, terwiesch@wharton.upenn.edu

We present an empirical analysis of the relationship between access to primary care and the likelihood of requiring services in the emergency department. Our results show that the booking density of primary care providers is a good predictor of how likely a patient is showing up in the ER.

3 - Does Multi-tasking Improve Productivity?

Diwas KC, Emory University, 1300 Clifton Road NE, Atlanta, GA, United States of America, Diwas_KC@bus.emory.edu

We examine the effect of multi-tasking on worker productivity and output quality in an emergency department. By drawing on recent findings in the experimental psychology literature we develop several hypotheses for the effect of multitasking on worker productivity. We find that multi-tasking has implications for the service encounter, including patient flow time and quality of care. We also find that multi-tasking increases the productivity up to a certain extent.

4 - Improving Access to Community-based Chronic Care through Improved Capacity Allocation

Tingting Jiang, Northwestern University, IEMS Department, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, tingting-jiang@northwestern.edu, Karen Smilowitz, Sarang Deo, Seyed Iravani, Stephen Samuelson

Most health care operations models focus on either efficiency improvements in the delivery system or improvements in clinical decisions. We consider a novel setting of community-based delivery of chronic condition, where it is necessary to integrate these two approaches. We develop and analyze a joint disease progression and capacity allocation model and test our findings using data provided by Mobile C.A.R.E, a community-based provider of asthma care to public school students in Chicago.

■ SD30

C - Room 216B

Interface of Operations, Finance, and Risk Management

Sponsor: Manufacturing & Service Oper Mgmt/ IFORM SIG

Sponsored Session

Chair: Volodymyr Babich, Georgetown University, McDonough School of Business, 37th and O St NW, Washington, DC, 20057, United States of America, vob2@georgetown.edu

1 - Profitability, Inventory, and Operating and Financial Leverage

John Birge, Professor, University of Chicago, Booth School of Business, Chicago, IL, United States of America, john.birge@chicagobooth.edu

The relationships among firm profitability, inventory, and leverage, both operational and financial, depend on how these characteristics are measured. Empirically, relative measures on the basis of assets differ from those on a sales basis. This talk will discuss a model that provides a consistent story for these differences.

2 - Risk-aversion Happens: Why Risk-neutral Manufacturers Ought to Hedge Commodity Material Purchases

Danko Turcic, Assistant Professor of Operations, Olin Business School, Washington University in St. Louis, Box 1133, St. Louis, MO, United States of America, turcic@wustl.edu, Ehsan Bolandifar, Panos Kouvelis

We study hedging of commodity inputs in a bilateral monopoly supply chain and report non-trivial differences between hedging in non-strategic and supply chain settings. In the former, a sufficient condition for hedging to be value increasing is that the hedger's payoff is a concave function of the hedgeable exposure. In the latter, concavity is a sufficient condition for hedging to be value increasing for the hedger's supply chain counterpart. It may, however, reduce the hedger's own payoff.

3 - Optimal Operating Control and Dividend Distribution Policies
Rene Caldentey, New York University, New York, NY, United States of America, rcaldent@stern.nyu.edu

In this talk we propose a continuous-time model to coordinate production and financing decisions for a firm that faces bankruptcy risks. We consider a firm whose net earnings follow a diffusion process which is influenced by the firm's operating strategy. The firm has to decide on the optimal operating policy (drift-volatility pair) as well as the leverage ratio and the distribution of dividends.

4 - Managing Disruption Risk: The Interplay between Operations and Insurance
Lingxiu Dong, Olin Business School, Washington Univeristy in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, dong@wustl.edu, Brian Tomlin

Business interruption (BI) insurance offers firms a financial mechanism for managing their exposure to disruption risk. Firms can also avail of operational measures to manage the risk. We explore the use of and the interplay between BI insurance and operational measures in managing disruption risk.

■ SD31

C - Room 217A

Joint Session HAS/SPPSN: Disease Monitoring and Medical Decision Making

Sponsor: Health Applications/Public Programs, Service and Needs
Sponsored Session

Chair: Jonathan Helm, University of Michigan, Ann Arbor, MI, United States of America, jhelm@umich.edu

Co-Chair: Mariel Lavieri, University of Michigan, Ann Arbor, MI, United States of America, Lavieri@umich.edu

1 - Optimal Screening Strategies of Patients on the Kidney Transplant Waiting List
Alireza Sabouri, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, V6T 1Z2, Canada, Alireza.Sabouri@sauder.ubc.ca, Steven Shechter, Woonghee Tim Huh

The health condition of patients on the kidney transplant waiting list deteriorates while they are waiting for an organ arrival and hence they may no longer be suitable for transplant. Therefore, transplant centers screen waiting patients at various intervals to identify ineligible patients. We propose a model for finding screening strategies that minimizes the expected screening cost and the expected penalty cost associated with transplanting an organ to an ineligible patient.

2 - Optimal Age-dependent Screening Strategy Design for Chlamydia Infection
Yu Teng, Weldon School of Biomedical Engineering, Purdue University, 206 S. Martin Jischke Drive, west lafayette, In, 47907, United States of America, yteng@purdue.edu, Nan Kong

Chlamydia infection is one of the most common sexually transmitted diseases in the U.S. Since the majority of infected people are asymptomatic and the incidence rate varies over the age spectrum, age-specific screening methods may be cost-effective in controlling the disease. We adapt a discrete-time dynamic model to evaluate the cost and effectiveness of age-specific screening strategies and solve the resultant continuous-variable dynamic optimization problem to identify the optimal strategy.

3 - Optimal Screening Policies for Childhood Obesity
Yan Yang, Stanford University, ICME, Stanford, CA, United States of America, yanyang@stanford.edu, Jeremy Goldhaber-Fiebert, Lawrence Wein

We formulate and solve a dynamic program for the optimal biennial childhood obesity screening policy from a societal viewpoint. Using longitudinal body mass index data from several thousand children, we find that the optimal policy differs significantly from the policy recently recommended by the United States Preventive Services Task Force.

4 - Dynamic Forecasting and Control Algorithms with Application to Glaucoma
Jonathan Helm, University of Michigan, Ann Arbor, MI, United States of America, jhelm@umich.edu, Gregg Schell, Joshua Stein, Mariel Lavieri, Mark Van Oyen

Chronic illnesses, such as glaucoma, are long lasting and affect almost one out of every two adults in the US. In monitoring these patients there is often a clear tradeoff between monitoring intervals that are too short and too long. This work develops dynamic state space prediction models of disease state in combination with measures of likelihood of disease progression to determine "time to next test". Finally, we apply this approach to glaucoma, using data from clinical trials.

■ SD32

C - Room 217BC

Panel Discussion: Analytics Applications in Railroads II

Sponsor: Railway Applications
Sponsored Session

Chair: Pooja Dewan, General Director Decision Systems, BNSF Railway, Fort Worth, tx, 76131, United States of America, Pooja.Dewan@bnsf.com

1 - Analytics Applications in Railroads II
Moderator: Pooja Dewan, General Director Decision Systems, BNSF Railway, Fort Worth, tx, 76131, United States of America, Pooja.Dewan@bnsf.com, Panelists: Michael Gorman, Jeff Day, Shiwei He

This year's round table goes well with the conference theme of TransfORmation. As you know our profession is trying to transform itself as Analytics in the hope to be more appealing to general audience, especially industry. We have put together panel of experts from academics, practitioners (railroads and consultants) and analytics software vendor. There will be two sessions in which we expect to hear their opinions on what this transformation means to the railroad industry in the near term and long term future.

■ SD33

C - Room 217D

Technometrics

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Hugh Chipman, Professor, Acadia University, 12 University Avenue, Wolfville, NS, B4P 2R6, Canada, hugh.chipman@acadiau.ca

1 - Compliance Testing for Random Effects Models with Joint Acceptance Criteria
Pritam Ranjan, Assistant Professor, Acadia University, Department of Mathematics and Statistics, Wolfville, NS, B4P2R6, Canada, pritam.ranjan@acadiau.ca, Crystal Linkletter, Chunfang Devon Lin, William Brenneman, Derek Bingham, Richard Lockhart, Tom Loughin

For consumer protection, governments perform inspections on goods by weight/volume to ensure consistency between actual & labeled contents. To pass inspection, samples must comply with restrictions on the individual items and on average. In this article we consider the current NIST criteria. We provide an approximation for the probability of acceptance that is applicable for processes with one or more sources of variation. We use simulations to assess the quality accuracy of the approximation.

2 - A Random Onset Model for Degradation of High-Reliability Systems
Scott Vander Wiel, Los Alamos National Laboratory, MS F600, Los Alamos, NM, 87545, United States of America, scottv@lanl.gov, Todd Graves, Shane Reese, Alyson Wilson

Weapons stockpiles are expected to have high reliability over time, but prudence demands regular testing to detect detrimental aging and maintain confidence that reliability is high. We present a model, called RADAR, in which a stockpile has high initial reliability that may begin declining at any time. We explore how confidence in continued high reliability changes as a result of reduced sampling, discovery of failed units, and information about when a unit failed.

■ SD34

C - Room 218A

Strategies for Incentive Alignment in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Vikram Tiwari, Assistant Professor, University of Houston, 312 Technology II Bldg, Houston, TX, 77204, United States of America, vtiwari@central.uh.edu

Co-Chair: Ana Groznik, Assistant Professor, Universidade Catolica Portuguesa, School of Business and Economics, Palma de Cima, Lisboa, 1649-023, Portugal, agroznik@clsbe.lisboa.ucp.pt

1 - Incentives for Improvement of Patients' Health in Primary Care
Ana Groznik, Assistant Professor, Universidade Catolica Portuguesa, School of Business and Economics, Palma de Cima, Lisboa, 1649-023, Portugal, agroznik@clsbe.lisboa.ucp.pt, Vikram Tiwari

In most payment reimbursement schemes offered by health insurance companies, physicians are incentivized to adhere to the commonly accepted treatment guidelines for patients. It is hoped that this indirectly impacts patient's health outcomes. Using stylized models we evaluate and compare alternative incentive schemes, especially those where payments are more directly tied to patient's health quality improvement, and study the necessary conditions for the equilibrium solution.

2 - Quality, Price, and Wait-time Competition between Health Providers with Insured Consumers
Aaron Ratcliffe, University of North Carolina at Chapel Hill, McColl Building CB 3490, Chapel Hill, NC, 27599, United States of America, Aaron_Ratcliffe@kenan-flagler.unc.edu, Wendell Gilland, Ann Marucheck

Competition and interactions with insurers drive how US health providers balance key strategies of quality, access, affordability and efficiency. We develop a three-stage queuing model to investigate impacts of competition on quality, wait time, price, profit and welfare in a healthcare setting with a third-party payer. We characterize optimal outcomes for monopoly and duopoly providers and social welfare maximization, and examine how insurers alter the effects of competition.

3 - Fee-For-Service Contracts in Pharmaceutical Distribution Supply Chains: Design, Analysis, and Management
Hui Zhao, Professor, Krannert School of Management, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States of America, zhaoh@purdue.edu, Chuanhui Xiong, Srinagesh Gavirneni, Adam Fein

Fee-For-Service (FFS) contracts dramatically changed the way pharmaceutical distribution supply chains are designed and managed. In spite of their popularity, FFS has never been rigorously analyzed and its effectiveness carefully tabulated. We analyze FFS model considering the unique features of pharmaceutical supply chains, calculate pareto-improving fee ranges (very useful for the contentious contract negotiation), and suggest ways to improve the efficiency of the pharma supply chains.

4 - The Concentration of Medical Expenditures and Prediction of Persons with Future High Expenditures
Steven Cohen, Director, Center for Financing, Access and Cost Trends, Agency for Healthcare Research and Quality, 540 Gaither Road, Rockville, MD, 20850, United States of America, scohen@ahrq.gov

Given the high concentration of health care expenditures in a given year among a small percentage of the population, a prediction model that can accurately identify the persistence of high levels of expenditures is an important analytical tool. In this study, the populations' health care expenditure distribution and its variation over time is examined. The performance of alternative prediction models to discern future levels of health care expenditures in a subsequent year are also evaluated.

■ SD35

C - Room 218B

Systems Reliability and Maintenance

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Zhigang Tian, Assistant Professor, Concordia University, Institute for Information Systems Engine, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca

Co-Chair: Nan Chen, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Department of Industrial & System Engr, Singapore, Singapore, isecn@nus.edu.sg

1 - Condition Based Maintenance Optimization Considering Improving Prediction Accuracy
Zhigang Tian, Assistant Professor, Concordia University, Institute for Information Systems Engine, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca, Bairong Wu

In many applications, the equipment remaining useful prediction accuracy improves with the increase of the age of the component as it approaches the failure time. In this research, an effective CBM optimization approach which considers the prediction accuracy improvements is proposed to optimize the maintenance schedules. We develop a numerical method to accurately evaluate the cost of the CBM policy. The proposed approach is demonstrated using field vibration monitoring data.

2 - Reliability Analysis of Repairable Systems with Dependent Failure Components
Qingyu Yang, Assistant Professor, Wayne State University, United States of America, qyang@wayne.edu, Nailong Zhang, Yili Hong

Competing risks models have received increasing attention for repairable system with multiple components. Most existing methods, however, assumes the independence of component failures. We propose a method to model the reliability of repairable systems subject to dependent failure components. The developed method is illustrated with a production system for cylinder heads.

3 - Stochastic Evolution Modeling Using Inverse Gaussian Process
Nan Chen, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Department of Industrial & System Engr, Singapore, Singapore, isecn@nus.edu.sg, Zhisheng Ye, Loon Ching Tang, Min Xie

This paper investigates the properties of Inverse Gaussian process for monotonically evolving signals. We have shown that the Inverse Gaussian process has close relationship with Wiener processes, and is a limiting compound Poisson process. It has been found that Inverse Gaussian process also possesses attractive features to incorporate random effects or covariates to accommodate the heterogeneity often encountered in practice. We used an example to illustrate the applicability of IG processes.

4 - Development of Protection Strategies for Critical Infrastructures under Competing Adversaries
Jose Emmanuel Ramirez-Marquez, Associate Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, jmarquez@stevens.edu, Chi Zhang

One of the main threats to critical infrastructures is from intentional attackers, who are resourceful and inventive in developing attack strategies. To consider their intelligence, a contest between the protector and the attacker with incomplete information is proposed for developing protection strategies for critical infrastructures. To deal with the computational challenges, the contest is transformed into two multi-objective optimization models solved via an evolutionary algorithm.

5 - Proportional Hazard Modeling of Hierarchical Systems with Multi-Level Information Aggregation
Jian Liu, Assistant Professor, The University of Arizona, Rm 268 ENGR Building, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, jianliu@email.arizona.edu, Mingyang Li

We propose a semi-parametric approach to modeling failure hazard of hierarchical systems by aggregating multi-level information under Bayesian framework. A novel method is developed to elicit prior hazard of the system from the aggregated posterior hazard of lower-level components. The system-level model accuracy is improved by reducing the prior subjectivity and compensating the lack of higher-level experimental data. A numerical case study demonstrates its effectiveness.

■ SD36

C - Room 219A

Discrete Optimization with Telecom Applications

Sponsor: Telecommunications

Sponsored Session

Chair: J. Cole Smith, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, j.cole.smith@gmail.com

1 - An Empirical Analysis of the Triples Formulation of the Maximum Concurrent Flow Problem
Eli Olinick, Associate Professor, Southern Methodist University, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, olinick@lyle.smu.edu

The classical edge-path and node-arc formulations of the maximum concurrent flow problem (MCFP) yield difficult-to-solve linear programs. We present a new formulation for the MCFP that produces significantly smaller LPs, and an empirical analysis comparing the three formulations.

2 - An Integer Programming Based Approach to the Close-enough Traveling Salesman Problem
Behnam Behdani, PhD Candidate, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, behdani@ufl.edu, J. Cole Smith

We propose an algorithm for solving a variant of the Traveling Salesman Problem known as the Close-Enough Traveling Salesman Problem (CETSP), where the traveler visits a node if it enters a compact vicinity of that node. We investigate several ways of obtaining a lower bound on the optimal CETSP tour length, and prescribe a method of computing a series of such bounds that converge to an optimal solution of the problem. Computational results demonstrate the efficiency of the proposed method.

3 - An Integer Programming Approach for Liar's Domination Problem Variation

Sibel Sonuc, PhD student, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, sibel.bilge@ufl.edu, J. Cole Smith

Consider an undirected graph where each node represents a location to be watched. An edge (u,v) exists if and only if a sensor on one node can watch the other. Among a number of sensors, at most k of them can be faulty. The sensors should be located so that a faulty sensor can be detected and the status of each node can be verified. We model this as a two-stage problem, where the first determines the best set of locations for sensors and the second computes maximum number of ambiguous nodes.

4 - A Distribution Network Design Problem with Consolidation and Capacity Considerations

Halit Uster, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77840, United States of America, uster@tamu.edu, Homarjun Agrahari

We consider a network design problem where smaller loads/packages are combined for long-distance transfers at capacitated processing centers. We develop a mixed integer model to determine center locations, transfer links, and routing. We present a Benders Decomposition based solution approach and computational results demonstrating its efficiency.

■ SD37

C - Room 219B

Quality Modeling and Monitoring in Service Industries

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Li Zeng, Assistant Professor, University of Texas at Arlington, 500 West First Street, Arlington, TX, 76019, United States of America, lzeng@uta.edu

1 - Modeling of Outbound Calls in Performance Monitoring of Telephone Nurse Triage Services

Li Zeng, Assistant Professor, University of Texas at Arlington, 500 West First Street, Arlington, TX, 76019, United States of America, lzeng@uta.edu

As an important component of the healthcare system, telephone nurse triage services have grown rapidly since the 1990s. Performance monitoring is important for quality control and improvement in such services. This study considers the monitoring of outbound calls, which is a critical metric of service accessibility. A hierarchical Bayesian model of the outbound calls is proposed and compared with other models.

2 - Quantitative Measures for Alcohol Induced Driving Behavior Characterization

Devashish Das, Graduate Student, University of Wisconsin, Madison, Department of Industrial Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, ddas3@wisc.edu, Shiyu Zhou, John D. Lee

In this talk, we will present a data analysis methodology to differentiate the driving conditions with and without alcohol induced impairment by comparing various quantitative measures on the steering wheel signal. Such as, simple statistics like the mean and the variance, as well as nonlinear invariant dynamic measures like entropy, Lyapunov's exponent etc. It is found that the nonlinear invariant measures are more robust than the simple measures in differentiating the two driving conditions.

3 - Analytical Modeling of Rapid Response Process in Acute Care

Jingshan Li, Associate Professor, University of Wisconsin - Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, jingshan@engr.wisc.edu, Xiaolei Xie, Colleen Swartz, Paul DePriest

In this talk, we present an analytical model of rapid response process in acute care to improve patient safety and quality of care. In particular, a complex network with parallel, split, and merge structures is used to model the rapid response process. Such a model has been compared with the collected data in acute care service in a academic hospital. It is shown that the model can provide accurate estimates of the care performance.

4 - Fractal Geometry Based SPC

Irad Ben-Gal, Tel Aviv University, Tel-Aviv, 69978, Israel, bengal@eng.tau.ac.il, Noa Ruschin Rimini, Oded Maimon

We suggest a new statistical process control (SPC) approach for data-rich environments. The proposed approach is based on the theory of fractal geometry. It enables a dynamic inspection of multivariate data taken from non-linear and state-dependent processes. It can be used in industrial and service organizations for anomaly detection, pattern analysis and root cause analysis.

■ SD38

H- Johnson Room - 4th Floor

New Directions in Location Analysis

Sponsor: Location Analysis

Sponsored Session

Chair: Dmitry Krass, Professor, University of Toronto, 105 St George St, Toronto, ON, M5S 3E6, Canada, Krass@Rotman.Utoronto.Ca

1 - Facility Location and New Product Introduction

Vahideh Abedi, Ph.D. Candidate, Rotman School of Management, University of Toronto, 105 St. George st, Toronto, ON, M5S 3E6, Canada, VahidehSadat.Abedi07@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

The success of introduction of a new product or service significantly depends on the joint decisions of medium of introduction (including store locations) and marketing strategies. We present a framework for the study of these decisions, derive some structural properties of the problem, and investigate structure of the optimal solution.

2 - The Multiple Gradual Cover Problem

Zvi Drezner, Professor, California State University, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu, Oded Berman, Dmitry Krass

The gradual cover problem allows for partial cover by a facility if the distance to the facility is between some minimum and maximum values. We propose a cover model by multiple facilities using this formlation. We interpret partial cover as probability of cover and consider a correlation coefficient between the cover by two facilities.

3 - Effective Placement of Accident Detecting Acoustic Sensors on a Road Network

Geetla Tejswaroop Reddy, PhD Condidate, University of Buffalo, 187 Kenmore Avenue, Buffalo, NY, 14223, United States of America, trgeetla@buffalo.edu, Rajan Batta, Matt Henchey

Acoustic sensors placed on a road segment detect an accident when a high amplitude sound for a very short time is observed. Here, we consider the effective placement of 'm' acoustic sensors on a road network where there are 'M' possible locations where the sensors can be placed, where 'm' is less than 'M'. Number of ways we can locate the acoustic sensors is exponential and since the acoustic sensors are effective only within a range so placement of sensors becomes crucial to accident detection.

■ SD39

H - Morehead Boardroom -3rd Floor

Platform-based Markets, Innovation, and Ecosystems

Sponsor: Information Systems Society

Sponsored Session

Chair: Peng Huang, University of Maryland, 4350 Van Munching Hall, College Park, MD, 20742, United States of America, huang@umd.edu

1 - Device Innovation for Open and Proprietary Platforms

Mei Lin, Assistant Professor, The University of Hong Kong, Meng Wah Complex, Pokfulam Road, Hong Kong, Hong Kong - PRC, linm@hku.hk, Xiajun Amy Pan

We study platform device innovation under industry structures based on open and proprietary operating systems. An open-platform industry fosters intra-network competition among device producers. Greater quality degradation of the existing devices incentivizes innovation by the potential entrants. In a proprietary-platform industry, the platform owner has full control over the device product line. The innovation incentive is driven by inter-network competition.

2 - Unpaid Complementors and Platform Network Effects? Evidence from On-line Multi-player Games

Kevin Boudreau, London Business School, Regent's Park, London, United Kingdom, kboudreau@london.edu, Lars Jeppesen

Two-sided network effects emerge when buyers prefer platforms with an attractive selection of complementary goods and widespread adoption then triggers further investment in complements. Does this remain the case where complementors are not paid? We study a context where developers received no direct payments: on-line multi-player games.

3 - Growth & Innovation in Platform Ecosystems
Marshall Van Alstyne, Boston University, Boston, MA, United States of America, mva@bu.edu, Geoffrey Parker, Lones Smith

A large portion of the economy occurs within software platforms. We develop optimal innovation strategies for user / developer ecosystems, based on models of endogenous growth. The platform owner sets rules for participation, fees & application bundling; R&D occurs rapidly, with generations of innovations building on one another; profit and adoption tradeoffs depend on open versus closed code. Results describe several platform strategies such as those of Apple, Facebook, Google, Microsoft & SAP.

■ SD40

H - Walker Room - 4th Floor

Determinants of Project Team Performance

Sponsor: Technology Management

Sponsored Session

Chair: Bradley Staats, Assistant Professor, University of North Carolina-Chapel Hill, McColl Building, Chapel Hill, NC, 27599, United States of America, bstaats@unc.edu

1 - Using What We Know: Turning Organizational Knowledge Into Team Performance
Bradley Staats, Assistant Professor, University of North Carolina-Chapel Hill, McColl Building, Chapel Hill, NC, 27599, United States of America, bstaats@unc.edu, Melissa Valentine, Amy Edmondson

We examine how teams draw on knowledge resources in the firm in the production of output. We theorize positive effects of team use of an organizational knowledge repository on team performance, and argue that these effects will be greater when teams face structural characteristics that intensify the challenge of knowledge integration. We also examine how use in the team is concentrated across team members. We test our hypotheses with data from an Indian software services firm.

2 - See the Forest for the Trees: Adaptive Learning Within Product Development Scenarios
Nitin Joglekar, Associate Professor, Boston University, Boston, MA, 02215, United States of America, joglekar@bu.edu, Leonardo Santiago

Scenario planning (Kahn 1973) fosters adaptive learning in organizations (De Geus 1988). We develop a model to compare alternative learning strategies in the face of rapidly evolving information associated with product development projects and their parent portfolio scenarios.

3 - Realizing the Need for Rework in Product Development: from Task Interdependence to Social Networks
Manuel Sosa, INSEAD, Boulevard de Constance, Fontainebleau, France, manuel.sosa@insead.edu

We characterize interpersonal knowledge transfers that uncover the need for design rework. We find that developers attracted by task interdependence and separated by distinct knowledge bases are more likely to realize the need for rework. In addition, the social attachment of interacting actors has decreasing marginal returns on rework realization.

4 - Outsourcing Innovation: Organizational Models in the Offshoring of R&D Services
Saikat Chaudhuri, Assistant Professor of Management, The Wharton School, University of Pennsylvania, 2029 Steinberg Hall-Dietrich Hall, 3620 Locust Walk, Philadelphia, PA, 19104-6370, United States of America, saikatc@wharton.upenn.edu, Phanish Puranam

While extant research on outsourcing has largely studied routinized tasks, firms are now offshoring higher-end work entailing greater uncertainty. We test how well the Global Delivery Model transfers to such functions, by analyzing a sample of global R&D projects conducted by a leading Indian outsourcing vendor. We find that an adapted organizational design can mitigate the negative impact higher ex-ante uncertainty has on performance. The results question traditional notions of firm boundaries.

■ SD41

H - Waring Room - 4th Floor

Innovation Strategy

Cluster: New Product Development

Invited Session

Chair: Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, karan@girotra.com

1 - How Complexity Impacts Innovation
Raul Chao, University of Virginia, Darden School of Business, Charlottesville, VA, 22903, United States of America, ChaoR@darden.virginia.edu, Elena Loutskina

A central element of technological search is distance relative to a firm's current position in the space of technological opportunity. In this study we develop a new metric for technological search distance and we empirically evaluate how organizational and financial complexity impact search distance for a large panel (22,136 firm-years) of publicly traded firms. We find broad empirical evidence that both organizational and financial complexity drive companies to pursue more exploratory search.

2 - Innovation in Services
Kamalini Ramdas, Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kramdas@london.edu, Amy Tucker, Elizabeth Teisberg

We will present a framework for innovation in services and illustrate the framework using a variety of examples from different service sectors. The framework can be used to generate early stage ideas for service innovation, with a specific focus on service delivery innovation.

3 - Innovation Strategy: Do Words Speak Stronger than Actions?
Stelios Kavadias, Associate Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree St NW, Atlanta, GA, United States of America, Stylianos.Kavadias@mgt.gatech.edu, Jeremy Hutchison-Krupat

A major challenge for senior management, when implementing innovation strategy, is to translate it into a tangible set of actions (project funding), despite incomplete knowledge of the future. We conceptualize strategy implementation as a communication game within a hierarchical organization to analyze this challenge. We characterize the interplay between senior management's actions (i.e. incentives) and "words" (i.e. the message sent), and the resulting funding for organizational initiatives.

■ SD42

H - Gwynn Room - 4th Floor

Social Media and Information Diffusion

Sponsor: Information Systems Society

Sponsored Session

Chair: Rajiv Garg, Carnegie Mellon University, 4800 Forbes Avenue, Suite 3030, Pittsburgh, PA, 15213, United States of America, rgarg@Andrew.cmu.edu

1 - Fast Learning of Graph Structure from Unlabeled Data for Anomalous Pattern Detection
Sriram Somanchi, H.J. Heinz III College, Carnegie Mellon University, 4800 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, somanchi@cmu.edu, Daniel Neill

Processes such as disease propagation and information diffusion often spread over some latent network structure which must be learned from observation. We propose a new method for learning graph structure by optimizing the similarity of the most anomalous subsets with and without graph constraints. Using simulated disease outbreaks injected into hospital data, we show that our method learns a structure similar to the true underlying graph, but enables faster and more accurate outbreak detection.

2 - Dynamic Pattern Detection with Connectivity and Temporal Consistency Constraints
Skyler Speakman, PhD Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, speakman@cmu.edu, Daniel Neill

GraphScan is a recently proposed method that detects anomalous patterns in datasets that have an underlying graph structure by identifying the most anomalous subgraph. This work details how GraphScan can be extended to include a wide range of soft constraints such as rewarding subgraphs that are temporally consistent with anomalous subgraphs from previous time steps. These constraints increase the power to detect and trace dynamic patterns that spread through the graph structure over time.

3 - Learning to Cross Boundaries in Online Knowledge Communities
Elina Hwang, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, elinah@cmu.edu, Param Vir Singh, Linda Argote

We investigate whether online knowledge communities promote boundary-spanning knowledge transfer by examining the effects of surface-level (location, status) and deep-level (expertise) similarities on knowledge transfer frequency. We propose that both similarities will drive more knowledge transfer by increasing commonly-held knowledge by a knowledge provider and a seeker. We further propose that experience moderates the relative effects of the similarities. Our analysis supports the hypotheses.

4 - Impacts of Crowd Structure in Collaborative-ideation Projects
Tat Koon Koh, Carnegie Mellon University, Pittsburgh, PA, United States of America, tkkoh@cmu.edu

Today, crowdsourcing platforms move the frontiers of innovations from firms to the crowd. Even organizations with strong in-house innovation capabilities, such as Dell and Eli Lilly, are using crowdsourcing platforms to tap into the collective wisdom of the crowd. This study examines how structure of the crowd affects performances of new products in collaborative-ideation projects, where the crowd cooperatively develops new product ideas. The results provide interesting insights into the contributions and limitations of the crowd in new product developments.

■ SD43

H - Suite 402 - 4th Floor

Energy Systems and Environmental Policy Modeling

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Vishnu Nanduri, Assistant Professor, University of Wisconsin-Milwaukee, Industrial Engineering, Milwaukee, WI, United States of America, vnanduri@uwm.edu

1 - Electric Vehicles and Electricity Markets: A Case Study of Illinois
Shan Jin, Iowa State University, 3024 Black Engineering, Ames, IA, United States of America, shanjin@iastate.edu, Vladimir Koritarov, Audun Botterud, Anant Vyas, Matthew Mahalik, Leslie Poch, Prakash Thimmapuram

We study the potential impacts of electric vehicles (EVs) on the electricity market in Illinois. We assume a total EV penetration of up to 15%, and simulate the future operation of the electricity market under different assumptions about EV charging patterns. We present results for generation dispatch, consumer costs, electricity prices, and total emissions from the power system.

2 - Marginal CO2 Emissions Allowances Investment Cost for Hydro-dominated Power Systems
Steffen Rebennack, Assistant Professor, Colorado School of Mines, Engineering Hall 310, Golden, CO, 80401, United States of America, srebenna@mines.edu

Despite the uncertainty surrounding the design of a mechanism which is ultimately accepted by nations worldwide, the necessity to implement regulations to curb emissions of greenhouse gases is consensual. We use optimal expansion planning to derive marginal investment cost when imposing CO2 emission quotas on a hydro-dominated power system. Benders decomposition is used where the sub-problems are stochastic least-cost hydro-thermal scheduling problems solved by stochastic dual DP methods.

3 - Investment Strategies in Power Systems under Environmental Regulations
Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50011, United States of America, lzwang@iastate.edu, Yanyi He, George Gross

We study the formulation and solution of investment decisions (such as in new generation, transmission, and storage technologies) under the explicit representation of environmental policies and their associated uncertainties. A case study with empirical data will be presented to demonstrate our modeling and solution approach.

4 - Stochastic Multiscale Modeling for Energy Resource Planning
Warren Powell, Professor, Princeton University, 230 Sherrerd Hall, Princeton, NJ, 08544, United States of America, powell@princeton.edu, Hugo Simao, Boris Defourny

We are developing a family of models for stochastic, multiscale optimization of the power grid. In this talk, I will outline the strategies we are using to handle different spatial and temporal scales, using a combination of machine learning and math programming under the umbrella of approximate dynamic programming.

5 - Generation Expansion Planning with a Real Options Approach under Cap and Trade Regulation And Stochastic Fuel Price Variations
Felipe Feijoo, University of South Florida, IMSE Department, Tampa, FL, United States of America, felipefeijoo@mail.usf.edu, Tapas Das, Patricio Rocha

A Game theoretic model is presented to analyze evolution of generation capacity portfolio under cap and trade regulations considering real options and stochastic variation of fuel prices. We formulate the expansion problem as a matrix game and the allowance and electricity markets as a tri-level continuous optimization problem.

■ SD44

H - Suite 406 - 4th Floor

JFIG Panel: Challenges in Graduate Student Management

Sponsor: Junior Faculty Interest Group (JFIG)
Sponsored Session

Chair: Dionne Aleman, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca

1 - JFIG Panel: Challenges in Graduate Student Management
Moderator: Dionne Aleman, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca, Panelists: Sheldon Jacobson, Monroe Keyserling, James Benneyan, Ozlem Ergun

Academic researchers rely on graduate students for forward research progress, however, managing graduate students can be a complex undertaking. Panelists will discuss techniques of helping graduate students surmount trouble with research production or problems in their personal lives, as well as do's and don'ts learned from experience.

■ SD45

H - Suite 407 - 4th Floor

Panel on Research Challenges in Market Design

Cluster: Auctions
Invited Session

Chair: Martin Bichler, TU München, Boltzmannstr. 3, Garching, 85748, Germany, bichler@in.tum.de

1 - Panel on Research Challenges in Market Design
Moderator: Martin Bichler, TU München, Boltzmannstr. 3, Garching, 85748, Germany, bichler@in.tum.de, Panelists: Wedad Elmaghraby, Peter Cramton, Karla Hoffman, Paul Milgrom, Tuomas Sandholm

Optimization has played an increasingly important role in modern market design. Examples include the design of combinatorial auctions for selling spectrum as they have been used in the recent years worldwide, multi-lot auctions in procurement and in transportation, or kidney exchanges. Combinatorial optimization, game theory, lab experiments and behavioral studies all play a role in the design of optimization-based markets. In this panel, leading researchers in market design from computer science, economics and management science will discuss research challenges and new developments in this field.

■ SD46

H - Suite 403 - 4th Floor

Panel Discussion: Business Analytics in the University Curriculum

Sponsor: INFORM-ED

Sponsored Session

Chair: Curt Hinrichs, Manager, JMP Academic Programs, SAS Institute, JMP Division, SAS Campus Drive, Cary, NC, 27513, United States of America, curt.hinrichs@sas.com

1 - Panel Discussion: Business Analytics Curriculum in MBA Programs

Moderator: Jerry Oglesby, Senior Director, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Jerry.oglesby@sas.com, Panelists: Goutam Chakraborty, Vijay Mehrotra, Kenneth Gilbert, Ron Klimberg, Curt Hinrichs

What impact does Business Analytics have on the business school curriculum? The panel will include faculty who have led the development of graduate-level Business Analytics programs at their institutions and who will discuss their results, along with the challenges and opportunities of this development. Each speaker will share the elements and evolution of their programs and what impact they are now making within the institution and in the business community. Q&A will follow.

■ SD47

H - Dunn Room - 3rd Floor

Routing with Uncertainty: Challenges in Practice

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Hongsheng Zhong, Senior Operations Research Analyst, UPS, 2311 York Road, Timonium, MD, 21093, United States of America, hzhong@ups.com

1 - Workforce Management in Periodic Routing: Modeling and Practice

Karen Smilowitz, Associate Professor, Northwestern University, 2145 Sheridan Road, Evanston,, IL, 60208, United States of America, ksmilowitz@northwestern.edu, Maciek Nowak

Service quality and driver efficiency in delivery operations may be enhanced by increasing the regularity with which drivers visit customers. However, such consideration can increase travel distance. In this talk, we review the treatment of workforce management in routing models from the academic literature and industry practice. We evaluate several related models and assess the alignment of each model with industry characteristics.

2 - Routing Courier Delivery Services with Urgent Demand

Maged Dessouky, University of Southern California, 3715 McClintock Avenue, Department of Industrial & Systems Eng., Los Angeles, CA, 90089, United States of America, maged@usc.edu, Chen Wang, Fernando Ordonez

The objective of this research is to develop better vehicle routing solutions that are not only able to efficiently satisfy a random demand over time, but that in doing so take into account the presence of sporadic, tightly constrained, urgent or emergency requests. Routing solutions capable of providing better customer service by satisfying more urgent requests, reducing operational costs, or both, are essential in some industries.

3 - The Use of Telemetry to Improve Routing Costs

Amit Verma, PhD Student, The University of Iowa, Pappajohn Business Building, Iowa City, IA, 52242, United States of America, amit-verma@uiowa.edu, Ann Campbell

Telemetry units can be used to transmit inventory levels of many products to vendors. Having more frequent readings can be helpful to prevent stockouts and prevent making costly deliveries too early. Our work, inspired by a project with carbon dioxide provider NuCO2, looks at the question of where to put telemetry units when they cannot be placed at all customers. We will introduce a model for this problem, describe a heuristic to solve it, and summarize our insights.

4 - Robust Partitioning for Stochastic Multi-vehicle Routing

John Carlsson, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, jgc@isye.umn.edu

The problem of coordinating a fleet of vehicles so that workloads are most evenly distributed is a hard one. In this paper, we consider an assignment problem in which client locations are unknown at the time of service and that each of them will be drawn identically and independently according to a distribution that is also "unknown". Simulations of a parcel delivery problem demonstrate that a data-driven partitioning approach makes better use of historical data as it becomes available.

■ SD48

H - Graham Room - 3rd Floor

Advances in Dynamic Network Modeling

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Carolina Osorio, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Office 1-232, Cambridge, MA, 02139, United States of America, osorioc@mit.edu

1 - Dynamic Network Loading: A Differentiable Approach that Yields Queue-length Probability Distributions

Carolina Osorio, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Office 1-232, Cambridge, MA, 02139, United States of America, osorioc@mit.edu, Gunnar Flötteröd, Michel Bierlaire

We present a dynamic network loading model based on transient finite capacity queueing theory. This differentiable model yields queue length distributions, accounts for spillbacks and captures the spatial correlation of all queues adjacent to a node. We compare the model to the kinematic wave model considering several congestion regimes. The model correctly represents the dynamic build-up, spillback, and dissipation of queues, and generates a plausible fundamental diagram.

2 - Price of Anarchy in Dynamic Network Equilibrium: Numerical Analysis

Kien Doan, Graduate Student, Purdue University, 550 Stadium Mall, West Lafayette, IN, 47907, United States of America, kdoan@purdue.edu, Satish Ukkusuri, Lanshan Han

In this study, we explore the price of anarchy in dynamic network assignment models. The inefficiency of the system is measured by the total cost difference between the system optimal assignment and the user equilibrium solution. We examine the worse case of inefficiency by testing various scenarios for single O-D and multiple O-D networks under different traffic patterns. Insights into the worst case inefficiencies and possible mechanism designs to minimize the price of anarchy will be discussed.

3 - Trajectory-adaptive Routing in Dynamic Networks with Dependent Random Link Travel Times

Song Gao, Assistant Professor, University of Massachusetts Amherst, 130 Natural Resources Road, 214C Marston Hall, Amherst, MA, 01003, United States of America, songgao@ecs.umass.edu, He Huang

Trajectory information is the least amount of information one can collect en route. This study addresses the optimal adaptive routing problem in a stochastic time-dependent network, where all link travel time random variables are correlated and the routing decisions are adaptive to trajectory information. Bellman's principle is shown invalid for optimality and non-dominance. An exact algorithm is designed based on a new property termed purity, for which Bellman's principle holds.

4 - Disequilibrium to Equilibrium for Transportation Networks with Fixed Demand and Representation of Day-to-Day Dynamics

Amit Kumar, Graduate Research Assistant, Purdue University, Nextrans Center, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, kumar44@purdue.edu, Srinivas Peeta

We develop a mathematical formulation to represent the change in path flows resulting from the day-to-day dynamics in the state of disequilibrium of transportation network. A flow update technique is presented to obtain the equilibrium flows from disequilibrium flows. The solution methodology is discussed and computational results are presented for a test network.

5 - Bi-directional Car-following Models for Microscopic Control between Connected Vehicles

Jing Jin, University of Wisconsin-Madison, 1415 Engineering Drive, Madison, WI, United States of America, jjin2@wisc.edu

This paper explores the bi-directional car-following models, which consider the impact from both preceding and following vehicles. These models can be used for microscopic speed coordination between vehicles under the connected vehicle environment. Seven bi-directional models are developed based on existing car-following models. Field trajectory data are used to calibrate and evaluate the control characteristics of the proposed models.

■ SD49

H - Graves Room - 3rd Floor

Simulation Optimization and Sensitivity Analysis

Sponsor: Simulation

Sponsored Session

Chair: Sujin Kim, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Singapore, 11757, Singapore, iseks@nus.edu.sg

1 - Bi-objective Stochastic Optimization Using the Trust-region Method

Jong-Hyun Ryu, Research Fellow, National University of Singapore, 1 Engineering Drive 2, Singapore, 117576, Singapore, iserj@nus.edu.sg, Sujin Kim

We develop a new method for approximating the Pareto front of a bi-objective stochastic optimization problem. Based on sample average values, a trust region and a quadratic model for each objective are updated as an attempt to effectively find non-dominated solutions. Our sampling scheme adaptively updates the sample size considering approximation and optimization errors. The numerical results show that the performance can be significantly improved with an appropriate sampling scheme.

2 - Bayesian Sequential Calibration for Stochastic Computer Models

Szu Hui Ng, Associate Professor, National University of Singapore, 1 Engineering Drive 2, Singpaore, 117576, Singapore, isensh@nus.edu.sg, Jun Yuan

In traditional calibration, once the optimal calibration parameter set is obtained, it is treated as known for future prediction. Calibration parameter uncertainty introduced from estimation is not accounted for. We will present a Bayesian calibration approach for stochastic computer models. We account for these additional uncertainties and derive the predictive distributions for both the computer model and real process. We also consider a sequential design to improve the calibration accuracy.

3 - Stochastic Dominance Based Comparison for System Selection

Demet Batur, Lecturer, University of Nebraska-Lincoln, W348B Nebraska Hall, Lincoln, NE, 68588-0518, United States of America, dbatur2@unlnotes.unl.edu, Fred Choobineh

We present a fully-sequential selection procedure for comparing simulated systems based on the first-order stochastic dominance rule. The decision maker selects an application specific section of the distribution of the performance metric of interest to apply the stochastic dominance rule. Since the procedure may not return a system as the best but some systems as nondominant, we introduce a second procedure that compares the systems by a weaker almost-first-order stochastic dominance rule.

4 - Fairing the Gamma: An Engineering Approach to Sensitivity

Wanmo Kang, Assistant Professor, Korea Advanced Institute of Science and Technology, Daejon, Korea, Republic of, wanmo.kang@kaist.edu, Hayong Shin, Kyoung-Kuk Kim

In financial industry, obtaining stable estimates for sensitivities of derivatives to the price changes of the underlying asset is very important. However, this aim is often hindered by the absence of closed form expressions for Greeks or the requirement of an excessive computational workload. In this talk, we propose some numerical methods designed for the computation of gamma values of exotic derivatives. We show the effectiveness through some examples.

■ SD50

H - Ardrey Room - 3rd Floor

Dynamical Systems Modeling and Data Mining for Healthcare Applications

Sponsor: Data Mining

Sponsored Session

Chair: Hui Yang, Assistant Professor, University of South Florida, 4202 E Fowler Avenue ENB118, Tampa, FL, 33647, United States of America, huiyang@usf.edu

1 - Multi-scale Modeling of Glycosylation Modulation Dynamics in Cardiac Electrical Signaling

Hui Yang, Assistant Professor, University of South Florida, 4202 E Fowler Avenue ENB118, Tampa, FL, 33647, United States of America, huiyang@usf.edu, Dongping Du

The cardiac action potential is produced by the orchestrated functions of ion channel dynamics. This investigation is aimed at modeling the variations of cardiac electrical signaling due to remodeling of a K+ channels. This multi-scale modeling investigation reveals novel mechanisms of hERG channel modulation by regulated glycosylation that also impact cardiac myocyte and tissue functions. It can potentially lead to new pharmaceutical treatments and drug designs for cardiac arrhythmia.

2 - Use of Data Mining Techniques in Analyses of Organ Transplantations Procedures

Dursun Delen, Associate Professor, Oklahoma State University, Stillwater, OK, United States of America, delen@okstate.edu

The prediction of survivability and prognosis analysis of organ transplantation procedures are not only clinically important, but also technically challenging. The current studies on survival analysis, which are mostly linear relationships-based traditional statistical techniques, have focused on limited number of predictive factors, potentially neglected many of the relevant variables. Using a large, feature-rich, nation-wide transplantation dataset along with popular data mining techniques, in this study we developed prediction models for graft survival and using sensitivity analysis on these prediction models we identified predictive factors that are most relevant to the prediction of the phenomenon.

3 - Pathway Variation Analysis: A Systems Modeling Approach to Reduce Unwarranted Variation in Care

Darek Ceglarek, PhD, University of Warwick, Coventry, United Kingdom, D.J.Ceglarek@warwick.ac.uk, Crispian Sievenpiper, Sudi Lahiri, Nagesh Shukla

Unwarranted variation in care in Emergency Departments (EDs) can result in patients getting unnecessarily diverted from a care pathway (CP) if a pathway is not developed accurately. We present a methodology, Pathway Variation Analysis, to reduce the problem of patients getting diverted from a CP in ED by: (i) modelling the CP with consideration to clinical decision-making, operational parameters and performance targets affecting care; (ii) incorporating information about symptomatology and time of admission; and (iii) simulation and analysis of variation from CP for corrective suggestions. The methodology led to significant improvements in stroke care in the largest hospital in Europe.

■ SD51

H - Caldwell Room - 3rd Floor

Operations for Shared Mobility Systems

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Robert Hampshire, Assistant Professor of Operations Research and Public Policy, Carnegie Mellon University, Heinz College, 4800 Forbes Avenue, 2102B Hamburg Hall, Pittsburgh, PA, 15217, United States of America, Hamp@andrew.cmu.edu

1 - An Empirical Analysis of Bike Sharing

Robert Hampshire, Assistant Professor of Operations Research and Public Policy, Carnegie Mellon University, Heinz College, 4800 Forbes Avenue, 2102B Hamburg Hall, Pittsburgh, PA, 15217, United States of America, Hamp@andrew.cmu.edu

Bike sharing programs are an emerging mobility mode that increases freedom of choice in mobility. Currently, over 100 cities around the world have deployed or have plans to deploy a bike sharing system. In Paris alone, there are over 90,000 trips taken daily using bike sharing. We present a demand model using empirical observations from bike sharing programs from around the world. We also discuss one of the main cost drivers of the system, the rebalancing operations.

2 - Barcelona Bike Sharing System: Supervised Machine Learning for Capacity Prediction

Karthik Dinakar, Research Assistant, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, kdinakar@media.mit.edu, Robert Hampshire, Carolyn Rose, Ryan Chin, Kent Larson

In this work, we use combination of temporal and static features for effective prediction of station capacity at a given instant in time. We find that M5P, which combines a conventional decision tree with linear regression functions perform better than sequential minimal optimization and ensemble methods.Our work shows that supervised machine learning methods can effectively used for capacity prediction.

3 - The Bike Sharing Repositioning Problem: The Montreal Case

Louis-Martin Rousseau, École Polytechnique de Montréal, C.P. 6079, succ. Centre-ville, Montréal, Canada, louis-martin.rousseau@polymtl.ca, Catherine Morency, Martin Trépanier

A bike sharing system of 405 stations and 5050 bikes is implemented in Montreal, Canada since 2009. The repositioning method is currently under review. We will discuss the operational constraints linked to supply characteristics and trip patterns and discuss an algorithmic approach to the problem. We also discuss the externalities that influences repositioning, like weather conditions, other modes availabilities, and seasonal mobility variation for short trips.

■ SD52

H - North Carolina - 3rd Floor

External Boundaries of the Firm

Sponsor: Organization Science

Sponsored Session

Chair: Richard Burton, Professor, Duke University, Fuqua School of Business, 100 Fuqua Drive, 90120, Durham, NC, 27708, United States of America, rich.burton@duke.edu

1 - The Co-Development of Markets and Firms: Business Incubators in Emerging Economies

Olga Hawn, PhD Candidate in Strategy, The Fuqua School of Business, Duke University, 1 Towerview Drive, Durham, 27708, United States of America, olga.hawn@duke.edu

This study addresses a classic puzzle: Which comes first–markets or firms? We investigate business incubators as an organizational mechanism that helps co-develop markets and firms in emerging economies.Drawing on the institutional development and strategic capabilities literatures, we argue that business incubators initially focus on market development and then increasingly shift their emphasis on business capabilities.We study 129 incubators operating in 66 emerging markets from 1999 to 2009.

2 - Adding by Subtracting: The Nature of Divestitures by Struggling and Excelling Firms

Elena Vidal, Fuqua School of Business, Duke University, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, maria.vidal@duke.edu

Divestitures are a common part of resource reconfiguration strategies. We draw from dynamic capabilities and prospect theory to investigate how the nature of divestitures firms use as part of their reconfiguration strategies is affected by their willingness to take risk. I propose that the nature of the divestitures by struggling firms is riskier and thus fundamentally disrupt the organization, whereas excelling firms on seek incremental disruptions.

3 - Deciding Where to Search: The Impact of Organizational Attention on Search Space

Nilanjana Dutt, Duke Univerity, Durham, NC, United States of America, nilanjana.dutt@duke.edu

Before starting a new activity, firms start by identifying relevant information through a search. By drawing from evolutionary theory, scholars have demonstrated differences in search breadth and depth. However, scholars still do not understand differences in how firms identify where to search or "search space." This paper demonstrates differences in search space; and suggests that search space is important in understanding strategies for new activities.

4 - Ever Changing Logic of Global Outsourcing:Client Strategies, Path Dependencies, & Industry Dynamics

Arie Y Lewin, Duke University ñ The Fuqua School of Business, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, ayl3@duke.edu, Carine Peeters, Stephan Manning, Silvia Massini

The paper focuses on integrating strategic drivers of global outsourcing decisions and dynamic interplay of underlying mechanisms at task, firm, industry and country level over time. Findings suggest that growing availability and visibility of service providers globally, along with internal development of robust outsourcing capabilities, have increased tendencies of client firms to outsource even complex knowledge intensive tasks and utilize talent and external expertise from all over the world.

■ SD53

H - South Carolina - 3rd Floor

Statistical Machine Learning

Sponsor: Data Mining

Sponsored Session

Chair: Peter Qian, Associate Professor, University of Wisconsin-Madison, Department of Statistics, 1300 University Avenue, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

Co-Chair: Sijian Wang, University of Wisconsin, Statistics Department, Milwaukee, WI, United States of America, wangs@stat.wisc.edu

1 - LAD Fused Lasso Signal Approximation

Xiaoli Gao, Assistant Professor, Oakland University, 2200 N. Squrrel Rd., Rochester, MI, 48309, United States of America, gao2@oakland.edu

The fused lasso penalty is commonly used in signal processing when the hidden true signals are sparse and blocky. In this paper, we study the asymptotic properties of an LAD-fused-lasso model used as a signal approximation (LAD-FLSA). Simulation studies are included to illustrate both the performance of an LAD-FLSA approach and the effect of the unbiased estimate of GDF.

2 - Mitigating Manhole Events in Manhattan

Cynthia Rudin, Assistant Professor of Statistics, Massachusetts Insititute of Technology, Sloan School of Management, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rudin@mit.edu, Steve Ierome, Delfina Isaac, Rebecca Passonneau, Axinia Radeva

There are a few hundred manhole events (fires, explosions, smoking manholes) in New York City every year, often stemming from problems in the low voltage secondary electrical distribution network that provides power to residential and commercial customers. I will describe work on the Columbia/Con Edison Manhole Events project, the goal of which is to predict manhole events in order to assist Con Edison (NYC's power utility company) with its preemptive maintenance and repair programs.

3 - Optimization in Microsimulation Kidney Paired Donation (KPD) Program

Peter Song, Professor, University of Michigan, 1415 Washington Heights, Ann Arbor, MI, 48109, United States of America, pxsong@umich.edu, Jack Kalbfleisch, Yan Zhou, Yijiang Li

This talk will focus on the algorithmic aspect of the microsimulation KPD program. Approaches for constrained graphic optimization will be discussed. In particular, integer programming recipes are utilized to implement statistical methods concerning the generation of the pool of incompatible donor-recipient pairs, virtual cross-match,lab cross-match, and prediction of graft survival. Numerical illustration on the software will be presented during the presentation.

4 - Robustified Inverse Regression

Yuexiao Dong, Temple University, 1810 N 13th Street, Philadelphia, PA, United States of America, ydong@temple.edu, Liping Zhu, Zhou Yu

Classical sufficient dimension reduction methods are sensitive to outliers present in the predictors, and may not perform well when the distribution of the predictors is heavy-tailed. We propose two robustified inverse regression methods which are insensitive to both outliers and inliers: weighted inverse regression estimation and sliced inverse median estimation. Our proposed methods have better overall performances than existing robust procedures in the presence of outliers and/or inliers.

■ SD54

H - Charlotte Hall - 3rd Floor

Doing Good with Good OR Competition: Finalist Presentations II

Cluster: Doing Good with Good OR Competition

Invited Session

Chair: Donna Llewellyn, Director, Georgia Institute of Technology, Center for the Enhancement of Teaching, and Learning, Atlanta, GA, 30332, United States of America, donna.llewellyn@cetl.gatech.edu

1 - Redesigning the Breast Cancer Screening Policies

Turgay Ayer, Assistant Professor, Georgia Institute of Technology, School of Industrial and Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332, United States of America, ayer@isye.gatech.edu, Oguzhan Alagoz, Natasha Stout, Elizabeth Burnside

The existing controversial breast cancer screening policies consider only women's age but ignore several other personal breast cancer risk factors and women's adherence to screening recommendations. In this study, we propose a model to redesign the controversial breast cancer screening policies by tailoring the screening decisions to women's personal risk and adherence levels.

2 - Collection and Distribution Strategies for Food Bank Operations

Joseph Warfel, PhD Candidate - IEMS, Northwestern University, 2145 Sheridan Rd, Tech C210, Evanston, IL, 60208, United States of America, joseph.warfel@u.northwestern.edu, Karen Smilowitz, Seyed Iravani

We present strategies for food distribution in hunger relief programs, focusing on the Food Recovery Program (FRP) at the Northern Illinois Food Bank. The FRP collects food donations from grocery stores and distributes to hunger relief agencies. We develop approaches to allow FRP to move towards a new distribution model which integrates collection and delivery of food on routes, lowering costs.

3 - A Systems Approach to Emergency Department Congestion
Hannah Wong, PhD, Harvard Medical School, 101 Merrimac Street, 10th Floor, Boston, MA, 02114, United States of America, Wong.Hannah@mgh.harvard.edu, Dante Morra, Michael Caesar, Robert Wu, Howard Abrams

This project uses system dynamics principles to assemble the ideas and simulate the problem of patients boarding in the Emergency Department (ED). The modeling process provided clinicians and managers with a new awareness of the interdependencies of their strategic and operational-level decisions. It also empowered them to move forward with redesign of sustainable strategies that significantly improved their ED performance.

■ SD55

H - Mecklenburg Hall - 3rd Floor

Joint Session CPMS/Analytics: Edelman Reprise II

Sponsor: CPMS, The Practice Section of INFORMS/Analytics

Sponsored Session

Chair: Doug Samuelson, President, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

Chair: Stephen C. Graves, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Avenue E62-579, Cambridge, MA, 02139, United States of America, sgraves@mit.edu

1 - Branch Reconfiguration Practice Using Operations Research in Industrial and Commercial Bank of China
Li Jie Guo, ICBC, Beijing, China, lijie.guo@icbc.com.cn, Xiao Hu Liu, Thomas Li, Ming Xie, Wenjun Yin, Bin Zhang, Jin Dong

ICBC, the world's largest bank, partnered with IBM using OR to optimize branch network throughout China. This project achieved excellent results and generated great value.

2 - System Dynamics Transforms Fluor Project and Change Management
Ken Cooper, Kenneth Cooper Associates LLC, Milford, NH, 03055, United States of America, ken.cooper@kcooperassociates.com, Edward Godlewski, Gregory Lee

Fluor Corporation designs and builds many of the world's most complex projects, and serves clients in many industries across six continents. On our most complex projects, we have implemented a system dynamics model-based system that has improved our project management, transformed our change management, and brought large quantified business benefits to us and our clients. The model can be rapidly set up and tailored to each major engineering and construction project. We use it to foresee the future cost and schedule impacts of project changes, and most important, to test ways to avoid the impacts. Since 2005, Fluor has used the system on over 100 projects and has trained hundreds of project managers and planners in its ongoing internal use. Quantitative business benefits exceed $800 million to date for Fluor and our clients. It has also transformed the mindset of our managers away from the industry's typical retrospective view, in which disputes could become the channel for resolving cost responsibility, and replaced it with a proactive approach, in which we work with our clients to find, in advance, ways to mitigate impacts and reduce costsóa win-win situation for Fluor and our clients.

■ SD56

H - Biltmore Boardroom - 2nd Floor

Inventory in Supply Chain

Contributed Session

Chair: Arnab Bisi, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States of America, abisi@purdue.edu

1 - The Sustainable Order Quantity Model: Multiobjective Optimization for Sustainable Operations Management (OM)
Yann Bouchery, Ecole Centrale Paris, Grande Voie des Vignes, Chatenay-Malabry, 92290, France, yann.bouchery@ecp.fr, Zied Jemai, Asma Ghaffari, Yves Dallery

Even if sustainable development is nowadays a must-have for operations management (OM) literature, model-based research that includes sustainability criteria is still scarce. In this paper, we reformulate the classical economic order quantity model as a multiobjective problem which is called the sustainable order quantity model. We analytically characterize the set of its efficient solutions (Pareto optimal solutions) and we derive some interesting and potentially impacting practical insights.

2 - Optimal Operational Strategies for an Assembly System under Supply Uncertainty
Wenting Pan, University of California-Irvine, 4307 Palo Verde Road, Irvine, CA, 92617, United States of America, wpan06@merage.uci.edu

We consider a two-component assembly system, where one of the components is subject to supply uncertainty. After the actual available quantity is realized but before the demand realization, the assembler has the option to order additional components from backup suppliers. We derive the optimal order policies, and analyze how the availability of the two backup suppliers affects the component order quantities and the threshold price of the final product.

3 - Going Green with Demand Sensing and Inventory Optimization
Stas Grishin, Terra Technology, 2575 Kilo Way, Laguna Beach, CA, 92651, United States of America, stas.grishin@terratechnology.com

We will define Demand Sensing, show how it helps companies transform their supply chain operations by minimizing uncertainty in the planning process, including replenishment, manufacturing, and transportation. We will illustrate how Inventory Optimization is used as a vehicle to translate better demand signals into optimized inventory levels, reduced waste, and minimized carbon footprint.

4 - A Non-parametric Adaptive Algorithm for the Censored-Data Inventory Problem
Arnab Bisi, Assistant Professor, Purdue University, 403 W. State Street, West Lafayette, IN, 47907, United States of America, abisi@purdue.edu, Karanjit Kalsi

We study the problem of determining stocking quantities in an inventory model with unknown demand distribution and unobserved lost sales. Using a convex underestimator based optimization method, we develop a non-parametric adaptive algorithm for inventory policies whose T-period average cost converges to the optimal cost at the rate O(logT/T). Simulation results show that our algorithm performs very well compared to existing algorithms.

■ SD57

W - Providence I- Lobby Level

Joint Session AAS/RMPS: Keynote Talk

Sponsor: Aviation Applications/Revenue Management and Pricing Section

Sponsored Session

Chair: Scott Nason, Former Vice-president of Revenue Management, American Airlines, Dallas, TX, United States of America

1 - The Airlines' Evolving Revenue Models
Scott Nason, Former Vice-president of Revenue Management, American Airlines, Dallas, TX, United States of America

Scott Nason, former Vice President of Revenue Management at American Airlines will present a keynote address entitled "The Airlines' Evolving Revenue Models." Nason will discuss current advances in revenue management, the impacts of alliances/mergers and network strategies on airline business models, and where lawsuits over airline travel distributions may be headed.

■ SD59

W - Providence III - Lobby Level

Quantitative Methods in Service

Sponsor: Service Science

Sponsored Session

Chair: Yingdong Lu, IBM Thomas J. Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, yingdong@us.ibm.com

1 - Map of the Market: Visualizing the Relationships in the IT Services Marketplace
Aleksandra Mojsilovic, IBM Thomas J Watson Research Center, Route 134, 1101 Kitchawan Road, Yorktown Heights, NY, United States of America, aleksand@us.ibm.com, Jun Wang, Kush Varshney

We develop a framework and models that combine firmographic and relational data, to analyze IT services contracts, perform market segmentation, identify market influencers and develop better client targeting models and recommender systems.

2 - Lower Bounds for the Steady-state M/GI/n Queue in the Halfin-Whitt Regime

David Goldberg, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, dag3141@mit.edu, David Gamarnik

We study the steady-state FCFS M/GI/n queue under the Halfin-Whitt scaling, a heavy-traffic regime used in the modeling of service systems. We derive new lower bounds for this queueing model, which capture the correct limiting large deviations behavior. Our main proof technique is a novel interpolation between an infinite-server queue and an n-server queue. Our bounds are of a structural nature, hold for all n and all times t, and have intuitive closed-form representations as the suprema of certain natural processes which converge weakly to Gaussian processes.

3 - Stationary Behavior of Many-Server Service Systems in Changing Environments

Bo Zhang, Research Staff Member, IBM T.J. Watson Research Center, Route 134, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, bozhang@gatech.edu, Bert Zwart

We study the stationary behavior of many-server service systems, where the customer arrival rate alternates between high and low values. We obtain the stationary distribution of a first-order approximating model (i.e. a fluid model) for such systems. Then we identify and analytically justify a very simple, yet insightful approximation for this stationary distribution.

■ SD60

W - College Room - 2nd Floor

Topics in Networks

Sponsor: Optimization/Networks

Sponsored Session

Chair: Mauricio Resende, AT&T Labs Research, 180 Park Avenue, Bldg. 103, Room C241, Florham Park, NJ, 07932, United States of America, mgcr@research.att.com

1 - A Competitive Strategy for Routing Flow over Time

Umang Bhaskar, Dartmouth College, HB 6211, Sudikoff Lab, Hanover, 03755, United States of America, umang@cs.dartmouth.edu, Elliot Anshelevich, Lisa Fleischer

Routing games are used to understand the impact of individual users' decisions on network efficiency. Prior work on routing games uses a simplified model of network flow where all flow exists simultaneously. In our work, we examine routing games in a flow-over-time model. We show that by reducing network capacity judiciously, the network owner can ensure that the equilibrium is no worse than a small constant times the optimal in the original network, for two natural measures of optimality.

2 - The Least Cost Influence Problem (LCIP) on a Social Network

S. Raghavan, Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, raghavan@umd.edu, Dilek Gunnec

We analyze the product diffusion process on a social network and allow for the provision of incentives to individuals that result in product adoption. The desire is to minimize the incentives paid out while ensuring that all nodes in the social network adopt the product. We analyze the LCIP problem on a tree network, and show that when the neighbors equally influence an individual the problem is polynomially solvable via a dynamic programming algorithm.

3 - Solution Algorithms for the Steiner Ring Star Problem

Youngho Lee, Professor, Korea University, Sungbuk Ku Anam Dong, Seoul, Korea, Republic of, yhlee@korea.ac.kr, Gigyoung Park

We present the Steiner ring star problem arising from the design of telecommunication networks. We develop alternate mixed 0-1 mixed integer programming models. By implementing the reformulation-linearization technique (RLT), we develop valid inequalities that tighten the LP relaxation. Computational results demonstrate the effectiveness of the proposed solution procedure.

4 - Optimization of AC Power Grid Design

Stephan Lemkens, RWTH Aachen University, Lehrstuhl II für Mathematik RWTH Aachen, Aachen, 52056, Germany, lemkens@math2.rwth-aachen.de, Arie Koster

In this work, we study the design of AC power grids by the means of Mixed Integer Linear Programming. Therefore we analyze different linearizations of the nonlinear AC power flow equations and compare the quality of the approximations with each other. Furthermore we consider the usefulness of the solution of the nonlinear AC power flow as a constraint in the mixed integer design model.

■ SD63

W - Tryon North - 2nd Floor

MCDM and Data Mining

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Yong Shi, Professor, Chinese Academy of Sciences/University of Nebraska, No. 80 Zhongguanchun East Rd, Beijing, 100190, China, yshi@gucas.ac.cn

1 - Finite Coverings-based Rough Sets

R. Mareay, Kafrelsheikh University, Department of Mathematics, Kafr El-Sheikh, Egypt, roshdeymareay@yahoo.com, A. M. Kozae, S.A. El-Sheikh

Standard rough sets are defned by a partition induced by an equivalence relation representing discernibility of elements. Equivalence relation may not provide a realistic view of relationships between elements in real-world applications. One may use coverings of, or non-equivalence relations on, the universe. Rough sets based on covering are generalizations of rough sets. In this chapter we define the approximation space for n- coverings defined on the universe of discourse. We define topologized covering approximation space. We generalize approximation space by using n-coverings. We define rough equality, rough inclusion of sets, the accuracy measure and membership function based on n- coverings. We introduce the application of n-coverings on information systems.

2 - Normative Utility, Preferences and Prescriptive Machine Learning Analytical Presentation

Yuri P. Pavlov, Associate Professor, Bulgarian Academy of Sciences, Institute of Biophysics and Biomedical E, Bl.105, Acad. G. Bonchev str., Sofia, 1113, Bulgaria, yupavlov@clbme.bas.bg

This paper presents an approach to evaluation of human's preferences. Here are presented different aspects of stochastic utility function evaluation and applications.The evaluation is preferences-oriented machine learning.The mathematical formulations presented here serve as basis of tools development. The evaluation leads to the development of preferences-based decision support in machine learning environments in different areas of applications.

3 - Fuzzy Link-based Cluster Analysis for Seismic Data

Yong Shi, Professor, Chinese Academy of Sciences/University of Nebraska, No. 80 Zhongguanchun East Rd, Beijing, 100190, China, yshi@gucas.ac.cn, Zhongbin Ouyang

Interpreting seismic data is an arduous and time-consuming task. While cluster analysis can be helpful to analyze the seismic data, most traditional clustering algorithms can hardly obtain satisfactory results since they do not take account of spatially dependencies of seismic data, which make clustering seismic data different from other clustering problems. Moreover, seismic data are by nature fuzzy and noisy, which limit many popular clustering algorithms. In this paper, we present a fuzzy link-based clustering technique for seismic data incorporating spatial and non-spatial information into the algorithm. Experimental results on synthetic data and standard image show that our algorithm is robust to noise and can discover clusters with arbitrary shape. This method is also demonstrated effective on real seismic data.

■ SD64

W - Queens Room - 2nd Floor

Joint SPPSN/LAW/CPMS:Threats to Life and Limb

Sponsor: Public Programs, Service and Needs/Law, Law Enforcement and Public Policy/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Arnold Barnett, Professor, Massachusetts Institute of Technology, Sloan School, 30 Wadsworth Street, Cambridge, MA, 02139, United States of America, abarnett@mit.edu

1 - Flu Physics: OR Models to Plan for, Respond to, and Reduce Incidence of Pandemic Influenza

Richard Larson, Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, rclarson@mit.edu, Stan Finkelstein

We review our MIT team's research on the 'pandemic flu system.' This includes usual OR subsystems such as supply chains, for vaccine manufacturing, distribution and administration, and less usual topics such as NPI's, Non-Pharmaceutical Interventions. Our work is informed by data from states, the CDC and from universities. We suggest a radically different way of distributing vaccines. We also argue that aggressive use of NPIs has similar benefits as vaccines.

2 - Once Upon a Time in Los Angeles: A Dilemma in Airport Safety
Arnold Barnett, Professor, Massachusetts Institute of Technology, Sloan School, 30 Wadsworth Street, Cambridge, MA, 02139, United States of America, abarnett@mit.edu, Amedeo Odoni, Mark Hansen, George Donohue, Toni Trani, Michael Ball

The North Airfield Safety Study at Los Angeles International Airport (LAX) was undertaken by six operations researchers in conjunction with colleagues at NASA-Ames. The key question was whether it was necessary for safety reasons to move runways on the North side of LAX further apart. We briefly discuss the background of the study, its key methods and results, and its aftermath.

3 - Improving Burn Victim Triage during a Catastrophic Incident
Linda Green, Columbia University, Decision, Risk, and Operations Division, New York, NY, 10027, United States of America, lvg1@columbia.edu, Carri Chan

The U.S. has mandated that regions develop plans for burn victims of mass casualty events. Hospitals without burn units will initially care for patients until they can be transferred to available burn beds. We describe a triage algorithm developed for NYC and examine the impact of comorbidities and availability of medical histories on its performance. We also provide results on the feasibility of transferring 400 victims within 3 to 5 days of the incident as mandated by the federal government.

4 - Addressing the Race Effects in Redemption Patterns
Alfred Blumstein, Carnegie-Mellon University, Pittsburgh, PA, United States of America, ab0q@andrew.cmu.edu, Kiminori Nakamura

One concern about criminal-background checking is disparate racial impact. We examine by race the hazard or recidivism risk as a function of time clean. We examine B-W ratios in arrest prevalence, early and later hazard, and explore factors contributing to observed differences, finding black-white hazard ratios less severe than prevalence.

■ SD65

W - Kings Room - 2nd Floor

E-service

Sponsor: Service Science

Sponsored Session

Chair: Ming-Hui Huang, Professor, National Taiwan University, 1, Sec. 4, Roosevelt Rd., Taipei, 10617, Taiwan - ROC, huangmh@ntu.edu.tw

1 - The Satisfaction-Productivity Incentive Tradeoff
Ming-Hui Huang, Professor, National Taiwan University, 1, Sec. 4, Roosevelt Rd., Taipei, 10617, Taiwan - ROC, huangmh@ntu.edu.tw

This study examines whether executive compensation is driven more by productivity or satisfaction, and how do their impact play out over time. The results show that executives, even if only following their self-interest, can be motivated to keep a balance between productivity and satisfaction, rather than simply maximizing short-term profitability.

2 - Managing Variability in Service Operations: Scripting and Improvisation in High-contact Services
Enrico Secchi, Ph.D. Candidate, Clemson University, Department of Management, 101 Sirrine Hall, Clemson, SC, 29634, United States of America, esecchi@clemson.edu, Aleda Roth

In this paper, we build a conceptual typology of high contact service delivery systems based on the degree to which service encounters rely on improvisation rather than scripted behaviors. Then, based on our typology, we develop and test a set of hypotheses that examine the impact of service delivery system design choices concerning the scripting of personnel behaviors on customer satisfaction and operating costs.

■ SD66

W - Park Room - 2nd Floor

DEA II

Cluster: Data Envelopment Analysis

Invited Session

Chair: Andy Johnson, Assistant Professor, Texas A&M University, Department of I&SE, College Station, TX, 77843-3131, United States of America, ajohnson@tamu.edu

1 - Using the Generalized Symmetric Weight Assignment Technique for Workforce Planning
Stanko Dimitrov, Assistant Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, sdimitro@uwaterloo.ca, Warren Sutton

We present empirical results for assigning sailors to jobs for the Navy using the generalized symmetric weight assignment technique. We compare the proposed assignment method to those currently being used along with some myopic methods. We conclude by showing that using the generalized symmetric weight assignment technique generates better assignments, as defined by the Navy metrics, than those currently being used.

2 - Integration of DEA and NBG: An Application in Japanese Banking Industry
Xiaopeng Yang, Osaka University, 2-1 Yamadaoka, Suita, Japan, xiaopeng.yang@ist.osaka-u.ac.jp, Hiroshi Morita

Different groups of users may have distinctive input/output classifications even for the same attribute. It means the variation of an attribute increasing the efficiency score from one perspective, may decrease its efficiency from another one simultaneously. In order to reconcile the conflicts from multiple perspectives, we integrate DEA and Nash Bargaining Game (NBG) theory. A case study of Japanese banks is also given to show the results of equilibrium solution for multiple perspectives.

3 - Estimating Aggregator Functions Using DEA
Rajiv Banker, Fox School of Business, Alter Hall 461, 1801 Liacouras Walk, Philadelphia, PA, 19122, United States of America, banker@temple.edu, Kartik Ganju

This paper examines estimation of aggregator functions such as utility functions with known structure such as monotonicity and concavity. Here, the values of the components are observed but the aggregate value is not. We show that a DEA based model is useful to estimate these functions. We report results of extensive Monte Carlo simulations that document the DEA based model performs well.

Monday, 8:00am - 9:30am

■ MA01

C - Room 201A

Impact of Unauthorized Markets on Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Reza Ahmadi, University of California, Anderson School of Management, Los Angeles, CA, 90024, United States of America, reza.ahmadi@anderson.ucla.edu

Co-Chair: Foaad Iravani, Doctoral Candidate, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095-1481, United States of America, firavani@anderson.ucla.edu

1 - Supply Chain Efficiency and Contracting in the Presence of Gray Market

Mehmet Sekip Altug, Assistant Professor, George Washington University, School of Business, Washington, DC, 20052, United States of America, maltug@gwu.edu, Garrett Van Ryzin

We consider a supply chain with one manufacturer and several authorized retailers that face uncertain demand and a potential gray market. While the gray market can be seen as an opportunity to sell any excess inventory, it also is a threat for authorized retailer's demand. We characterize the equilibrium market-clearing gray market price and analyze how gray market changes the supply chain dynamics including certain contracts that are provided by the manufacturer to its authorized retailers.

2 - When Gray Markets Have Silver Linings: All-unit Discounts, Gray Markets and Channel Management

Ming Hu, University of Toronto, Rotman School of Management, Toronto, ON, Canada, Ming.Hu@Rotman.Utoronto.Ca, Michael Pavlin, Mengze Shi

Gray markets are unauthorized channels of distribution for a supplier's authentic products. This paper studies a distribution channel that consists of a supplier who offers all-unit quantity discounts for batch orders to enjoy cost savings, and a reseller who may divert some goods to the gray markets. Our analysis underscores the importance of integrating inventory and pricing decisions when managing distribution channels affected by gray markets.

3 - Coping with Gray Markets: The Impact of Market Conditions and Product Characteristics

Foaad Iravani, Doctoral Candidate, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095-1481, United States of America, firavani@anderson.ucla.edu, Hamed Mamani, Reza Ahmadi

Many trademark owners are challenged by the resale of their products in unauthorized channels known as gray markets. We analyze the impact of gray market on a price-setting manufacturer serving two markets with uncertain demand. We explore the effect of product and market characteristics on the manufacturer's reaction to the gray market and market entry decision. We also provide interesting insights about the value of strategic pricing versus the uniform pricing policy adopted by some companies.

■ MA02

C - Room 201B

Risk Management Approaches in Finance

Cluster: Optimization in Finance

Invited Session

Chair: Stan Uryasev, Consultant, American Optimal Decisions, 5214 SW 91 Way, Ste. #130, Gainesville, FL, 32608, United States of America, uryasev@ufl.edu

1 - Conditional Risk Measures: Estimation and Asymptotics

So Yeon Chun, PhD Candidate, Georgia Institute of Technology, Atlanta, GA, United States of America, schun@isye.gatech.edu, Alexander Shapiro, Stan Uryasev

We discuss linear regression approaches to estimation of conditional risk measures. In particular, Value-at-Risk and Average Value-at-Risk are discussed in details. Two estimation procedures are considered, one is based on residual analysis of least squares method and the other is in the spirit of M-estimation approach. Large sample statistical inference is derived and finite sample properties are investigated in an extensive Monte Carlo study. Empirical results on real data are also provided.

2 - Calibrating Risk Preferences with Generalized CAPM Based on Mixed CVaR Deviation

Stan Uryasev, Consultant, American Optimal Decisions, 5214 SW 91 Way, Ste. #130, Gainesville, FL, 32608, United States of America, uryasev@ufl.edu, R. Tyrrell Rockafellar, Konstantin Kalinchenko

The generalized Capital Asset Pricing Model based on mixed CVaR deviation is used for calibrating risk preferences of investors protecting investments in S&P500 by means of options. Calibration is done by extracting information about risk preferences from option prices on S&P500. Actual market returns are matched with the estimated returns based on the mixed CVaR beta, capturing tail performance of stock returns.

3 - Portfolio Risk Management: Market Neutrality, Catastrophic Risk, and Fundamental Strength

Chanaka Edirisinghe, Professor, University of Tennessee, 610 Stokely Management Center, 916 Volunteer Blvd, Knoxville, TN, 37996, United States of America, chanaka@utk.edu

Equity portfolio design requires short- and long-term risk management, where the former is achieved via allocating optimal weights on assets. However, long-term risks lie in the selection of long/short asset pools based on firm-fundamentals and other market factors. Using an economic-regime based 2-period dynamic model, market scenarios are used explicitly to determine fundamental strength-based firm selections, coupled with short-term rebalancing under various risk metrics in portfolio design.

■ MA03

C - Room 202A

Panel Discussion: Leaders Offer Professional Advice to Women and Men

Sponsor: Women in OR/MS

Sponsored Session

Chair: Esma Gel, Associate Professor, Arizona State University, SCIDSE, Tempe, AZ, 85281, United States of America, esma.gel@asu.edu

Co-Chair: Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts - Amherst, Eugene M. Isenberg School of Management, Amherst, MA, 01003, United States of America, nagurney@gbfin.umass.edu

1 - Leaders Give Professional Advice to Women and Men

Moderator: Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts - Amherst, Eugene M. Isenberg School of Management, Amherst, MA, 01003, United States of America, nagurney@gbfin.umass.edu, Panelists: Eric Wolman, Radhika Kulkarni, Mark Daskin, Les Servi

The panelists will provide their insights and tips on how to succeed in our profession.

■ MA04

C - Room 202B

Future Directions for INFORMS Online (IOL) and Other IT Initiatives

Sponsor: Computing Society

Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Digital Marketing of INFORMS Online

Kevin Geraghty, VP Analytics, 360i, 1545 Peachtree St, Atlanta, GA, United States of America, KGeraghty@360i.com

INFORMS Online provides substantial authoritative content for people interested in Operations Research and Analytics. As Editor-in-chief of INFORMS Online my initial task will be to work with INFORMS Online staff to engage a broad online audience by enhancing findability and participation. This talk discusses the SEO (Search Engine Optimization), Site Customization, and Social Media initiatives you will see over the next 12 months for INFORMS online.

2 - Future Web 2.0 and Mobile Computing Initiatives for INFORMS IT
Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

We will start with quick intro to the current four main IT systems of INFORMS: AA, IOL, Pubs, and eMeetings. Then we will present our future goals to integrate those systems into a single unified platform, and add support for social networking, online content sharing, and mobile computing.

■ MA05

C - Room 203A

Joint Session Tutorial/Behavioral Operations Management: Laboratory Experiments in Operations Management

Cluster: Tutorials/Behavioral Operations Management

Invited Session

Chair: Elena Katok, Professor, Pennsylvania State University, Smeal College of Business, 483 Business Building, University Park, PA, 16802, United States of America, ekatok@psu.edu

1 - Laboratory Experiments in Operations Management
Elena Katok, Professor, Pennsylvania State University, Smeal College of Business, 483 Business Building, University Park, PA, 16802, United States of America, ekatok@psu.edu

Controlled laboratory experiments give researchers a great deal of control making them useful for testing analytical models. In this tutorial I introduce laboratory experiments and discuss methodological issues in designing and conducting laboratory experiments. I will also discuss several research programs that recently benefited from laboratory experiments.

■ MA06

C - Room 203B

Non Parametric Data-Driven Policies for Stochastic Inventory Models

Cluster: Tutorials

Invited Session

Chair: Retsef Levi, Massachusetts Institute of Technology, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, retsef@mit.edu

1 - Non Parametric Data-Driven Policies for Stochastic Inventory Models
Retsef Levi, Massachusetts Institute of Technology, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, retsef@mit.edu

In this talk, we will survey several recent non parametric data-driven algorithmic approaches to core stochastic inventory control models. Instead of the traditional assumption that demand distributions are specified as part of the input, one assumes that only historical demand/sales information is available. We will discuss several techniques to devise data-driven policies and analyze their performance.

■ MA07

C - Room 204

Approximation Methods in Queueing Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Ohad Perry, IEMS, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, ohad.perry@northwestern.edu

1 - Heavy Traffic Limit of the Processor Sharing Queue via Excursion Theory
Florian Simatos, CWI, Science Park 123, Amsterdam, 1098XG, Netherlands, florian.simatos@cwi.nl, Bert Zwart, Amaury Lambert

Thanks to a recent result of A. Lambert (AOP 2010), it is possible to realize one busy cycle of the queue length of the Processor-Sharing (PS) queue as the image by some functional of a Levy process. The functional involves the local time process and a random time-change. I will show how to exploit this mapping to derive the heavy traffic limit of the PS queue thanks to excursion theory.

2 - Fairness in overloaded Parallel Queues
Mor Armony, Associate Professor, New York University, 44 West 4th Street, New York, NY, 10012, United States of America, marmony@stern.nyu.edu, Carri Chan, Nick Bambos

Many systems have periods where they are temporarily overloaded. In such cases, the unstable queues may starve limited resources. This work examines what happens during periods of overload in heterogeneous parallel queues. Specifically, we look at how to fairly distribute stress. We explore the dynamics of the queue workloads under the MaxWeight scheduling policy during long periods of stress and discuss how to tune this policy in order to achieve a target fairness ratio across these workloads.

3 - A Fair Policy for the Inverted-V Model of the G/GI/N Queue
Josh Reed, Assistant Professor, New York University, 44 West 4th Street, New York, NY, 10012, United States of America, jreed@stern.nyu.edu, Yair Shaki

We consider the G/GI/N queue with multiple server pools, each with a different service time distribution. We assume that incoming customers are routed to the server pool with the longest weighted cumulative idle time. We show that in the Halfin-Whitt regime the diffusion scaled cumulative idle time process of each of the server pools are held in fixed proportion to one another and we obtain a heavy-traffic limit for the process keeping track of the total number of customers.

4 - On the Generalized Skorokhod Problem
Amy Ward, Associate Professor, University of Southern California, Bridge Hall 401H, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu, Josh Reed, Dongyuan Zhan

We construct an explicit solution to the generalized Skorokhod problem with a reflecting boundary at zero. As an application of our result, we show how one may relate the distribution of the reflecting Ornstein-Uhlenbeck process to the first hitting time of an unreflecting Ornstein-Uhlenbeck process. We also use this relationship to approximate the transient distribution of the GI/GI/1+GI queue in conventional heavy traffic and the GI/M/N/N queue in a many-server heavy traffic regime.

■ MA08

C - Room 205

Cloud Computing - Research/Application Opportunities

Cluster: Cloud Computing

Invited Session

Chair: Ilyas Iyoob, Sr. Scientist and Manager of OR, CloudMatrix, Dorsett Oaks Cir, Austin, TX, 78727, United States of America, ilyas.iyoob@chainopt.com

1 - Cloud Computing – Survey of Optimization Problems
Ilyas Iyoob, Sr. Scientist and Manager of OR, CloudMatrix, Dorsett Oaks Cir, Austin, TX, 78727, United States of America, ilyas.iyoob@chainopt.com, Emrah Zarifoglu

In this paper, we list the different types of optimization problems that need to be solved in the area of cloud computing – both in the business side as well as in the technical side. The problems need to be solved from the perspectives of customers, cloud providers, as well as cloud brokers. Preliminary results show that the true benefits of cloud computing can be acquired only through rigorous application of analytics and optimization to the planning and execution of the cloud.

2 - Service Deployment Decisions in Cloud Data Centers Based on Service Level Agreements (SLAs)
Anders Nordby Gullhav, PhD Candidate, Norwegian University of Science and Technology, Alfred Getz vei 1, Trondheim, NO 7491, Norway, anders.gullhav@iot.ntnu.no, Björn Nygreen, Poul Heegaard

In this paper, we present a MIP model designed to aid service providers, utilizing cloud technology, on decisions related to service provisioning and management of their data center resources. The decisions must fulfill the QoS requirements and demand of the end-users, and they involve replication and deployment strategies. The objective in our model is to minimize the power usage of a service provider's data centers while also taking into account the cost of using public cloud infrastructure.

3 - The Study on Strategic Development of China's Cloud Computing Industry
Gang Fang, Beijing University of Posts and Telecommunications, No. 10 Xi Tu Cheng Road, Beijing, 100876, China, aaliyah.fang@gmail.com, Xiongjian Liang

This paper uses SWOT and AHP to analyze various factors that influence China's cloud computing development in the perspective of qualitative and quantitative, designs the index system, calculates the weight of each index; meanwhile, uses Gray Model to forecast prospects of China's cloud computing industry. Finally, based on the results of situation analysis and forecast, this paper proposes overall concepts and specific suggestions on the future development of China's cloud computing industry.

■ MA09

C - Room 206A

Emerging Topics in Revenue Management

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Dana Popescu, Assistant Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, dana.popescu@insead.edu

1 - Cost-per-impression and Cost-per-action Pricing in Display Advertising with Risk Preferences
Kristin Fridgeirsdottir, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kfridgeirsdottir@london.edu, Kevin Ross

Web publishers and advertisers typically use the action probability to convert between CPM and CPA prices. However, it is well known that publishers usually prefer CPM pricing as they find it less risky while advertisers prefer CPA pricing, which is performance based. This simple conversion rule commonly used, assumes that both parties are risk neutral. We introduce a new conversion rule that takes risk into account and explains the preferences observed in practice.

2 - Are Consumers Really Strategic? Implications from an Experimental Study
Nikolay Osadchiy, Assistant Professor, Emory University, Atlanta, GA, United States of America, nikolay.osadchiy@emory.edu, Elliot Bendoly

Novel retail selling mechanisms involve a tradeoff between buying now vs later at a lower price. Recreating this setting in a laboratory, we observe a substantial fraction of subjects making decisions consistent with expected utility maximization. We find that subjects are particularly sensitive to whether the information about riskiness of the buy-later option is provided. Implications for managerial practice are discussed.

3 - Pricing Resources vs. Pricing Products in Network Revenue Management
Dana Popescu, Assistant Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, dana.popescu@insead.edu

In a classical network formulation, a firm has a set of resources and sells a set of products. The firm wants to manage the allocation of resources to different products. However, what the customer is buying and what the firm is pricing are not always one and the same thing. In the airline industry, for instance, customers are buying seats on a plane, while the airlines are pricing itineraries. In such cases, the firm has a choice: should it price the resources or should it price the products?

4 - Estimating Choice Models for Revenue Management Applications
Mark Ferguson, Georgia Institute of Technology, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, Mark.Ferguson@mgt.gatech.edu, Laurie Garrow, Jeffrey Newman

We provide a new methodology for estimating discrete choice models in a setting where demand is constrained and the data available is only from a single firm. Our method avoids the use of the Expectation Maximization method, provides more robust parameter estimates, and runs in a fraction of the time.

■ MA10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - Syncopation Software – DPL Even Easier from Excel!
Chris Dalton, CEO, Syncopation Software, 1623 Main Street, Concord, MA, 01742, United States of America, cdalton@syncopation.com

DPL 8 features an all new Excel add-in interface — work directly in Excel! Like a head-up display, key modeling and analysis features are right in front of you while you build your spreadsheet. Many of DPL's insightful outputs are now available in Microsoft Office native formats — analyze, format, tweak, copy and paste to create the ultimate PowerPoint presentation!

2 - LINKS-simulations.com - Exploiting LINKS Simulations Web-Based Resources for Maximum Teaching and Learning Impact
Randall G. Chapman, President, LINKS-simulation.com, 320 Forest Haven Drive, Winter Garden, FL, 34787, United States of America, chapman@chapmanrg.com

How can an instructor teach effectively and efficiently with a large-scale, team-based, competitive supply chain management simulation? By exploiting the simulation's web-based teaching and learning resources! This software demo explores web-based resources for supporting instructors and their students throughout LINKS simulation events.

■ MA11

C - Room 207A

Queueing Control

Sponsor: Applied Probability

Sponsored Session

Chair: Mark Lewis, Professor, Cornell University, 226 Rhodes Hall, Ithaca, NY, 14853, United States of America, mark.lewis@cornell.edu

Co-Chair: Hayriye Ayhan, Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, hayhan@isye.gatech.edu

1 - Tandem Lines with Non-collaborative Servers
Tugce Isik, Georgia Institute of Technology, School of ISyE, Atlanta, GA, United States of America, tugceisik@gatech.edu, Hayriye Ayhan, Sigrun Andradóttir

We study a system of tandem queues with finite buffers and equal number of servers and stations. The servers are flexible but unable to collaborate. We characterize the server assignment policy that maximizes the long-run average throughput for two stations in tandem and investigate special cases for longer lines.

2 - Switching On and Off the Full Capacity of an M/M/Infinity Queue
Eugene Feinberg, Professor, Stony Brook University, Stony Brook, NY, 11794-3600, United States of America, efeinberg@notes.cc.sunysb.edu, Xiaoxuan Zhang

This paper studies optimal switching on and off the M/M/infinity queue with holding, running and switching costs. The main result is that an optimal policy either always runs the system or is defined by two thresholds M and N, such that the system is switched on upon an arrival epoch when the system size accumulates to N and it is switches off upon a departure epoch when the system size decreases to M.

3 - The M/G/1 + G Queue, Finite Dams and an Organ Transplantation Model

David Perry, University of Haifa, Mount Carmel, Haifa, 31905, Israel, dperry@stat.haifa.ac.il

We propose a prototype model for the problem of managing waiting lists for organ transplantations. The model captures the double-queue nature of the problem: there is a queue of patients, but also a queue of organs. Both may su§er from "impatience": the health of a patient may deteriorate, and organs cannot be preserved longer than a certain amount of time. Using tools from queueing theory, we derive explicit results for key performance criteria: the rate of unsatisfied demands and of organ outdatings, the steady-state distribution of the number of organs on the shelf, the waiting time of a patient, and the long-run fraction of time during which the shelf is empty of organs. As will seen the dynamics of the virtual outdating process is closely related to workload of the M/G/1 + G queue and the finite dam model.

4 - Dynamic Service Rate Control for Systems with Markov Modulated Arrivals

Ravi Kumar, Cornell University, 292 Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, rk454@cornell.edu, Huseyin Topaloglu, Mark Lewis

We consider the problem of service rate control in a single server queue with infinite buffer capacity and Markov-modulated Poisson arrival process. Service rates are allowed to depend on both the queue length and the state of arrival process. We show that under the assumption that the arrival intensity process is stochastically monotone, the optimal service rate control policy which minimizes the discounted cost is monotone in queue length as well as the state of arrival intensity process.

■ MA12

C - Room 207BC

Reinforcement Learning

Sponsor: Computing Society/ Computational Stochastic Optimization

Sponsored Session

Chair: Doina Precup, Associate Professor, McGill University, 3480 University Street, Montreal, QC, H3A2A7, Canada, dprecup@cs.mcgill.ca

1 - Distributionally Robust Approach to Approximate Dynamic Programming

Emmanuel Yashchin, IBM Reseach, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, yashchi@us.ibm.com

Approximate dynamic programming is a popular method for solving large Markov decision processes. This paper proposes a new class of ADP methods – distributionally robust ADP – that address the curse of dimensionality by minimizing a pessimistic bound on the policy loss. This approach turns ADP into an optimization problem, for which we derive new formulations in terms of mathematical programs. In comparison with previous work, DRADP provides tighter bounds and better empirical performance.

2 - Bayesian Exploration for Approximate Dynamic Programming

Ilya Ryzhov, Princeton University, Princeton, NJ, United States of America, iryzhov@Princeton.edu, Warren Powell

We use a correlated Bayesian belief model to represent our uncertainty about the value function in ADP. Correlations between the values of different states allow us to learn about multiple states from a single decision. We apply the knowledge gradient concept from optimal learning to create a new exploration strategy.

3 - Methods for Constructing Basis Functions for Value Function Approximation

Doina Precup, Associate Professor, McGill University, 3480 University Street, Montreal, QC, H3A2A7, Canada, dprecup@cs.mcgill.ca

Reinforcement learning and Approximate Dynamic Programming rely on estimating value functions, which can be used to make optimal choices. The representation of the value function is critical for the success of these methods. I will present methods that construct basis functions for linear value functions automatically. The basis functions are reward-sensitive; this allows us to provide theoretical guarantees for the quality of the approximation that can be obtained.

■ MA13

C - Room 207D

Pricing and Revenue Management: Data-Driven Research

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Mahesh Kumar, University of Maryland, College Park, MD, kumarmahesh@gmail.com

Chair: Itir Karaesmen, American University, Washington DC, United States of America, karaesme@american.edu

1 - Sales People Decision Making in Pricing

Itir Karaesmen, American University, Washington DC, United States of America, karaesme@american.edu, Wolfgang Jank, Shu Zhang, Wedad Elmaghraby

Prior empirical research shows that pricing is at the discretion of the sales people in many B2B companies. Yet, sales person decision making is rarely studied. Using a data set from a distributor, we build statistical models and investigate (i) what factors influence price changes, (ii) what type of models best describe decision process of the sales people, and (iii) the effect of sales people and their heterogeneity.

2 - Impact of Retail Capacity and Product Substitution on Price Promotions – Theory and Evidence

Mehmet Gumus, Assistant Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A 1G5, Canada, mehmet.gumus@mcgill.ca, Philip Kaminsky, Sameer Mathur

To coordinate pricing and inventory decision-making across time in a multi-product setting, retailers must explicitly consider the impact of their capacities and inter-product substitution on their price promotion decisions. We develop two demand models that explicitly consider these effects within a deterministic dynamic pricing and inventory ordering framework, and explore both analytically and empirically the impact of these effects on a firms optimal pricing and inventory ordering decisions.

3 - The Effects of Correlated Demand on Pricing, Inventory, and Production

Mahesh Kumar, kumarmahesh@gmail.com, Suresh Govindaraj, Bharat Sarath

We propose a new explanation for price discrimination that is based on the sellers' objective to smooth profits. We show that when a seller carries multiple products, the spread in buying and selling prices of any product depends not only on its own profits and inventory position, but also on the correlations of these variables with the other products. Consequently, the seller may price the same product differently depending on the range of products that she carries.

4 - How Efficient is Email Marketing? – Evidence from an Online Ticket Marketplace

Kate Li, Suffolk University, 73 Tremont Street, Boston, MA, 02135, United States of America, kjli@suffolk.edu, Duncan Fong

We use data from an online ticket marketplace to evaluate the short-term effectiveness of email marketing campaigns and compare the performance of different types of email promotions. We also analyze the long-term impact of email promotions on customer expectation and behavior and propose methods to profile and target customers.

■ MA14

C - Room 208A

Modeling Strategic Behavior in the Energy Sector II

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Benjamin Hobbs, Professor, Johns Hopkins University, 313 Ames Hall, Baltimore, MD, 21218, United States of America, bhobbs@jhu.edu

1 - Comparison of Centrally and Self-Committed Electricity Markets

Ramteen Sioshansi, Assistant Professor, The Ohio State University, Integrated Systems Engineering, 240 Baker Systems, Columbus, OH, 443215, United States of America, sioshansi.1@osu.edu, Emma Nicholson

We compare the energy cost ranking and incentive properties of two types of uniform-price auction formats commonly used in wholesale electricity markets: centrally committed and self-committed markets. We derive Nash equilibria for both market designs in a symmetric duopoly setting and also derive simple conditions under which the two market designs will be expected cost-equivalent.

2 - Strategic Eurasian Natural Gas Model for Energy Security and Policy Analysis

Chi Kong Chyong, PhD Student, University of Cambridge, Judge Business School, Wolfon College, Barton Road, Cambridge, CB3 9BB, United Kingdom, k.chyong@jbs.cam.ac.uk, Benjamin Hobbs

The mathematical formulation of a large-scale equilibrium natural gas simulation model is presented. This model differs from earlier ones in its detailed representation of the structure and operations of the Former Soviet Union gas sector. To demonstrate the model, a social benefit-cost analysis of the Nord Stream gas pipeline project from Russia to Germany via the Baltic Sea is provided.

3 - Examination of Market Power in Carbon-constrained Electricity Markets

Vishnu Nanduri, Assistant Professor, University of Wisconsin-Milwaukee, Industrial Engineering, Milwaukee, WI, United States of America, vnanduri@uwm.edu

In this paper a game-theoretic approach is used to model the strategic behavior of electric power generators who compete in both electricity and CO2 allowance markets. We develop a multi-agent reinforcement learning algorithm to solve this game-theoretic model. We examine the potential for market power among generators in a sample 9-bus electric power network.

4 - Imperfect Competition in an Electricity Market with Regional CO2 Cap-and-Trade

Andrew Liu, Assistant Professor, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, andrewliu@purdue.edu, Yihsu Chen

It is shown in a previous work that in a perfectly competitive electricity market with regional CO2 cap-and-trade policy, different points of regulation would yield the same market outcomes and social surpluses. In this work we replace the perfect competition assumption by studying an oligopolistic market. The same conclusions are shown to still hold. We further consider capacity expansions and illustrate the impacts of regional CO2 policies through numerical examples.

■ MA15

C - Room 208B

Behavioral / Descriptive Decision Models II

Sponsor: Decision Analysis

Sponsored Session

Chair: Yael Grushka-Cockayne, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, GrushkaY@darden.virginia.edu

Co-Chair: Shweta Agarwal, PhD Student (Decision Sciences), London School of Economics, Houghton Street (NAB 3.17), London, WC2A 2AE, United Kingdom, s.agarwal@lse.ac.uk

1 - Skill or Chance? Fictitious Variation in the NFL Draft

Cade Massey, Yale University, New Haven, CT, United States of America, cade.massey@yale.edu

It is widely believed that NFL teams and personnel differ in their draft-picking ability. Yet, we know that people tend to neglect the role of chance in outcomes, and that the NFL draft is a domain with considerable uncertainty (Massey & Thaler 2011). We hypothesize and find that the significant differences in draft outcomes are almost completely chance-driven. We suggest this kind of "fictitious variation" (Rabin 2002) is general, common and important.

2 - Losing versus Gaining Information: Implications for Confidence and Accuracy

Jack Soll, Associate Professor of Management, Duke University, Fuqua School of Business, 100 Fuqua Drive, Durham, NC, 27516, United States of America, jsoll@duke.edu, Min Kay

We examine how confidence and accuracy change as a function of gaining or losing information. Past research has shown that adding cues often leads to greater increases in confidence than in accuracy. We show that this overvaluation of information is amplified when cues are subtracted rather than added. In other words, the loss of information is perceived as having greater impact on accuracy than the equivalent gain. We demonstrate this asymmetry and examine potential explanations.

3 - One-shot Questions to Assess Risk Tolerance: Evidence from Business Executives

Philippe Delquié, George Washington University School of Business, Washington, DC, United States of America, delquie@gwu.edu

The risk tolerance coefficient of exponential utility was elicited of business executives using new and standard one-shot questions. Asking for "most preferred" investment in a gamble sometimes produces *higher* responses than the standard "maximum acceptable" investment question! This suggests that indifference points or limit preferences are ill-defined, and this has general implications for how we probe for risk preferences.

4 - On Controllability of Uncertainty and its Implications for Risk Management

Shweta Agarwal, PhD Student (Decision Sciences), London School of Economics, Houghton Street (NAB 3.17), London, WC2A 2AE, United Kingdom, s.agarwal@lse.ac.uk, Gilberto Montibeller

Prevailing classifications of uncertaintyó based on lack of knowledge or choice of probability assignmentó lend conceptual clarity to the notion of uncertainty in terms of enhancing the estimation of uncertain states rather than influencing them. However, managerial attitudes to risk reflect that being able to affect uncertainty has a bearing on how the risks of a decision problem are described. We revisit the conceptualizations of uncertainty and suggest a new categorization based on 'control'.

■ MA16

C - Room 209A

Forest Management Models

Sponsor: Energy, Natural Resources and the Environment/ Forestry

Sponsored Session

Chair: Marc McDill, Associate Professor, Pennsylvania State University, 310 Forest Resources Bldg, University Park, PA, 16802, United States of America, mem14@psu.edu

1 - Is There an Optimal Management Unit Size?

Marc McDill, Associate Professor, Pennsylvania State University, 310 Forest Resources Bldg, University Park, PA, 16802, United States of America, mem14@psu.edu, Andrea Arratia, Joe Petroski

Forest harvest scheduling models optimize harvesting decisions over time under different objectives and constraints. Area-restricted models can combine adjacent management units as long as contiguous harvest blocks are small enough. Smaller units allow more flexibility in the shape and timing of harvest blocks but increase formulation sizes and potentially solution times. The impact on objective function values and solution times of delineating forests into varying unit sizes was evaluated.

2 - Combining Cluster Packing with the Path Formulation for Spatially Explicit Harvest Scheduling Models

Rachel St. John, University of Washington, School of Forest Resources, Seattle, WA, 98195, United States of America, rkrieg@u.washington.edu, Sándor Tóth

The two most commonly cited exact formulations of area-based harvest scheduling are Goycoolea et at.'s (2005) cluster packing and McDill et al.'s (2002) path formulation. Each model can capture concerns that the other cannot, but neither method can accommodate all types of constraints. We propose a new "mapping" method that merges the two models. We discuss the computational implications of the combined model and show how the new mapping can reduce the size of the cluster packing formulation.

3 - A Robust Model to Protect Road Building and Harvest Decisions from Timber Estimate Errors

Cristian Palma, Universidad del Desarrollo, Faculty of Engineering, Concepción, Chile, cristianpalma@ingenieros.udd.cl, John Nelson

We present a robust tactical optimization model to decide road building and harvest decisions in the presence of timber estimate errors. We show that robust decisions differ from deterministic decisions, and discuss their impact on the objective function and feasibility rates of different scenarios of timber estimates.

4 - Model IV - Adaptive Volume Coefficients and Discrete-time Difference Equations in Forest Planning

Rachel St. John, University of Washington, School of Forest Resources, Seattle, WA, 98195, United States of America, rkrieg@u.washington.edu, Sàndor Tóth

In forest management, long planning horizons present difficulties for harvest scheduling models especially when fast-growing tree species are present with short rotation ages. Allowing a stand to be harvested multiple times can make models large and difficult to solve. We introduce a new model, called Model IV, whose size increases linearly with the number of harvests per stand. Common modeling concerns such as clearcut size restrictions and intermediate treatments can be captured in the model.

■ MA17

C - Room 209B

Expert Elicitations: Theory

Sponsor: Decision Analysis

Sponsored Session

Chair: Erin Baker, Associate Professor, University of Massachusetts, Amherst, Amherst, MA, United States of America, edbaker@ecs.umass.edu

1 - Expert Elicitation of Adversary Preferences Using Ordinal Judgments

Vicki Bier, Professor, University of Wisconsin, 1513 University Avenue, Madison, WI, 53706, United States of America, bier@engr.wisc.edu, Chen Wang

In this talk, we show how to use ordinal judgments (e.g., partial rank orderings of potential terrorist targets or attack strategies) from intelligence experts as a basis to infer probability distributions for uncertain adversary preferences (represented by the attribute weights in a multiple-attribute utility function) using either probabilistic inversion or Bayesian density estimation. Particular attention is paid to how the methods deal with expert consensus or disagreement.

2 - Model-based Identification and Correction of Biases in Survey-style Expert Elicitation

Melissa Kenney, AAAS S&T Fellow; Assistant Research Scientist, NOAA; The Johns Hopkins University, 1315 East West Highway, SSMC 3 Rm 12235, Silver Spring, MD, 20910, United States of America, kenney@jhu.edu, Venkat Prava, Benjamin Hobbs, Robert Clemen

We develop model-based methods to quantify the magnitude and correct for cognitive biases in subjective probability assessments. Namely we focus on partition dependence and carryover. The partition dependence and carryover model consists of a convex combination of the unbiased probability, the bias component, and error. We conducted experiments to consider survey design approaches to minimize the carryover bias and to complement existing datasets to refine the models.

3 - Calibration, Sharpness and the Weighting of Experts in a Linear Opinion Pool

Stephen Hora, University of Southern California, 3710 McClintock Avenue, Los Angeles, CA, 90089, United States of America, hora@sppd.usc.edu, Erim Kardes

Linear opinion pools are the most common form of aggregating the probabilistic judgments of multiple experts. Here, the performance of such an aggregation is examined in terms of the calibration and sharpness of the component judgments. The performance is measured through the average Brier score of the aggregate. Trade-offs between calibration and sharpness are examined and optimal weights for the multiple, dependent experts are found through a convex quadratic program.

4 - Combining Probabilities: Decomposition and Aggregation Order

Erin Baker, Associate Professor, University of Massachusetts, Amherst, Amherst, MA, United States of America, edbaker@ecs.umass.edu

If quantities in an elicitation have been decomposed, is it better to combine experts before or after recomposing the quantities? Similarly, if multiple elicitations have been collected, should the individual elicitations be combined and then put into the decision model; or should the individual elicitations be put into the decision model and then combined? We find that combining expert opinion early results in lower errors when experts are combined using a simple linear average.

■ MA18

C - Room 210A

Supply Chain Scheduling with Industry Applications

Cluster: Scheduling and Project Management

Invited Session

Chair: Zhi-Long Chen, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@RHSmith.umd.edu

1 - Balancing Production, Inventory, and Delivery Costs in Paper Manufacturing

Neil Geismar, Assistant Professor, Texas A&M University/Mays Business School, Wehner 320F - 4217 TAMU, College Station, TX, 77843, United States of America, ngeismar@mays.tamu.edu

We consider a supply chain scheduling problem from the paper industry involving the operations of a single plant that serves multiple clients by producing paper of various basis weights. A customer's order contains multiple jobs, each of which specifies paper of a certain weight and width while allowing for a limited substitution across basis weights. The plant combines jobs within each weight into sets. We minimize the sum of production, inventory, and delivery costs.

2 - Production Scheduling Problems with Batching in the Steel Industry

Lixin Tang, Professor, Northeastern University, The Logistics Institute, Liaoning Key Lab of Mfg Sys & Logistics, Shenyang, 110004, China, lixintang@mail.neu.edu.cn

We address new scheduling problems with batching arising from the steel industry. We consider: 1) semi-continuous batching scheduling in which jobs in the same batch enter and leave the machine one by one and uniformly; 2) Integrated scheduling of parallel-serial batching. For polynomial solvable cases, effective algorithms are given. For NP-hard problems, heuristic algorithms are designed with performance analysis. For more complicated problems, optimization based algorithms are proposed.

3 - Coordinated Scheduling of Production and Storage/Retrieval in the Steel Industry

Feng Li, Student, The Logistics Institute,Liaoning Key Laboratory of Manufacturing Systems and Logistics, Northeastern University, Shenyang, LN, 110004, China, feng_lee@sohu.com, Lixin Tang

We study coordinated scheduling of production and storage/retrieval that commonly occurs in the production and warehousing operations in the steel industry: 1) Coordinated scheduling of steelmaking-continuous casting production and slab storage; 2) Coordinated batching scheduling of hot rolling production and slab retrieval; 3) Coordinated batching scheduling of cold rolling production and coil storage/retrieval. We study their computational complexity, give exact algorithms and heuristics.

4 - Supply Chain Scheduling with Fixed Departure Dates

Zhi-Long Chen, Professor, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, ZChen@RHSmith.umd.edu, Joseph Leung

We consider several supply chain scheduling problems where jobs are first processed on a single production line and then delivered to their customer by a given number of delivery vehicles each of which has a given departure date. Such problems arise in the supply chains of many make-to-order electronics products in the real world. We propose solution algorithms for solving these problems to optimality.

■ MA19

C - Room 210B

INFORMS-FSS Student Research Paper Competition

Sponsor: Financial Services Section

Sponsored Session

Chair: Aparna Gupta, Associate Professor of Quantitative Finance, Lally School of Management and Technology, Rensselaer Polytechnic Institute, Troy, NY, 12180, United States of America, guptaa@rpi.edu

1 - Portfolio Selection under Model Uncertainty: A Penalized Moment-based Optimization Approach

Jonathan Li, PhD Student, University of Toronto, 5 King's College Road, Toronto, Ontario, Toronto, ON, M5S 3G8, Canada, jli@mie.utoronto.ca

We present a new approach that enables investors to seek a reasonably robust policy for portfolio selection in the presence of rare but high-impact realization of moment uncertainty. In practice, Portfolio managers face difficulty in seeking a balance etween relying on their knowledge of a reference financial model and taking into account possible ambiguity of the model. Based on the concept of Distributionally Robust Optimization (DRO), we introduce a new penalty framework that provides investors flexibility to define prior reference models using moment information and accounts for model ambiguity in terms of "extreme" moment uncertainty. We show that in our approach a globally-optimal portfolio can in general be obtained in a computationally tractable manner. Computational experiments show that our penalized moment-based approach outperforms classical DRO approaches in terms of both average and downside-risk performance using historical data.

2 - The Cost of Latency

Mehmet Saglam, PhD Candidate, Columbia University, 3022 Broadway 4F, New York, NY, 10027, United States of America, MSaglam13@gsb.columbia.edu

Modern electronic markets have been characterized by a relentless drive towards faster decision making. Significant technological investments have led to dramatic improvements in latency, the delay between a trading decision and the resulting trade execution. We describe a theoretical model for the quantitative valuation of latency. Our model provides a closed-form expression for the cost of latency in terms of well-known parameters of the underlying asset. We implement our model by estimating the latency cost of trading NYSE common stocks from 1995 to 2005 and show that median latency cost across our sample more than tripled during this time period. Furthermore, using the same dataset, we compute the various percentiles of the implied latency observed in the market and conclude that the median implied latency decreased by approximately two orders of magnitude over this time frame.

3 - Dynamic Portfolio Choice with Market Impact Costs

Poomyos Wimonkittiwat, University of California-Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States of America, poomyos@berkeley.edu

Illiquidity and market impact refer to the situation where it may be costly or difficult to trade a desired quantity of assets over a desire period of time. In this paper, we formulate a simple model of dynamic portfolio choice that incorporates liquidity effects. The resulting problem is a stochastic linear quadratic control problem where liquidity costs are modeled as a quadratic penalty on the trading rate. Though easily computable via Riccati equations, we also derive a multiple time scale asymptotic expansion of the value function and optimal trading rate in the regime of vanishing market impact costs. This expansion reveals an interesting but intuitive relationship between the optimal trading rate for the "illiquid" problem and the classical Merton model for dynamic portfolio selection in perfectly liquid markets. It also gives rise to the notion of a "liquidity time scale".

4 - First Passage Times (FPT) of Two-dimensional Brownian Motion and Correlated Default

Haowen Zhong, Columbia University, 313A, Mudd Building, Columbia University, New York, NY, 10027, United States of America, hz2193@columbia.edu

First passage times (FPT) of two-dimensional Brownian motion has been utilized to study the correlation of default times under structural models. Despite various attempts since 1970's, analytical solution for the joint distribution of the FPTs is still not available. We obtain the analytical solution for the joint Laplace transform of FPTs, leading to an efficient inversion algorithm to compute the FPTs. We also point out the link between the joint Laplace transform and a new bivariate exponential distribution. The results are then exploited to study correlated defaults.

5 - Calibrating Risk Preferences with Generalized CAPM Based on Mixed CVaR Deviation

Konstantin Kalinchenko, PhD Candidate, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, kalinchenko@ufl.edu

The generalized Capital Asset Pricing Model based on mixed CVaR deviation is used for calibrating risk preferences of investors protecting investments in S&P500 by means of options. The corresponding new generalized beta is designed to capture tail performance of S&P500 returns. Calibration is done by extracting information about risk preferences from option prices on S&P500. Actual market option prices are matched with the estimated prices from the pricing equation based on the generalized beta. In addition to the risk preferences, an optimal allocation to a portfolio of options for the considered group of investors is calculated.

■ MA20

C - Room 211A

Novel Relaxations and Approximations for Global Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Xiaowei Bao, Sabre Holdings, 3150 Sabre Dr, Southlake, TX, 76092, United States of America, xiaoweib@gmail.com

1 - Reformulation Linearization Techniques: Enhancing BARON's Relaxations for Polynomial Programs

Keith Zorn, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, kpz@andrew.cmu.edu, Nick Sahinidis

Reformulation Linearization Techniques are applied to enhance the performance of the Branch-and-Reduce Optimization Navigator (BARON) for polynomial programs. Node selection strategies, cut generation algorithms, and constraint reduction policies are compared. Improvements in range reduction, objective bounding, and polyhedral relaxation construction are examined through a computational study.

2 - Convex, Continuous Relaxations of Discontinuous Factorable Functions

Achim Wechsung, Massachusetts Institute of Technology, Room 66-363 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, awechsun@mit.edu, Paul I. Barton

Discontinuities are common to many optimization problems, but current deterministic optimization methods cannot solve such problems directly; instead, mixed-integer formulations are used. Recently, we proposed a relaxation technique that is able to construct continuous, convex relaxations based on McCormick's composition result. Here, the notion of branching on discontinuous factors to improve convergence is proposed and analyzed.

3 - Convex Envelopes of Multilinear Terms: The Dual Approach

Leo Liberti, Professor, École Polytechnique, Palaiseau, France, leoliberti@gmail.com, Assale Adje, Alberto Costa

The literature provides explicit lower convex and upper concave envelopes for: bilinear, trilinear and quadrilinear terms, presented as sets of inequalities in terms of the primal variables. The size of such sets grows dramatically in function of the monomial degree (e.g. pages of inequalities are required for the quadrilinear case). We argue that the dual representation yields relaxations of more manageable size.

4 - Strong Polyhedral Relaxations of Multilinear Functions

Jim Luedtke, Assistant Professor, University of Wisconsin-Madison, 3236 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 5370, United States of America, jrluedt1@wisc.edu, Mahdi Namazifar, Jeff Linderoth

We study methods for obtaining polyhedral relaxations of multilinear terms. The goal is to obtain a formulation that is more compact than the convex hull formulation, but yields tighter relaxations than the McCormick relaxation. We present promising computational results for an approach based on grouping the variables into subsets that cover all multilinear terms in the problem.

■ MA21

C - Room 211B

Stochastic Approximation for Stochastic Variational Problems

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Uday Shanbhag, University of Illinois, Department of ISE, Urbana, IL, United States of America, udaybag@illinois.edu

1 - On the Convergence Rate for Stochastic Approximation in the Non-smooth Setting

Eunji Lim, University of Miami, 281 McArthur Bldg, Coral Gables, FL, United States of America, lim@miami.edu

We consider a stochastic approximation (SA) method for finding the minimizer of a function f, which is convex but nondifferentiable at the minimizer. Due to the nondifferentiability at the minimizer, f is allowed to increase at a positive rate near the minimizer. From this property, we show that the nth estimate for the minimizer generated by the SA procedure converges at a rate of $1/n$ in the mean, which is faster than the classical convergence rates for differentiable functions f.

2 - Regularized Iterative Stochastic Approximation Methods for Stochastic Variational Inequality Problem

Jayash Koshal, Student, University of Illinois Urbana-Champaign, Department of Industrial and System Eng., 104 S. Mathews Avenue, Urbana, IL, 61801, United States of America, koshal1@illinois.edu, Angelia Nedich, Uday Shanbhag

We consider the distributed computation of equilibria arising in monotone stochastic Nash games over continuous strategy sets. We introduce two classes of distributed single-timescale stochastic approximation schemes, each of which requires exactly one projection step at every step, and provide convergence theory for each scheme. Conditions are provided for recovering global convergence in extensions of such schemes where players choose their steplength sequences independently.

3 - An Adaptive Steplength Stochastic Approximation Scheme for Monotone Stochastic VI

Farzad Yousefian, PhD Candidate, University of Illinois Urbana-Champaign, 117 Transportation Bldg., 104 S. Mathews Avenue, Urbana, IL, 61820, United States of America, yousefi1@illinois.edu, Angelia Nedich, Uday Shanbhag

We present an adaptive steplength stochastic approximation framework for monotone stochastic VI. Motivated by minimization of a suitable error bound, a recursive rule for prescribing steplengths is proposed for strongly monotone problems. By introducing a regularization sequence, extensions to merely monotone regimes are proposed. Finally, an iterative smoothing extension is suggested for accommodating multivalued mappings. Numerical results suggest that the schemes prove effective.

■ MA22

C - Room 212A

Stochastic Programming Algorithms and Applications

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Lewis Ntaimo, Associate Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ntaimo@tamu.edu

Co-Chair: Eric Beier, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77843-3131, United States of America, ebeier@tamu.edu

1 - Scenario Fenchel Decomposition for Stochastic Integer Programs

Eric Beier, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77843-3131, United States of America, ebeier@tamu.edu, Lewis Ntaimo

We present a new algorithm for solving stochastic MIPs with integer variables in the first and second stages. Traditional scenario decomposition methods guarantee optimality after a branch and bound routine. Our new algorithm is based on the progressive hedging algorithm and uses Fenchel cutting planes to recover the convex hull of scenario subproblems near the optimum, which means convergence properties for SLPs hold. Computational results will be presented.

2 - Computational Study of Mean-Risk Stochastic Programs

Tanisha Cotton, PhD Candidate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, tanbgreen05@neo.tamu.edu, Lewis Ntaimo

To introduce risk into stochastic programs (SPs), convexity preserving dispersion statistics, quantile- deviation and absolute semideviation are used to as mean-risk objectives. In this talk, we present a computational study of decomposition algorithms for stochastic linear programs. We report on the performance of the algorithms on standard instances as well as the relative effect of the risk-measure parameters on the optimal solution.

3 - Branch-And-Bound Approach for Probabilistic Constrained Integer Programs

Julian Gallego, PhD Student, Texas A&M University, 3017 Emerging Technologies Building, 3131 TAMU, College Station, TX, 77843, United States of America, kamizama77@tamu.edu, Lewis Ntaimo

Probabilistically constrained integer programs (PCIPs) are difficult to solve despite many applications. In this talk, we present a new branch-and-cut method for PCIPs based on irreducible infeasible subsystems (IIS). We use a numerical example to illustrate this IIS-based branch-and-bound approach.

4 - Two-stage Stochastic Programs with Mixed Probabilities: A Numerical Method

Paul Bosch, Universidad Diego Portales, Santiago, Chile, paul.bosch@udp.cl

We describe how two-stage stochastic programs with mixed probabilities can be treated computationally. We obtain a convex conservative approximation of the chance constraints and approximate the expectation function in the first stage by the average. This raises the question of how to solve the linear program with the convex conservative approximation (nonlinear constraints). We study the case where random vector of probability constraint in the second stage is normally distributed.

■ MA23

C - Room 212B

OR Applications in Emergency Planning and Management

Cluster: Homeland Security/Emergency Prep

Invited Session

Chair: Gino J. Lim, Associate Professor, University of Houston, E211, Egr. Bldg 2, 4008, Houston, TX, 77004, United States of America, ginolim@uh.edu

Co-Chair: MohammadReza Baharnemati, Research Assistant, University of Houston, 7600 Kirby Dr., APT 1306, Houston, TX, 77030, United States of America, mbaharnemati@uh.edu

1 - Analyzing Evacuation vs. Shelter-in-Place Strategies After a Terrorist Nuclear Detonation

Lawrence Wein, Professor of Management Science, Stanford University, Stanford, CA, United States of America, wein_lawrence@GSB.Stanford.Edu, Sylvie Denuit, Youngsoo Choi

We superimpose a radiation fallout model onto a traffic flow model to assess the evacuation versus shelter-in-place decisions after the Department of Homeland Security's National Planning Scenario #1: a terrorist nuclear detonation in Washington DC. Our results highlight the importance of sheltering for at least 12 hours after a nuclear detonation.

2 - Using Advanced Technology to Develop Robust Routes for Emergency Responders

Rajan Batta, Professor, Industrial and Systems Engineering, and Associate Dean for Graduate Studies, University at Buffalo (SUNY), School of Engineering and Applied Scienc, 412 Bell Hall, Buffalo, NY, 14260, United States of America, batta@buffalo.edu, Matt Henchey

It is envisioned that the ITS will be a sensor rich environment composed of advanced sensor, communication and computer technology. From this environment we plan to make a 'generational leap' in emergency response and rescue capabilities. The development of robust routes for emergency responders will bypass congestion where possible and encourage safe travel to the scene of the accident. This will be done via data fusion techniques, which will use data from the sensor rich environment.

3 - An Information-based Rerouting Decision Making Tool for Regional Evacuation
MohammadReza Baharnemati, Research Assistant, University of Houston, 7600 Kirby Dr., APT 1306, Houston, TX, 77030, United States of America, mbaharnemati@uh.edu, Gino J. Lim

In this paper, we consider the concept of traffic rerouting in case of having traffic congestion during an evacuation. An information-based rerouting decision making tool is presented to provide new paths for evacuees whose evacuation paths are affected by an incident(s). The evacuation process is observed during evacuation and as soon as an incident occurs, information related to the incident are gathered and new paths are generated if required.

■ MA24

C - Room 213A

Cutting Planes in Mixed-Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Simge Kucukyavuz, Ohio State University, 1971 Neil Avenue, Columbus, OH, United States of America, kucukyavuz.2@osu.edu

1 - Branch-and-cut for Optimization with Multiple-Choice
Ismael de Farias, Texas Tech, Department of Industrial Engineering, Lubbock, TX, United States of America, ismael.de-farias@ttu.edu

We present new inequalities valid for the multiple-choice optimization polyhedron. Additionally, we present and discuss computational experience with branch-and-cut using the inequalities as cutting planes.

2 - On Relations between 0-1 Mixed Integer Bilinear Covering Sets and Fixed-charge Flow Sets
Jean-Philippe Richard, Associate Professor, University of Florida, 303 Weil Hall, Gainesville, United States of America, richard@ise.ufl.edu, Mohit Tawarmalani, Kwanghun Chung

We show that 0-1 mixed integer bilinear covering sets (MIBCS) and certain fixed-charge flow sets (FCFS) have polyhedral structures that are intimately related. In particular, we prove that all facets of one set can be obtained from the facets of the other, and vice-versa. We then show how lifting can be used to derive three families of facet-defining inequalities for MIBCS, which in turn, yield new facet-defining inequalities for FCFS.

3 - n-step Conic Mixed Integer Rounding Cuts
Sujeevraja Sanjeevi, Texas A&M University, 3017 ETED, 3131 TAMU, College Station, TX, 778433131, United States of America, sujeevraja@tamu.edu, Kiavash Kianfar, Sina Masihabadi

We introduce new families of cutting planes, called the n-step conic mixed integer rounding (n-step CMIR) cuts, for the second-order conic MIP (CMIP). These cuts are a generalization of the CMIR cuts of Atamturk and Narayanan. The CMIR cuts are simply the first family corresponding to n=1. We further show that under mild conditions the n-step CMIR cuts define facets for the mixed integer set defined by a general polyhedral conic constraint.

4 - Enhancements to the Cutting Plane Tree Algorithm
Dinakar Gade, Graduate Research Associate, Department of Integrated Systems Engineering, The Ohio State University, 1971 Neil Avenue, 210 Baker Systems, Columbus, OH, 43210, United States of America, gade.6@osu.edu, Simge Kucukyavuz, Suvrajeet Sen

In this talk, we propose improvements to the cutting plane tree algorithm by developing enhanced disjunctive cuts and discuss convergence of the algorithm. We study the relationship of a special class of these cuts with existing cutting planes. We report preliminary computational results on MIPLIB instances.

■ MA25

C - Room 213BC

Dynamic Models in Sourcing and Procurement

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Damian Beil, Associate Professor, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, dbeil@umich.edu

Co-Chair: Gabriel Weintraub, Columbia University, Columbia Business School, New York, NY, United States of America, gyw2105@columbia.edu

1 - Efficiency of Long-term Contracts under Dynamic Hidden Information
Hao Zhang, Assistant Professor, University of Southern California, Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, 90089, United States of America, zhanghao@marshall.usc.edu

Some interesting supply-chain management problems can be cast as a dynamic principal-agent problem in which the principal offers a long-term contract to an agent who has private information on the underlying system, e.g., production cost, consumer type, and inventory level. We identify conditions under which the principal's optimal long-term contracts converge to first-best contracts and achieve first-best efficiency over time. This structural result has many potential applications.

2 - Coordinating Risk Pooling Capacity Investments in Joint Ventures
Guillaume Roels, Assistant Professor, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90066, United States of America, groels@anderson.ucla.edu, Philippe Chevalier

In this paper we study how to structure a joint venture between two manufacturing firms that pool their resources to reduce their overall demand risk. We propose two contractual arrangements that lease the capacity of the joint venture to the partners either in proportion to their respective capacity usages (Total Capacity Leasing) or only to eliminate local capacity imbalances (Partial Capacity Leasing), and offer contractual recommendations for coordinating risk-pooling capacity investments.

3 - The Design of Repeated Procurement Auctions with Cost Reduction Investments
Sachin Adlakha, California Institute of Technology, Pasadena, CA, United States of America, adlakha@caltech.edu, Gabriel Weintraub

We study the design of repeated procurement auctions where bidders can invest to reduce their average costs over time. The buyer optimizes its procurement costs over a parameterized class of auctions; the parameter determines the level of "competitiveness" of one auction. We use recently developed techniques to analyze dynamic oligopoly models to solve the buyer's problem. Our results show how dynamic incentives can play a key role in auction design.

4 - Split Award Auctions for Supplier Retention
Aadhaar Chaturvedi, Post-doctoral Fellow, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, aadhaar@umich.edu, Damian Beil, Victor Martínez-de-Albéniz

Buyers frequently organize auctions amongst the qualified suppliers, within its supply base, to stay abreast of supply-market pricing. Use of winner-take-all auctions can alienate losing suppliers who might defect from the supply base. Therefore, to maintain the supply base, buyers employ split awards. In this paper we model and investigate the trade-off between the effective purchasing costs on the one hand, and the future qualification cost paid to maintain the supply base on the other.

■ MA26

C - Room 213D

Supply Chain Marketing Interface

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Yao Zhao, Professor, Rutgers University, 1 Washington St, Newark, NJ, 07012, United States of America, yaozhao@andromeda.rutgers.edu

1 - How Durable Should Manufacturers Make Their Durable Products
Lian Qi, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, lianqi@business.rutgers.edu, James Sawhill

Durable goods manufacturers need to understand the trade-offs inherent in deciding the reliability they build into products. We study this trade-off for a monopoly manufacturer with an infinite time horizon. As a base case, we analyze the problem by assuming that the underlying technology is static. This assumption is relaxed in a more general model. We separate the reliability decision from the optimal replacement cycle decision in order to consider the potential benefits of buy-back policies.

2 - Explaining the Persistence of High Brand Name Prescription Drug Prices in the Face of Generic Entry
Kathleen Iacocca, University of Scranton, 2521 Allenbrook Dr., Apt 103, Allentown, PA, 18103, United States of America, martinok2@gmail.com, Yao Zhao, James Sawhill

The price gap between brands and generics persists even when the brand is competing directly with and losing significant market share to its generic equivalent. Using a model for prescription drug demand, we find that consumer inertia along with other factors can explain the brand's reluctance to compete on price.

3 - Product Portfolio Evaluation and Customized Pricing: A Risk Management Perspective
Xiaowei Xu, Associate Professor, Rutgers Business School, 1 Washington Park, RM 958, Newark, 07102, United States of America, xiaoweix@andromeda.rutgers.edu

We consider a retailer that sells a product line to a market with multiple segments. The risk neutral or averse retailer can customize product prices to each market segment, in which customer demand takes a logit form. Taking a risk management perspective, we provide insights of how to rank products.

■ MA27

C - Room 214

Project Management and Scheduling

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Nicholas G. Hall, Professor, The Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hall_33@fisher.osu.edu

1 - Approximate Characteristic Functions for Intractable Cooperative Games in Operations Planning
Zhixin Liu, Assistant Professor, University of Michigan - Dearborn, 19000 Hubbard Drive, Dearborn, MI, 48126, United States of America, zhixin@umd.umich.edu, Nicholas G. Hall

We design approximate characteristic functions for intractable operations planning games. An algorithm is proposed to specify solution procedure for coalitions' optimization problems, solution space of coalitions' optimization problems, dependence of coalition value on outside decisions, and effective coalition structure. Applications include economic lot sharing, knapsack problem, facility location, capacity allocation, k-median, and flowshop sequencing.

2 - How Small Do Job Pieces Have to be in Optimal Preemptive Schedules?
Vadim G. Timkovsky, The University of Sydney, NSW 2006, Sydney, Australia, vadim.timkovsky@sydney.edu.au, Edward G. Coffman, Jr., Daniel C. T. Ng

Sauer and Stone showed in 1987 that some shortest preemptive schedules of unit-length jobs with precedence constraints on identical parallel machines require exponentially small job pieces in the number of jobs. We strengthen their results and obtain similar results for other preemptive scheduling problems with integer data inputs.

3 - Performance and Robustness for the Stochastic Resource-constrained Multi-project Scheduling Problem
Rainer Kolisch, Professor, Technische Universitaet Muenchen, Arcisstr. 21, Munich, 80333, Germany, rainer.kolisch@wi.tum.de, Thomas Fliedner

We study the effect of two different scheduling policies (resource- and activity-based) embedded in a genetic algorithm on the average and the variance of the sum of the project's makespans for the stochastic resource-constrained multi-project scheduling problem. Our results indicate that resource-based policies dominate activity-based policies and that the goals of minimizing the mean and the variance of the objective function are not conflicting.

■ MA28

C - Room 215

Service Operations and Outsourcing Management

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Fuqiang Zhang, Professor, Washington University in St. Louis, Operations & Manufacturing Management, St. Louis, MO, United States of America, FZhang22@wustl.edu

1 - Outsourcing Service Processes to a Common Service Provider under Price and Time Competition
Gad Allon, Northwestern University, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Awi Federgruen

In many industries, firms consider the option of outsourcing an important service process associated with the goods or services they bring to the market. We develop analytical models to characterize the benefits and disadvantages of outsourcing in service industries in which the retailers compete with each other in terms of the price they charge and/or the waiting time expectations and standards which they adopt and sometime advertise.

2 - Better Selection or Efficient Contracting in Service Outsourcing?
Zhijian Cui, Assistant Professor, IE Business School, Calle María de Molina, 13, Madrid, Spain, zhijian.cui@ie.edu, Sameer Hasija

By comparing competitive bidding and sequential contracting in service outsourcing, this study shows the contingencies under which one process dominates another. We show that the competitive bidding yields good selection but contract inefficiency. The sequential contracting enables the firm to achieve perfect contract efficiency but poor selection. In addition, this study highlights the implication of a performance menu, a contract menu that involves multiple performance measurements.

3 - Guilt by Association: Strategic Capacity Decisions for Disaster Prevention and Recovery
Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu, Brian Tomlin

Firms operating subsystems that enable a system's functionality face unique challenges when subsystem failures are dependent. Namely, the possibility that the system is down due to failures of both subsystems creates an ambiguity in allocating the time-based penalty, significantly impacting and the firms' incentives to invest in capacity. We analyze capacity investment games in such an environment and compare the equilibrium capacities in centralized and decentralized systems.

4 - Outsourcing Competition and Information Sharing with Asymmetrically Informed Suppliers
Ling Xue, Assistant Professor, University of Scranton, 700 Linden St., Scranton, PA, 18510, United States of America, xuel2@scranton.edu, Fuqiang Zhang, Xia Zhao

We study an outsourcing problem where two service supplier compete for the service contract from a client. The suppliers face uncertain service cost which is dependent on the client's inherent type. The suppliers receive correlated private signals and compete under asymmetric information. We characterize the equilibrium outcome of the supplier competition and find that the client does not necessarily have incentives to reduce the level of information asymmetry.

■ MA29

C - Room 216A

Stochastic Portfolio Selection

Cluster: Quantitative Finance

Invited Session

Chair: Paul Glasserman, Columbia Business School, 403 Uris Hall, Columbia University, New York, NY, 10028, United States of America, pg20@columbia.edu

1 - Dynamic Portfolio Execution
Martin Haugh, Columbia University, 332 S. W. Mudd Building 500 W. 120th Str, New York, NY, 10027, United States of America, mh2078@columbia.edu, Chun Wang

We consider the problem of dynamically purchasing or selling a fixed portfolio of securities when there is a price impact associated with trading. These problems suffer from the curse of dimensionality and so we seek good sub-optimal strategies using approximate dynamic programming and other heuristic techniques. We consider problems with no short-sales and other portfolio constraints and use recently developed duality techniques to evaluate the quality of our policies.

2 - Consistent Portfolio Selection with a Large Number of Assets
Ming Yuan, ming.mingyuan@gmail.com

As many have observed empirically, the estimated mean-variance efficient portfolios oftentimes do not come close to meet their theoretical promises when there are more than a few assets in the market. We argue that such lackluster performance could be significantly improved and the prowess of the mean-variance analysis remains, if it is not more prevalent, when there are a large number of assets.

3 - Portfolio Optimization with Generalized Hyperbolic Distributions
John Birge, Professor, University of Chicago, Booth School of Business, Chicago, IL, United States of America, john.birge@chicagobooth.edu, Luis Chavez-Bedayo

Asset returns generally exhibit non-normal behavior; moreover, priors on future returns are naturally a mixture of potential underlying distributions. Generalized hyperbolic (GH) distributions provide a parametric family that is consistent with these characteristics. This talk will describe general properties of optimal portfolios assuming GH distributions and CARA utility.

4 - Robust Portfolio Control with Stochastic Factor Dynamics
Xingbo Xu, Columbia University, 500 West 120th Street, New York, 10025, United States of America, xx2126@columbia.edu, Paul Glasserman

A multi-period robust portfolio control problem with uncertainty measured by relative entropy is studied, with quadratic transaction costs and returns driven by mean reverting factors. Optimal controls are linear combinations of previous positions and factors. Closed form iteration is derived for finite horizon case. For infinite horizon, iteration and decomposition methods are analyzed. Performance is compared on historical data.

■ MA30

C - Room 216B

Joint Operational and Financial Decisions of Firms

Sponsor: Manufacturing & Service Oper Mgmt/ iFORM SIG

Sponsored Session

Chair: Jiri Chod, Boston College, 140 Commonwealth Avenue, Fulton Hall, Chestnut Hill, MA, 02467, United States of America, jiri.chod@bc.edu

1 - Flexible versus Dedicated Technology Choice under Budget Constraints
Onur Boyabatli, Assistant Professor, Singapore Management University, 50 Stamford Road 04-01, Singapore, 178899, Singapore, oboyabatli@smu.edu.sg, Tiecheng Leng, Beril Toktay

This paper focuses on a two-product firm that decides flexible versus dedicated technology choice in a single-period framework. The firm is budget constrained both in the capacity investment and the production stages. We analyze the impact of the budget constraint in each stage on the flexible versus dedicated technology choice.

2 - Supply Chain Performance under Market Valuation: An Operational Approach to Restore Efficiency
Guoming Lai, Professor, University of Texas-Austin, 1 University Station, B6500, CBA 5.202, Austin, TX, 78705, United States of America, Guoming.Lai@mccombs.utexas.edu, Jun Yang, Wenqiang Xiao

Based on a supply chain framework, we study the ordering decision of a downstream buyer firm who receives private demand information and has the incentive to influence her capital market valuation. We characterize a separating market equilibrium under a general single contract offer. We show ordering distortion may arise. Then, we investigate operational mechanisms to prevent such inefficient ordering distortion.

3 - Optimal Operational versus Financial Hedging for a Risk-averse Firm
Adam (Wanshan) Zhu, Associate Professor, Department of Industrial Engineering, Tsinghua University, 613 South Shun-De Building, Beijing, 100084, China, zhuws@tsinghua.edu.cn, Roman Kapuscinski

A Multinational Risk-averse Newsvendor (MRN) produces goods at home (domestically) and sells both overseas and at home, over multiple periods. The MRN faces risks due to uncertain exchange rate, as well as uncertain demand. Intuitively, exchange rate risk should be managed by a finance department as financial risk, while uncertain demand risk should be managed by an operations department as a part of operational risk. Traditionally this is the practice of many firms. In this paper, we consider both of these risks jointly and investigate the effectiveness of two specific alternatives that allow MRN to reduce the total risk. The first alternative is general financial hedging contracts (including futures, forwards, swaps, and options). The second one is operational hedging, which is based on optimally allocating production capacity between domestic and overseas facilities. We characterize the optimal capacity allocation decisions, financial hedging decisions, and the underlying production and transshipment decisions in a generalized model. Then, we compare the relative weaknesses and strengths of financial hedging and operational hedging. We find that the operational hedging adds more value than financial hedging in most cases, and more interesting, they become complementary for firms facing high cross-border friction.

4 - Effect of Operational Hedging on the Marginal Costs of Capital and Revenue Generation
Fehmi Tanrisever, Technische Universiteit Eindhoven, Eindhoven, Netherlands, f.tanrisever@tue.nl, Sinan Erzurumlu, Nitin Joglekar

Financing and operational decisions are separable when there are no capital market frictions. In this research, we discuss the role of operational hedging in mitigating capital market frictions and enhancing the financing options of a startup firm. We show that operational hedging practices, while distorting the investment space of the firm and limiting the future growth opportunities, may facilitate financing by creating a more robust balance sheet.

■ MA31

C - Room 217A

HAS Poster Session

Sponsor: Health Applications

Sponsored Session

Chair: Steven Shechter, Sauder School of Business, University of British Columbia, Vancouver, BC, Canada, steven.shechter@sauder.ubc.ca

1 - A Markov Decision Model for Alzheimer's Disease Progression
Muge Capan, North Carolina State University, 2931 Ligon Street, Raleigh, 27607, United States of America, mcapan@ncsu.edu, Julie Ivy

We develop a Markov Decision Process model to examine the impact of treatment on post diagnosis Alzheimer's disease progression. Our research aim is to develop a dynamic model to evaluate potential economic impact of a new treatment. This model presents a valuable framework which captures both the uncertainty related to disease progression and treatment outcomes. We utilize probabilistic sensitivity analysis of model penalties and transition probabilities to control the dynamic process.

2 - Analytic Solution the Susceptible-infective Disease Spread Model with Varying Contact Rate
Hamed Yarmand, PhD Student, North Carolina State University, 3105 Aileen Dr Apt D, Raleigh, NC, 27606, United States of America, hyarman@ncsu.edu, Julie Ivy

A common class of epidemiological models is the Kermack-McKendrick model and its variations which are represented as systems of ODEs and in most cases are strongly nonlinear and cannot be solved analytically. We consider SEIR and SI models with varying contact rate and represent them as continuous-time Markov chains. For the SI model, we find the state probability distribution by solving the Kolmogorov forward equations and use it to find the analytic solution to the original SI model.

3 - Constraint Programming Used for Beam Orientation Optimization for Total Marrow Irradiation
Chieh-Hsiu J. Lee, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, chjlee@mie.utoronto.ca, Dionne Aleman, Michael Sharpe

The beam orientation optimization problem for total marrow irradiation using intensity modulated radiation therapy is a large and complex problem of selecting beam positions for treatment. We use a constraint programming approach to obtain a solution set of beams that result in good treatment plans.

4 - Economic Evaluation of Brentuximab for Hodgkins Lymphoma
Vusal Babashov, Epidemiology & Biostatistics, University of Western Ontario, 1151 Richmond Street,, London, Canada, vbabasho@uwo.ca, Mehmet Begen, Greg Zaric

It is estimated that 9,450 new Hodgkin Lymphoma (HL) cases occurred in North America and 1,436 of the prevalent cases died from this rare disorder in 2010. Although, the majority of patients diagnosed with HL attain complete remission after the first line therapy, 15% of early and 30-40% of advanced stage patients relapse after the initial treatment. Recent results from Brentuximab Vedotin Phase 1 and Pivotal Phase 2 trials are a promising. We conduct an economic evaluation of this new drug.

5 - Impedance Plethysmographic Pulse Morphology Pattern Classification for Metabolic Syndrome (MetS)
Medha Dhurandhar, Head & Prog Coord, Centre for Development of Advanced Computing, Pune University Campus, Pune, 411007, India, mdhurandhar@gmail.com

We present a Decision Support System for non-invasive predictive analysis of Metabolic Syndrome (MetS) based on impedance plethysmographic pulse signal waveforms using Data Mining. Current diagnostic methods are invasive. Proposed method classifies IPG-based pulse morphology patterns for MetS. Results are validated with real world data with sensitivity (98.22%), positive predictive value (97.87%). As MetS is a serious condition, which is preventable & treatable, early detection is critical.

6 - Improving Patient Flow in an Obstetric Unit
Jacqueline Griffin, Georgia Institute of Technology, Atlanta, GA, United States of America, jackie.griffin@gatech.edu, Shuangjun Xia, Siyang Peng, Pinar Keskinocak

To study the tradeoffs in blocking and system efficiency, we develop a simulation model of an obstetric unit with a focus on patient flow, considering patient classification, blocking effects, time dependent arrival and departure patterns, and statistically supported distributions for length of stay (LOS). The model is applied to DeKalb Medical's Women's Center, an obstetrics hospital in Atlanta, GA, to analyze the hospital's readiness for potential changes to patient mix and patient volume.

7 - Learning, Behavior, and Incentives for Coronary Heart Disease

Brandon Pope, Texas A&M University, 234F Zachry 3131 TAMU, College Station, United States of America, brandonpope84@gmail.com, Andrew Johnson, James Rohack, Abhijit Deshmukh

While the primary means of giving incentives is contracts, incentives can be generally thought of as any mechanism that affects decision making. The incentives we consider are created by providing knowledge to healthcare consumers. By using a learning model of consumer behavior, we model a policy maker's knowledge provision problem as a Markov decision process. We utilize this framework to solve for optimal knowledge provision policies regarding behaviors pertinent to coronary heart disease.

8 - Optimal Age-Dependent Screening Strategy Design for Chlamydia Infection

yu teng, Weldon School of Biomedical Engineering,Purdue University, 206 S. Martin Jischke Drive, west lafayette, IN, 47907, United States of America, yteng@purdue.edu, Nan Kong, Lanshan Han, Wanzhu Tu

Chlamydia infection is one of the most common sexually transmitted diseases in the U.S. Since the majority of infected people are asymptomatic and the incidence rate varies over the age spectrum, age-specific screening methods may be cost-effective in controlling the disease. We adapt a discrete-time dynamic model to evaluate the cost and effectiveness of age-specific screening strategies and solve the resultant continuous-variable dynamic optimization problem to identify the optimal strategy.

9 - Optimal Booking Strategies for Outpatient Procedure Centers

Bjorn Berg, North Carolina State University, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, bpberg@ncsu.edu, Thomas Rohleder, S. Ayca Erdogan, Brian Denton, Todd Huschka

Patient appointment booking, sequencing, and scheduling decisions are challenging for outpatient procedure centers due to uncertainty in procedure times and patient attendance. We formulate a model based on a two-stage stochastic mixed-integer program for optimizing booking and appointment times in the presence of uncertainty. A case study based on an endoscopy suite at a large medical center is used to draw a number of useful managerial insights for procedure center managers.

10 - Optimal Cystoscopy Schedules for Bladder Cancer Patients

Yuan Zhang, North Carolina State University, 373 Daniels Hall, Raleigh, NC, 27695, United States of America, yzhang13@ncsu.edu, Brian Denton, Matthew Nielsen

We discuss a partially observable Markov decision process (POMDP) to investigate the optimal timing of diagnostic tests for low risk bladder cancer patients. The objective is to maximize quality adjusted life years (QALYs). We describe structural properties of the POMDP and the resulting optimal policy. Finally, we present numerical results illustrating the factors that most influence patient specific screening policies.

11 - Parameter Comparison and Model Selection in Drug Development

Clayton Barker, Research Statistician, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, clay.barker@sas.com, Rajneesh Rajneesh

We extend the Analysis of Means chart idea to compare parameter estimates across independent groups. This is useful in drug development, where modeling involves comparing parameter estimates from nonlinear regression. We discuss an information based criterion for model selection and a self-starting library of nonlinear models.

12 - Positioning Emergency Medical Services for Trauma Response for Rural Traffic Crashes

Poyraz Kayabas, Graduate Research Assistant, North Dakota State University, Room 212, CJPP Building,, P.O. Box 6050, NDSU, Fargo, ND, 58105, United States of America, poyraz.kayabas@ndsu.edu, Eunsu Lee

Given the episodic nature of crash injuries along rural areas, it is difficult to optimize service based on a needs-assessment in emergency medical service (EMS) response history. The emphasis of efficiency of limited resources creates a difficult decision making environment in balancing service accessibility based solely in geography and exposure factors such as population level and travel activity. This study provides an logistical analysis of EMS response to rural trauma victims.

13 - Predicting Emergency Department Volume to Create a "Surge Response" for Non-Crisis Events

Valerie Chase, University of Michigan, 1205 Beal Avenue, Ann Arbor, United States of America, valjeanc@umich.edu, Amy Cohn, Mariel Lavieri, Tim Peterson

Our goal is to identify surges in emergency department volume based on the level of utilization of physician capacity. The models have been created and validated using data from a large urban teaching hospital. Our models improve current practice by identifying surges in patient volumes sooner on non-crisis days.

14 - Simulation Optimization of PSA-Threshold Based Prostate Cancer Screening Policies

Daniel Underwood, North Carolina State University, 150 Renwick Ct., Raleigh, NC, 27615, United States of America, daniel.underwood@ncsu.edu

We discuss a simulation optimization model to estimate near optimal PSA screening policies based on the mean expected quality adjusted life years (QALYs) of a large population. We describe the optimization method, based on a genetic algorithm. Numerical experiments are presented to compare the optimal policy to existing guidelines. Our results provide evidence that patients should be screened more aggressively but for a shorter period of time than current guidelines recommend.

15 - Strategic National Stockpile (SNS) Logistics Network Design: Location and Routing

Yepeng Sun, Ph.D candidate, University of Louisville, 789 Eastern PKWY APT 4, Louisville, United States of America, y0sun010@louisville.edu, Gerald Evans, Sunderesh Heragu

To build a logistics network for large-scale emergency relief, mathematical models and the relevant algorithms are developed as a large-scale emergency preparedness planning tool to determine the location of warehouses and the assignments between warehouses and demand points, the number of different types of trucks and the routing of trucks. The objective is to minimize the total cost as well as assuring that the relief materials can be delivered to demand points within a limited duration.

16 - Medical Resident Scheduling Using Multi-Criteria Optimization Models

Marcial Lapp, University of Michigan, Ann Arbor, United States of America, mlapp@umich.edu, Brian Jordan, Kathy Lu, Daniel O'Connell, Amy Cohn, Jinshuai Guo, Yiwen Jiang, Siyuan Sun, Xun Xu

Work schedules for medical residents are subject to complex rules and restrictions. We provide a modular framework which can be used to (1) evaluate the feasibility of a given schedule; (2) compare multiple different schedules across several different metrics; and (3) generate high-quality feasible solutions for evaluation, modification, and implementation.

17 - Using Simulation to Develop a Productivity Standard in a Pre-Admission Testing Department

Abigail R. Wooldridge, University of Louisville, 6518 Green Manor Drive, Louisville, KY, 40228, United States of America, wooldridge.abigail.r@gmail.com, Jennifer Kello, Matt Mueller

A regional, five hundred bed hospital is developing metrics to measure cycle times, patient volume, and delays due to the transition in healthcare to value-based purchasing. This presentation details the use of time study data to build the simulation model used to set a productivity standard in the Pre-Admission Testing department. Expansion of the model to make it customizable to the other facilities in the hospital's network is also considered.

18 - Collaborative Healthcare Services Using Medical Service Code

Jung-Woon Yoo, Assistant Professor, Bradley University, 1501 W Bradley Ave, Peoria, IL, 61525, United States of America, jyoo@bradley.edu

Medical outsourcing, such as medical tourism, is a new trend in healthcare services. This paper proposes an information system framework for large-scale healthcare collaboration to help patients get treatment at lower cost while hospitals increase the utilization of their resources. In the proposed framework, medical operations, examinations, or consultations are defined as medical services, and current procedural terminology code system is used to share services with other healthcare providers.

19 - RFID-based Design of Smart Inventory for Medical Supply

Xiaoyu Ma, Wayne State University, 4815 4th Street, Detroit, MI, United States of America, eb1946@wayne.edu

Unpredictable service demand and high service level invoke challenges to medical logistic management. Escalating waste from deficient supply and expiration control trigger expectation to enhance visibility within operational process. RFID may improve the benefits of medical supply through improving information accuracy, reducing inventory losses and increasing process efficiency. We propose a design of Smart Inventory based on RFID and a case study in a Veteran's Affairs hospital is presented.

20 - A Clinical Decision Tree for Maximizing Survival Rate

Youngrok Lee, Iowa State University, 1108 S 4th St Unit 42, Ames, IA, 50010, United States of America, younglee@iastate.edu, Sigurdur Olafsson

This study proposes a heuristic approach to find the optimal decision tree for maximizing survival rate. In a perspective of optimization, the proposed method generates survival time models for an objective function, builds a decision tree from the optimal subset leading to maximum estimated survival rate, and prunes invalid decision rules from the decision tree. A case study conducted for gastric cancer shows that the proposed method is superior to the conventional decision tree learning.

21 - A Study in Usability: Handheld Apps for NJ's Department Health & Senior Services Hippocrates Software

Christie Nelson, Rutgers University, 23A Norwood Ct, Princeton, NJ, 08540, United States of America, cgrewe@eden.rutgers.edu, Yves Sukhu, William M. Pottenger

A study was performed on handheld applications for New Jersey's Department of Health and Senior Services Hippocrates software. Hippocrates is used for monitoring and responding to health-related emergencies by New Jersey. Research was conducted on two apps (iPad and Android) developed by other team members to identify potential areas for improvement. Research was based on similar software, current technologies, user interviews, a human factors evaluation of functionality, and usability testing.

22 - An Ambulance Location Model with Constraints on Failure and Survival Probabilities

Boray Huang, National University of Singapore, 1 Engineering Drive 2, E1A 06-25, Singapore, Singapore, isehb@nus.edu.sg, Yuan Zhou, Hui-Chih Hung

We study the ambulance location problem in an Emergency Medical Service system. The goal of the research is to locate the ambulance stations and decide the fleet size at each station. We build a set covering model with constraints on failure probability and survival probability. As the constraints are non-linear, we first derive the analytical solutions for a simple case. Then a heuristic is proposed for the general cases.

23 - How do Home Health Nurses Spend Their Time?

Ashlea Bennett Milburn, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, ashlea.bennett@uark.edu, Scott Mason

A 2010 survey revealed home health nurse involvement in supply chain duties such as order placement, order picking, and delivery is leading to high indirect costs and taking time away from patient care. A follow-up study is presented, in which expert interviews and extensive data analysis are used to compare frequent practices based on total cost, supply chain performance, and nurse involvement.

24 - Analyzing and Designing Outpatient Appointment Schedules with Operational Policy Targets

Emre Veral, Professor, Baruch College, 17 Lexington Ave, Box B9-240, New York, NY, 10010, United States of America, emre.veral@baruch.cuny.edu, Benedetto Valenti, Will Millhiser

We propose a new paradigm in appointment scheduling. Using a stochastic model to assess the distributions of patient waiting time and MD overtime, we focus on probabilistic targets to design scheduling templates. Analysis of existing rules demonstrates their inherent shortcomings, and model capabilities enable new schedule designs that meet operational performance targets such as the percentage of patients waiting more than X minutes, or the probability that session overtime exceeds Y minutes.

25 - Hospital Bed Allocation under Dynamic Demand

Atif Osmani, PhD Student, Dept. of Industrial Engineering, North Dakota State University, Fargo, ND, 58102, United States of America, atif.osmani@ndsu.edu

Due to dynamically changing demand patterns, hospitals are facing problems with conjunction in certain specialties and under utilization of beds in others. Reallocation of beds across various specialties is a recurring issue for hospital administrators. A unique approach is presented to periodically assess the strategy and determine the optimal allocation of hospital beds.

26 - Multi-facility Surgical Case Scheduling

Jihan Wang, Ph.D. Student, Wayne State University, 4815 Fourth St., Rm. 2033, Detroit, MI, 48202, United States of America, aw0984@wayne.edu, Alper Murat, Kai Yang

In a healthcare network, several facilities are located close to each other. The overall network can benefit in terms of increased utilization and reduced wait time by coordinating surgical scheduling decisions across the member hospitals. In our study, we expand the scope of OR scheduling to multi-facility setting by considering the transferring of surgical cases among multiple facilities of the network. A goal programming approach is adopted for the multi-criteria decision making process.

27 - Patient and Nurse Considerations in Home Health Routing

Jessica Spicer, Graduate research assistant, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, jbentz@uark.edu, Ashlea Bennett Milburn

In home health care, as in many applications, cost is an important factor used to measure the quality of a route. However home health agencies may also be interested in creating routes that achieve a variety of other patient and nurse satisfaction goals. We use an integer programming model to study the relationship among these multiple objectives, as well as the impact of new technologies such as remote monitoring devices on these various goals.

28 - The Donor-Dependent Scoring Policy: Shaping the Cadaver Kidney Allocation in the New Era

Yichuan Ding, Phd candidate, Stanford University, 14 Comstock Circle, Apt 106, Stanford, CA, 94305, United States of America, y7ding@stanford.edu, Stefanos Zenios

We study a special class of scoring schemes that are used to rank candidates on the cadaver kidney waitlist, called the donor-dependent scoring scheme (DDSS). The policy by the UNOS in 2008 is a typical DDSS. By modeling the transplantation waitlist, we investigate the outcome of using a DDSS, and conclude that a DDSS increases the recipient's incentive to accept an offered kidney at an earlier time. Our simulation test shows that a DDSS decreases the number of discarded kidneys by 6 percent.

29 - Blood Platelet Optimization for Blood Banks

Nico M. van Dijk, University of Amsterdam , Department of Operations Research, University of Amsterdam, The Netherlands, Netherlands, n.m.vandijk@uva.nl, Cees Smit Sibinga, René Haijema, Wim de Kort, Nikky Kortbeek, Michiel Jansen, Jan van der Wal

Donated Blood Platelets have a limited shelftime. Outdating , shortages, age and costs are to be minimized. Three phases are shown over 6 years: I. The development of combined dynamic programming and simulation. II. Its application and implementation to Dutch Bloodbanks. III. Its extension to transportation and hospitals.

■ MA32

C - Room 217BC

Railway Safety and Capacity Research

Sponsor: Railway Applications

Sponsored Session

Chair: Rapik Saat, Research Assistant Professor, University of Illinois at Urbana-Champaign, 205 N Mathews Avenue, 1243 Newmark Civil Engineering Lab, Urbana, IL, 61820, United States of America, mohdsaat@illinois.edu

1 - Integrated Railroad Hazardous Materials Transportation Safety Risk Management Framework

Rapik Saat, Research Assistant Professor, University of Illinois at Urbana-Champaign, 205 N Mathews Avenue, 1243 Newmark Civil Engineering Lab, Urbana, IL, 61820, United States of America, mohdsaat@illinois.edu

The objective of this research is to develop a risk management framework and provide quantitative analytical methods to assess the relative effectiveness of various strategies involving infrastructure, operational, container design and routing improvements to reduce railroad hazardous materials transportation risk.

2 - A Multivariate Analysis of Railroad Toxic-Inhalation-Hazard (TIH) Transportation Release Rate

Xiang Liu, University of Illinois at Urbana-Champaign, B-118 Newmark Civil Engineering Lab, Urbana, IL, 61801, United States of America, liu94@illinois.edu, Rapik Saat, Christopher Barkan

We present a multivariate model to quantify Toxic-Inhalation-Hazard (TIH) release rate accounting for route, tank car design, train and operational characteristics in railroad transportation. Our model is intended to assist railroads to evaluate route-specific TIH release risk in Positive-Train-Control (PTC) implementation.

3 - Effects of Highway-Rail Grade Crossings on Hazardous Materials Release Rates

Samantha Chadwick, University of Illinois at Urbana-Champaign, 205 N. Mathews Avenue, 61801, IL, United States of America, schadwi2@illinois.edu

Substantial research has gone into making highway-rail grade crossings safer for highway users, since train-automobile collisions generally cause more damage to the automobile. Now, the development of route risk analysis algorithms necessitates a better understanding of the effects highway users can have on trains. This research examines derailment rates at grade crossings with the goal of developing a hazardous materials release risk model that can be applied on a system-wide basis.

4 - Measuring the Capacity Impact of Higher Speed Passenger Trains

Samuel Sogin, University of Illinois at Urbana-Champaign, 205 N. Matthews, Urbana, IL, 61801, United States of America, ssogin2@illinois.edu, Christopher Barkan, Rapik Saat

North American freight railroads are expected to experience increasing network capacity constraints due to new demands for freight and passenger services. We analyze the impact of adding passenger trains on a freight network by evaluating the capacity in terms of train delay, the amount transported and moved, and network reliability.

■ MA33

C - Room 217D

2011 QSR Best Student Paper Competition

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Haitao Liao, Assistant Professor, University of Tennessee, 211 Pasqua Building, Knoxville, TN, 37996, United States of America, hliao4@utk.edu

1 - Efficient Semiparametric Estimation of Gamma Processes for Deteriorating Products

Zhisheng Ye, National University of Singapore, 1 Engineering Drive 2, Singapore, Singapore, g0800229@nus.edu.sg

This paper develops efficient EM algorithms for semiparametric estimation of the simple gamma process and the gamma process with random effect. Consistency of the estimators is established. A score test is developed for testing existence of the random effect.

2 - Hypergraph-based Gaussian Process Models with Qualitative and Quantitative Input Variables

Shuai Huang, Research Assistant, Arizona State University, 2343 West Main Street, Mesa AZ 85201, United States of America, shuang31@asu.edu

Several novel Gaussian process models have been developed for computer experiments with qualitative and quantitative factors. We develop a new Gaussian process model based on hypergraph and the associated Laplacian matrix. Compared with existing models, the proposed model requires much fewer free parameters and shows better performance on benchmark examples.

3 - Predicting Residual Life Distributions under Randomly Evolving Future Environmental Profiles

Linkan Bian, Georgia Institute of Technology, 765 Ferst Dr, Main 309, Atlanta GA 30332, United States of America, linkanbian@gatech.edu

This paper presents a sensor-based stochastic methodology for characterizing the degradation and predicting the residual life distribution of components functioning under randomly evolving future environmental profiles. This methodology leverages in-situ sensor-based information pertaining to the degradation process itself and the environmental conditions.

4 - Multi-layer Designs for Computer Experiments

Shan Ba, Georgia Institute of Technology, 765 Ferst Avenue, Atlanta GA, United States of America, sba3@isye.gatech.edu

We present a new class of space-filling designs developed by splitting two-level factorial designs into multiple layers. The method takes advantages of many available results in factorial design theory and therefore, the proposed Multi-layer designs (MLDs) are easy to generate.

■ MA34

C - Room 218A

Hospital Operations

Sponsor: Health Applications

Sponsored Session

Chair: Hannah Smalley, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, United States of America, hkolberg3@gatech.edu

Co-Chair: Pinar Keskinocak, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, United States of America, pinar@isye.gatech.edu

1 - Detect Abrupt Declines in Surgeon Workloads Using Multivariate Time Series Analysis of Billing Data

Franklin Dexter, Professor, University of Iowa, Department of Anesthesia, 200 Hawkins Drive, 6JCP, Iowa City, IA, 52242, United States of America, franklin-dexter@uiowa.edu, Johannes Ledolter, Ruth Wachtel, Bettina Smallman, Danielle Masursky

Data studied were cases and American Society of Anesthesiologists' Relative Value Guide units for all operating room anesthetics of one group for 130 four-week periods. Multivariate time series analysis was used. The findings increase confidence in the validity and usefulness of previously described methods for forecasting workloads of groups of surgeons. However, anesthesia groups have little chance of benefiting economically by monitoring its individual surgeons' workloads using billing data.

2 - Operating Rooms Long-Term Staff Planning for a Surgical Department

Monica Villarreal, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States of America, monica.v@gatech.edu, Pinar Keskinocak

We propose a 2-phase model for the long-term staff planning problem for the operating rooms of a surgical department at hospital in Georgia. In the first phase, we decide on the required staffing budget for each of the service lines, given historical demand and projected changes. In the second stage, we decide on the shifts to staff, which defines the staffing levels through the day. We test our results through a simulation and compute metrics such as delays, overtime, and staff pooling.

3 - The Signaling Effects of Healthcare Quality Awards on Hospital Competition

Bogdan Bichescu, University of Tennessee, 916 Volunteer Blvd., Knoxville, TN, 37996, United States of America, bbichescu@utk.edu, Randy Bradley, Wei Wu

Healthcare is a highly competitive environment in which both for-profit and not-for-profit hospitals compete against one another to both provide services to patients and attract resources (i.e., nurses and physicians) to deliver their services. We investigate the financial and operational benefits associated with clinical excellence by performing a matching study that compares quality award-winning hospitals to comparable hospitals without quality awards during the period of our study.

4 - A Continuity Score to Improve Pediatric ICU MD Schedule Design for Enhanced Handoff Efficiency

Hannah Smalley, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, United States of America, hkolberg3@gatech.edu, Atul Vats, Pinar Keskinocak

We propose a Handoff Continuity Score (HCS) as a novel approach for objectively assessing continuity and familiarity among oncoming physicians at handoff. We used the HCS to analyze a pediatric ICU MD schedule before and after a schedule redesign implemented to improve continuity. Increased HCS was associated with an MD qualitative assessment of enhanced continuity and handoff efficiency. We developed an IP which identified the potential for additional scheduling improvements.

■ MA35

C - Room 218B

Condition Monitoring and Prognostics II

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Nagi Gebraeel, Associate Professor, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, nagi@isye.gatech.edu

Co-Chair: Linkan Bian, Georgia Institute of Technology, 765 Ferst Dr, Main 309, Atlanta, GA, 30332, United States of America, linkanbian@gatech.edu

1 - Maximum Likelihood Estimation of Component Lifetime Distributions in a Random Environment

Jeffrey Kharoufeh, Associate Professor, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, jkharouf@pitt.edu, John Flory

We consider the problem of estimating the lifetime distribution of a component whose degradation rate is modulated by an unobservable, exogenous environment. The attributes of the environment are inferred from the component's observable degradation process via maximum likelihood estimates. The estimated environment process is used to dynamically compute the component's lifetime distribution.

2 - Two-step Prognostic Methodology for Multi-component Systems

Li Hao, ISyE Georgia Tech, 755 Ferst Dr NW, Room 309, Atlanta, GA, 30332, United States of America, lhao8@gatech.edu, Nagi Gebraeel, Jianjun Shi

Sensors that monitor complex systems often capture mixtures of component signals. We present a two-step prognostic methodology for multi-component systems: A separation algorithm to isolate component signals and a stochastic model to predict future conditions of components from isolated signals. We perform a simulation study using vibration signals to evaluate the robustness of methodology to the effectiveness of separation algorithm and the accuracy of predicting component remaining lifetimes.

3 - Predictive Maintenance via Target Based Bayesian Network Learning

Irad Ben-Gal, Tel Aviv University, Tel-Aviv, 69978, Israel, bengal@eng.tau.ac.il, Aviv Gruber

We present a new Bayesian network learning method that learns the behavior of an unknown system from real data and can be used for optimization processes in industrial and service systems. We illustrate the proposed method by a classical example of predictive maintenance. We show how in a targeted Bayesian network learning, a tremendous complexity reduction can be accomplished, while maintaining most of the essential information for predictive maintenance of the system.

■ MA36

C - Room 219A

Emergency Department and Healthcare Operations Management

Sponsor: Health Applications

Sponsored Session

Chair: Soroush Saghafian, PhD Candidate, University of Michigan, Ann Arbor, MI, United States of America, soroush@umich.edu

Co-Chair: Mark Van Oyen, Associate Professor, University of Michigan, 3249 Rockcress CT, Ann Arbor, MI, 48103, United States of America, vanoyen@umich.edu

1 - Advancing ED and OR Patient Care Performance

Eva Lee, Professor & Director, Georgia Insitute of Technology, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

The studies are joint with Grady Health Systems & Children's Hospital of Atlanta. The work addresses overcrowding of the Emergency Department; excessive presence of patients with non-urgent medical conditions; long wait times; decreased quality of care and patient satisfaction; unnecessarily long length-of-stay, and return/readmission of patients. Systems models and advanced computation are developed for optimal care delivery to improve performance efficiency and cost-effectiveness.

2 - Drug Surveillance for Multiple Adverse Events

Joel Goh, Stanford University, Stanford, CA, United States of America, joelgoh@stanford.edu, Stefanos Zenios

In this paper, we consider the problem of designing a drug surveillance system, to monitor and detect an unacceptably high rate of adverse events within a population. In our model, we explicitly model the presence of multiple adverse events and their potential correlations. We propose a test statistic derived from likelihood ratios, and show that the original sequential test can be well-approximated as a test for the drift vector of a multidimensional Brownian motion.

3 - Patient Flow in the Emergency Department

Christian Terwiesch, University of Pennsylvania, The Wharton School, 3730 Walnut St., Philadelphia, PA, United States of America, terwiesch@wharton.upenn.edu, Robert Batt

We analyze various aspects of patient flow in the emergency department. We look at how various operational decisions impact waiting times, left without being seen rates, and medical outcomes.

4 - Complexity-Based Triage: A Tool for Improving Patient Safety and Operational Efficiency

Soroush Saghafian, PhD Candidate, University of Michigan, Ann Arbor, MI, United States of America, soroush@umich.edu, Wallace Hopp, Jeffrey Desmond, Steven Kronick, Mark Van Oyen

Most hospital Emergency Departments (ED's) use triage systems that classify and prioritize patients almost entirely on the basis of urgency. We propose a new triage system that incorporates patient complexity as well as urgency. Using a combination of analytic and simulation models, we demonstrate that complexity-based triage can substantially improve both patient safety (i.e., reduce risk of adverse events) and operational efficiency (i.e., shorten average length of stay).

■ MA37

C - Room 219B

Optimization Methods in Quality, Statistics and Reliability

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Abhishek Shrivastava, Assistant Professor, City University of Hong Kong, Department of MEEM, 83 Tat Chee Avenue, Kowloon, Hong Kong - PRC, abhishek.shrivastava@cityu.edu.hk

1 - Designs for the Lasso

Chunfang Devon Lin, Assistant Professor, Queen's University, Department of Mathematics and Statistics, Jeffery Hall, University Avenue, Kingston, ON, K7L 3N6, Canada, cdlin@mast.queensu.ca, Xinwei Deng, Peter Qian

We propose an approach using nearly orthogonal Latin hypercube designs, originally motivated by computer experiments, to significantly enhance the accuracy of the Lasso procedure. Systematic methods for constructing such designs are presented. The effectiveness of the proposed method is illustrated with several examples.

2 - Robust Statistics in High Dimensions

Constantine Caramanis, Assistant Professor, The University of Texas at Austin, Department of Electrical and Comp. Engineering, Austin, TX, 78712, United States of America, caramanis@mail.utexas.edu

This talk considers several topics in high-dimensional statistics when a constant fraction of the points are corrupted. We investigate algorithms with non-zero breakdown point, and give concrete lower bounds on the estimation error. In particular, we show the importance of developing techniques tailored for the high-dimensional regime.

3 - Pareto-Optimal Prioritization Scheme Design: A GA-based Simulation-Optimization Approach

Nan Kong, Purdue University, School of Biomedical Engineering, West Lafayette, IN, United States of America, nkong@purdue.edu, Wen-Hsin Feng, Hong Wan

We study a recipient prioritization scheme design problem. We consider multiple system outcomes simultaneously and incorporate a simulation model into a genetic algorithm solution framework to obtain Pareto-optimal solutions. To accommodate the stochastic nature of the system, we adapt a ranking and selection procedure to determine the required sample size sequentially for each candidate solution. We also adapt an approach to evaluate the probabilistic dominance of the solution.

4 - Hybrid Statistical and Direct Optimization of Blackbox Functions

Robert Gramacy, University of Chicago, Booth School of Business, 5807 S Woodlawn Avenue, Chicago, IL, 60637, United States of America, rbgramacy@chicagobooth.edu

This talk will highlight the benefits of hybridizing statistical and direct methods for optimizing blackbox functions. It will focus on 3 free software packages: NOMAD and APPSPACK for derivative-free optimization, and tgp for statistical surrogate modeling. We'll see how the statistical methods can borrow the convergence properties of the direct ones, and how the direct ones can benefit from the more globally scoped statistical methods, plus handle noisy data and unknown constraints.

■ MA38

H- Johnson Room - 4th Floor

Facility Location under Uncertainty I

Sponsor: Location Analysis

Sponsored Session

Chair: Larry Snyder, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, larry.snyder@lehigh.edu

1 - Dynamic Location Model with Market Learning

Michael Lim, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 S. 6th st., Champaign, IL, 61820, United States of America, mlim@illinois.edu, Shahzad Bhatti, Ho-Yin Mak

Two stage retail location problem with learning is considered. In the first stage, facilities are deployed based on the distribution of the demand. In the second stage, demand is fully revealed and additional facilities are deployed. Based on the gradual covering model, we construct a nonlinear integer programming model and develop an efficient solution algorithm that effectively converges to near-optimality for large-scale instances. We also derive managerial insights and guidelines.

2 - Addressing Spatial Uncertainty in Dispersion Modeling
Alan Murray, Arizona State University, Geographical Sciences and Urban Planning, Tempe, AZ, 85287, United States of America, Alan.T.Murray@asu.edu, Ran Wei

There exist many facets of uncertainty in digital spatial information. It seems unlikely that error or uncertainty would ever be completely eliminated. Optimization models must therefore contend with the various uncertainties and errors in spatial data. We propose an integrated approach to address data uncertainty in a spatial dispersion model. We demonstrate that it is possible to explicitly account for uncertainty impacts by formulating and solving new multi-objective models.

3 - A Conic Approach for Supply Chain Design Problems
Gemma Berenguer, PhD Candidate, University of California-Berkeley, Berkeley, CA, United States of America, gemmabf@berkeley.edu, Z. Max Shen

We study joint location-inventory problems with stochastic demand. We formulate these problems as conic quadratic mixed-integer models which can be solved efficiently. Our models are very general as they can accommodate stochastic lead times, correlated demands, and multiple commodities. We also conduct numerical studies on two specific nonprofit supply chain problems.

4 - An Optimization Model for Reliable Air Transportation Networks
Ye Xu, University of California, Berkeley, 1117 Etcheverry Hall, Berkeley, CA, 94706, United States of America, yex207@berkeley.edu, Z. Max Shen

Air transportation networks suffer a lot from disruptions caused by severe weather, natural disasters, power outage, etc. We propose a reliable hub-and-spoke structure in which airports are allowed to have backup hubs, and formulate the problem as a mixed-integer program that minimizes the expected transportation cost and the penalty cost of lost demand. Some interesting properties and managerial insights are developed by numerical studies.

■ MA39

H - Morehead Boardroom -3rd Floor

Internet and Information Goods

Sponsor: E-Business

Sponsored Session

Chair: Mohammad Rahman, Assistant Professor, University of Calgary, Haskayne School of Business, 2500 University Drive NW, Calgary, AB, T2N 1N4, Canada, rahman@ucalgary.ca

1 - Who Reacts to IT Investment Announcements?
Dawei Zhang, University of Calgary, 2500 University Drive NW, Calgary, AB, T2N 1N4, Canada, dzhang@ucalgary.ca, Barrie R. Nault, Matthew Lyle

Following research that suggests there is information in option volume about future stock prices, we compare option volumes with equity volumes around the release of IT investment news to determine which market processes the information more quickly. Using events from Dewan and Ren (2007), we relate volumes in option and equity markets to disentangle the magnitude of the response to the event as well as the time to which option traders begin trading on IT information relative to equity markets.

2 - IT, Logistics Outsourcing and Industry-level Productivity
Fengmei Gong, University of Calgary, Haskayne School of Business, 2500 University Drive N.W., Calgary, AB, T2N 1N4, Canada, fgong@ucalgary.ca, Mohammad Rahman, Barrie R. Nault

We estimate whether an industry's logistics outsourcing contributes to productivity, and test how information technology (IT) affects that contribution. One theory, based on transaction costs, is that IT leads to improved coordination, and consequently to increased outsourcing of logistics services. An alternative theory, based on information sharing, is that IT leads to improved information, which in turn substitutes for logistics services making the supply chain more efficient.

3 - Free or For a Fee? Impact of Information Pricing Strategy on Diffusion in Online Social Media
Animesh Animesh, McGill University, 1001 Sherbrooke Street, Montreal, QC, H3A 1G5, Canada, animesh.animesh@mcgill.ca, Hyelim Oh

Waking up to the realities of new Internet age, print newspapers are experimenting with different pricing models for their online content. Recently, NYT rolled out a new paywall strategy. Given the importance of the online social media for newspaper's growth, we examine the impact of paywall rollout on the diffusion of NYT's content in online social media. Our results suggest that paywall lowers the diffusion of NYT content in social media and offers interesting insights into diffusion patterns.

4 - Effect of Piracy and Network Externality on Bundling Strategy for Information Goods
James Zhang, University of California-Irvine, Irvine, CA, 92697, United States of America, james.zhangzhe@uci.edu, Shivendu Shivendu

We model a multi-product monopolist who has an option of bundling two products or selling them separately or a combination of both. Our market consists of consumers who are heterogeneous in their product valuation and piracy cost. We show that bundling is not always optimal in the presence of piracy. The adverse impact of piracy on bundling of information goods is mitigated when a strong network externality is present.

■ MA40

H - Walker Room - 4th Floor

Innovation and Entrepreneurship III: Growth

Sponsor: Technology Management

Sponsored Session

Chair: Jane Davies, University of Cambridge Judge Business School, Trumpington Street, Cambridge, United Kingdom, j.davies@jbs.cam.ac.uk

1 - The Optimal Time-money Tradeoff in Growth Oriented Entrepreneurial Firms
Onesun Steve Yoo, Assistant Professor, University College London, Department of Management Science & Innovation, Gower Street, London, WC1E 6BT, United Kingdom, onesun.yoo@ucl.ac.uk, Charles Corbett, Guillaume Roels

We present a formal model of hiring characterizing the entrepreneurial setting, identify the key tradeoffs, and provide prescriptions for the timing of hiring decisions. We show that the shadow value of time becomes greater than the shadow value of money during the growth phase, making time the key bottleneck resource. Characterizing hiring as an exchange of money with time, we identify the optimal hiring cash threshold, its nonmonotonicity with respect to the setup time, and present insights.

2 - Effective Managerial Approaches to Commercializing Radical Innovation via Corporate Venturing
John Angelis, Rochester Institute of Technology, E. Philip Saunders School of Business, 105 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, jangelis@saunders.rit.edu, Richard DeMartino

Although there is widespread agreement that corporate venturing plays a critical role in the commercialization of radical innovations, little is known concerning effective venturing approaches. The existing literature does not distinguish how methods should change when corporate venturing initiatives employ radical innovation instead of incremental. The purpose of this paper is to outline general management approaches to facilitate the use of venturing to commercialize radical innovation.

3 - Innovation Diffusion and Firm Growth
Jane Davies, University of Cambridge Judge Business School, Trumpington Street, Cambridge, United Kingdom, j.davies@jbs.cam.ac.uk, Moren Levesque

We investigate whether growth in innovation adoption relates to firm investments in resources. Given the stage of innovation, we characterize which investments must grow to yield additional adopters. Since models of firm growth neglect the demand side (market adoption) while models of diffusion neglect the supply side (firm capabilities to meet demand), we contribute by offering and empirically testing a counterpart to Bass innovation-diffusion model that considers firm investment decisions.

■ MA41

H - Waring Room - 4th Floor

Incentives in Innovation and Product Design

Cluster: New Product Development

Invited Session

Chair: Yi Xu, University of Maryland, Smith School of Business, College Park, MD, 20742, United States of America, yxu@rhsmith.umd.edu

1 - Social Network Effects on Product Design and Diffusion

Dilek Gunnec, University of Maryland, Smith School of Business, College Park, MD, United States of America, dgunnec@rhsmith.umd.edu, S. Raghavan

We look at the effects of the structure of a social network on the design and diffusion of a product. A non-symmetric linear influence form among potential customers is assumed where one's "neighbors" have the same influence on him. We first analyze the optimal design of the product, and then optimize the diffusion process to maximize the market share of this product. Budgetary constraints are discussed and extensive numerical experiments are presented.

2 - Challenges in New Service Design & Development

Stelios Kavadias, Associate Professor, Georgia Institute of Technology, College of Management, 800 West Peachtree St NW, Atlanta, GA, United States of America, Stylianos.Kavadias@mgt.gatech.edu, Ioannis Bellos

Service offerings present a unique challenge: customers co-create the value of the outcome. Such co-production corresponds to identifying and matching the exact customer needs. The subjective and intangible nature of new service offerings amplifies the existing information asymmetries. We model the interactions (service encounters), between a customer and a service provider, as a process comprising distinct steps. Our results identify the main drivers behind the design of such encounters.

3 - The 3C's of Outsourcing Innovation: Cost, Capability, and Control

Cheryl Druehl, George Mason University, Fairfax, VA, United States of America, cdruehl@gmu.edu, Gal Raz

Using a newsvendor setting, we examine a two-stage supply chain. The buyer determines the degree of product innovation (increased value to consumers) and/or process innovation (cost reduction) and whether to outsource any (or both) these activities. We investigate the impact of Control (who makes decisions), Capability (who is better at the activity), and Cost (who is more economical) on the supply chain performance, the innovation investment, and the outsourcing decision.

4 - Incentives, Outsourcing, and Product Quality Control Mechanisms

Yi Xu, University of Maryland, Smith School of Business, College Park, MD, 20742, United States of America, yxu@rhsmith.umd.edu, Yan Dong, Sean Wan, Kefeng Xu

This research aims to better understand the structural effects of quality control mechanisms in supply chains where a brand owner designs and markets a product. The brand owner could either manufacture the product using a component provided by a supplier or outsource the manufacturing entirely to a manufacturer. We studies two commonly adopted quality control mechanisms: supplier inspection and quality audit.

■ MA42

H – Gwynn Room – 4th Floor

An Interactive Panel/Audience Discussion: Grant Writing for New Faculty

Cluster: Junior Faculty Interest Group (JFIG)

Sponsored Session

Chair: Renata Konrad, Worcester Polytechnic Institute, 100 Institute Rd, Worcester, MA, United States of America, rkonrad@WPI.EDU

1 - An Interactive Panel/Audience Discussion: Grant Writing for New Faculty

Moderator: Renata Konrad,Worcester Polytechnic Institute, 100 Institute Rd, Worcester, MA, United States of America, rkonrad@wpi.edu, Panelists: Russell Barton, Michael Fu, Archis Ghate, Reha Uzsoy

In this interactive panel discussion, we will discuss successful (and not so successful) strategies for writing grants. The panel is composed of program directors from funding agencies, senior and junior faculty members. Panel members will shares strategies for writing grants including choosing the appropriate agency, preparing for and writing a grant. A large part of the panel will be dedicated to interactive discussion with the audience.

■ MA43

H - Suite 402 - 4th Floor

Electric Vehicles and the Grid: Management of Electricity Consumption

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Owen Worley, PhD Candidate, Northwestern University, 2145 Sheridan Rd, Rm C210, Evanston, IL, 60208, United States of America, OwenWorley2014@u.northwestern.edu

1 - Integrating Consumer Advance Demand Information in Smart Grid Management System

Tongdan Jin, Assistant Professor, Texas State University, 601 University Drive, San Marcos, TX, 78666, United States of America, tj17@txstate.edu, Heping Chen, Chongqing Kang

We propose a smart grid management system that allows consumers to provide advance demand data before consuming the electricity. This new concept aims to shift the electricity supply chain from "production-then-consumption" mode to "order-then-production" paradigm. We discuss the system concept, the operational condition, and the implication to the integration of distributed resources such as renewable technology and plug-in hybrid electric vehicles.

2 - Optimization of Battery Charging and Purchasing at Electric Vehicle Battery Swap Stations

Owen Worley, Northwestern University, 2145 Sheridan Rd., Rm. C210, Evanston, IL, 60208, United States of America, owen.worley@u.northwestern.edu, Diego Klabjan

A promising model for providing charging services to owners of electric vehicles is a network of battery swap stations. A swap station operator will need to decide how many batteries to purchase initially, and when, based on dynamic electricity rates, to charge the batteries. We propose a dynamic programming model to assist in making optimal charging decisions, and a master problem embedding the dynamic program for making the purchasing decision.

3 - Incorporating Smartcharging PEVs in Generation Dispatch Planning

Rajesh Tyagi, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, tyagi@ge.com, Jason Black

Introduction of PEVs will significantly increase energy load at utilities, requiring significant generation and transmission investments if this additional demand is not proactively managed. Utility controlled smart charging is one such mechanism: in return for lower electricity prices, the customer may specify that his battery be charged by, say 7 am, and the utility then charges it when its generation costs are low. In this talk, we describe the approach that GE plans to use.

■ MA44

H – Suite 406 – 4th Floor

Undergraduate I

Cluster: Undergraduate Operations Research Prize

Invited Session

Chair: David Czerwinski, San Jose State University, 1 Washington Square, San Jose CA 95192, United States of America, david.czerwinski@sjsu.edu

1 - Contract Preferences for a Loss Adverse Retailer: Buyback versus Revenue Sharing

Vivian Zhao, Hong Kong University, Pokfulam, Hong Kong - PRC, vivianmzhao@gmail.com, Karen Donohue

A recent behavioral study has shown that suppliers prefer buyback contracts in high service-level environments and revenue sharing contracts in low service-level environments, which is consistent with loss aversion. We examine analytically whether this same preference structure holds true for retailers. We find that the preferences of a loss averse retailer is still a function of service level, but also depends on the retailer's perception of the value of the product.

2- Municipal Bond Management under Uncertainty

Katherine Glass-Hardenbergh, Lehigh University, Bethlehem PA, United States of America, kag211@lehigh.edu

The purpose of this research is to model and analyze financial instruments in the municipal bond market. We present a methodology that incorporates the most significant risks and allows investors to compare individual bonds and mutual funds in order to highlight their risk-return profiles and select the instrument better suited to their preferences. We also provide investment guidelines. In particular, we recommend that investors with a specific time horizon or greater desire for certainty invest in individual bonds with suitable credit ratings. This contrasts with the common perception that investors should invest in mutual funds for their greater diversity.

3 - Skeletonization for Isocentre Selection in Leksell Gamma Knife Perfexion

Evgueniia Doudareva, University of Toronto, Toronto ON, Canada, jenya.doudareva@utoronto.ca

Leksell Gamma Knife Perfexion (PFX) is used to deliver radiosurgery to treat lesions and tumours in the brain by means of selectively ionizing the tissue with high-energy beams of radiation. An important component of designing PFX treatments is the selection of points at which to focus the radiation, called isocentres. This study applies skeletonization methods to select isocentres. Skeletonization identifies a structure's skeleton, or its most basic shape; we use this skeleton to inform isocentre locations. The resulting isocentres are used as input to a sector duration optimization model that determines the optimal shot shapes of the radiation deposited at each isocentre. The results for four clinical cases are presented. For each case, target structure dose meets clinical radiosurgery guidelines, and brainstem dose is kept to acceptable levels.

■ MA45

H - Suite 407 - 4th Floor

Combinatorial Auction Design and Applications II

Cluster: Auctions

Invited Session

Chair: Benjamin Lubin, Assistant Professor, Boston University, 595 Commonwealth Avenue, Information Systems Department, Boston, MA, 02215, United States of America, blubin@bu.edu

1 - Compact Bidding Languages and Supplier Selection

Kemal Guler, HP Labs, 1501 Page Mill Rd MS 1040, Palo Alto, CA, United States of America, kemal.guler@hp.com, Christian Hass, Martin Bichler

Combinatorial auctions have been used in procurement markets with economies of scope. Auction design for markets with economies of scale and scope are less well understood. We propose a compact bidding language to express a supplier's cost function in markets with economies of scale and scope. We propose an optimization formulation and provide experimental evaluation of language features on the computational effort, on spend, and the knowledge representation of the bids.

2 - Side Constraints in Combinatorial Auctions – Pricing and Equilibrium Strategies

Ioannis Petrakis, TU Munich, Boltzmannstr. 3,† Room 01.10.056, Garching, 85748, Germany, Petrakis.ioannis@gmail.com, Georg Ziegler, Martin Bichler

Side constraints are often requisite for the participants to express their preferences in combinatorial auctions. First, we define winning and deadness levels as a general pricing rule, which can be used in any auction format independent of the bidding language and side constraints. Second, we establish positive results concerning efficiency and equilibrium strategies for an auction that uses deadness levels. We discuss how such ask prices relate to other efficient ascending auction designs.

3 - Evaluating the Incentive Properties of Payment Rules: The Case for Regret Quantiles

Benjamin Lubin, Assistant Professor, Boston University, 595 Commonwealth Avenue, Information Systems Department, Boston, MA, 02215, United States of America, blubin@bu.edu, David Parkes

Many settings do not admit strategyproof mechanisms in concert with e.g. budget-balance or core allocation. Thus, we seek rules that minimize strategic incentives – but by what measure? We argue that standard answers, e.g. minimizing per-instance ex-post maximal regret, provide poor design guidance. We propose to instead focus on quantiles of ex-post regret over a type distribution, and present evidence that this leads to designs with improved equilibrium behavior.

4 - Unrelated Goods in Package Auctions - Comparing Vickrey and Core-selecting Outcomes

Marissa Beck, Stanford University, 450 Serra Mall, Stanford, CA, 94305, United States of America, mrbeck@stanford.edu, Marion Ott

Package auctions were designed for items that are complements or substitutes, but we consider how these auctions perform in presence of goods that exhibit no such relation to each other. These unrelated goods give a connection between outcomes of Vickrey and core-selecting auctions and have surprising revenue implications: a seller always receives at least as much (and in many cases strictly more) revenue when running separate core-selecting auctions for groups of unrelated goods.

■ MA46

H - Suite 403 - 4th Floor

Panel Dicsussion: Project MINDSET: High School OR and Outreach

Sponsor: INFORM-ED

Sponsored Session

Chair: Ken Chelst, Professor, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States of America, kchelst@wayne.edu

1 - Project MINDSET: High School OR and Outreach – Panel Discussion

Moderator: Ken Chelst, Professor, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States of America, kchelst@wayne.edu, Panelists: Karen Keene, David Goldsman, Robert E. Young, Karen Norwood, David Pugalee

Project MINDSET, funded by NSF, has produced a two semester curriculum and textbook that uses OR to motivate a variety of high school math concepts. There are more than 1000 high school students engaged in studying this new curriculum in Michigan, North Carolina, California and Georgia. Presenters will share the experiences of both students and teachers in this pilot program. Next, we will describe the rigorous evaluation that is planned in this the fifth and final year of the project. Finally, we will outline the steps needed to bring this curriculum into a new locale and discuss the assistance we can offer to facilitate the process.

■ MA47

H - Dunn Room - 3rd Floor

Urban Logistics

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Chi Xie, Research Associate, University of Texas at Austin, 1 University Station, C1761, Austin, TX, 78759, United States of America, chi.xie@mail.utexas.edu

1 - Addressing Demand Uncertainty in City Logistics

Teodor Gabriel Crainic, Professor, CIRRELT and ESG UQAM, 2920 Chemin de la Tour, Montréal, QC, H3T 1J4, Canada, TeodorGabriel.Crainic@cirrelt.ca, Fausto Errico, Nicoletta Ricciardi, Walter Rei

We the issue of building the tactical plan of a two-tiered City Logistics system while explicitly accounting for the uncertainty in demand. We describe the problem, propose a two-stage stochastic formulation, and discuss three recourse strategies. Algorithmic challenges are discussed and a promising solution methodology is proposed.

2 - Intelligent Dynamic Signal Timing Optimization Program

Ali Hajbabaie, Graduate Research Assitant, University Of Illinois at Urbana Champaign, 205 N Mathwes Avenue, Room 3150, Urbana, IL, 61801, United States of America, ahajbab2@illinois.edu, Rahim Benekohal

In this study, we introduce Intelligent Dynamic Signal Timing Optimization Program (IDSTOP). IDSTOP incorporates Genetic Algorithm with microscopic traffic simulation to find near optimal signal timing parameters in an oversaturated urban transportation network under time-variant demand. IDSTOP's formulation and solution technique as well as different heuristics that are developed to reduce its run time are explained. In addition, IDSTOP's performance on a realistic case study network is tested.

3 - Which Policy Works Better for Signal Coordination? Common, or Variable Cycle Length

Ali Hajbabaie, Graduate Research Assitant, University Of Illinois at Urbana Champaign, 205 N Mathwes Avenue, Room 3150, Urbana, IL, 61801, United States of America, ahajbab2@illinois.edu, Rahim Benekohal

In this study, we compare the effects of using a common cycle strategy, to the effects of using a variable cycle length strategy on signal coordination in an urban transportation network. For this purpose, a Genetic Algorithm based method is developed to find optimal signal timing parameters when a common cycle is used and when the cycles can be different. Several network performance measures such as delay, throughput, and fuel consumption are used for the comparison.

4 - Evaluating City Logistics Alternatives
Qian An, University of Southern California, 2637 Ellendale Place, Los Angeles, CA, United States of America, qan@usc.edu, Maged Dessouky, James Moore

City logistics is a relatively new research area that focuses on strategies for increasing the efficiency of goods movement in urban areas, reducing noise and vehicle emissions, and improving safety in residential areas. Our objective is to formulate a location routing model that gives a very good strategic design for such a two-level distribution network, and also to estimate the benefits from this approach by exercising the Southern California Planning Model.

5 - Traveling Salesman Problem with Stochastic Demands in Stochastic-state Networks
David Fajardo, The University of Texas at Austin, Earnest Cockrell Jr. Hall, 6.202, Austin, TX, 78712, United States of America, davidfajardo2@gmail.com, Travis Waller

We formulate a Traveling Salesman Problem in which the subset of customers that must be visited is stochastic and represented through a finite set of possible network-states, each corresponding to a specific realization of the demand vector. An exact solution method based on a Markovian Decision Process formulation is presented, and a heuristic based on a 2-stage Stochastic Program with recourse approximation of the problem are presented.

■ MA48

H - Graham Room - 3rd Floor

Modeling and Solving Dynamic Traffic Networks in Continuous Time

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Henry Liu, Associate Professor, University of Minnesota, Minneapolis, MN, United States of America, henryliu@umn.edu

1 - Computing Dynamic User Equilibrium in Continuous Time
Terry Friesz, The Pennsylvania State University, 305 Leonhard Building, University Park, PA, United States of America, tlf13@psu.edu, Tao Yao, Amir Meimand, Ke Han

In this talk, we discuss how to formulate a DUE model which considers both the within-day and the day-to-day scales. Subsequently, we discuss continuous-time and time-stepping algorithms, that might be fashioned to solve our proposed model.

2 - Consistency between Continuous-time and Discrete-time Dynamic Network Loading Models
Rui Ma, Rensselaer Polytechnic Institute, Troy, NY, United States of America, mar2@rpi.edu, Jeff Ban, Jong-Shi Pang, Henry Liu

When dealing with and solving continuous-time dynamic network loading models, one important step is to discretize the model in time to obtain its discrete-time counterpart. In this research, we present the consistency requirement when discretizing a continuous-time model. We illustrate this concept using point queue model as an example.

3 - Modeling and Solution of Continuous-time Instantaneous Dynamic User Equilibria
Jeff Ban, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, United States of America, banx@rpi.edu, Jong-Shi Pang, Henry Liu, Rui Ma

In this research, we model t he continuous-time instantaneous dynamic user equilibrium as a dynamic variational inquality (DVI) problem with constant time delay. We present methods to solve such as a DVI model and show the convergence of the discrete solution to the continuous-time solution when the discrete time step goes to infinitely small.

4 - On the Solution Set of the Boundedly Rational User Equilibria (BRUE)
Henry Liu, Associate Professor, University of Minnesota, Minneapolis, MN, United States of America, henryliu@umn.edu, Xuan Di, Jong-Shi Pang, Jeff Ban

Wardropian User Equilibrium has been studied extensively in the past, based on the assumption of perfect rationality. Although the concept of bounded rationality has been introduced into the transportation field in 1980s, rigorous treatment of the boundedly rational user equilibria (BRUE), including its mathematical formulation and the properties of its solution set, has been lacking. In this talk, we will present our findings on these issues.

5 - Stochastic User Equilibrium with Bounded Perception Errors
Yingyan Lou, Assistant Professor, The University of Alabama, 260 H.M. Comer Hall, Box 870205, Tuscaloosa, AL, 35487, United States of America, ylou@eng.ua.edu, Seyed Mohammad Miralinaghi

This study proposes an enhanced stochastic user equilibrium model where drivers' perceptions of travel times are considered bounded. Closed-form expressions of the route choice probability functions are derived for multiple types of distributions of perceived travel times. The resulting flow pattern and its implications in the context of transportation planning are examined. The relationship between the proposed model and several other traffic assignment models is also explored.

■ MA49

H - Graves Room - 3rd Floor

Smarter Energy Management

Sponsor: Simulation

Sponsored Session

Chair: Soumyadip Ghosh, Research Staff Member, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ghoshs@us.ibm.com

1 - Simulation-based Study of Distributed Denial-of-service Attacks in Advanced Metering Infrastructure
Dong (Kevin) Jin, University of Illinois at Urbana-Champaign, 1308 W Main St, Urbana, IL, 61801, United States of America, dongjin2@illinois.edu, Huaiyu Zhu, Cheolwon Lee, Davdi Nicol, Incheol Shin

Advanced Metering Infrastructure (AMI) is one of the key components in the smart grid. AMI can provide two-way digital communication between the utility and millions of smart meter. This work investigates the potential meter-initiated DDoS attacks within the AMI systems. We build an efficient model and conduct large-scale network simulation experiments. The results reveal the impact of the attacks and suggest means of building secure architecture for detecting and preventing such attacks.

2 - The Impact of Wind Penetration on Electricity Markets
Jayakrishnan Nair, PhD Candidate, California Institute of Technology, 1200 E California Blvd, MC 305-16, Pasadena, CA, 91125, United States of America, ujk@caltech.edu, Sachin Adlakha, Adam Wierman

We study the impact of a high penetration of intermittent wind generation on electricity markets. Specifically, we analyze the effect of wind prediction accuracy, as well as the volume of wind farm installations, on the conventional generation that needs to be contracted for in long term, day ahead, and real time markets. This provides insight into how the markets for conventional generation might need to be restructured in order to make efficient use of high volumes of renewable generation.

3 - Analytical Toolset for Building Energy Performance and Greenhouse Gas Emission
Young Lee, Research Staff Member, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ymlee@us.ibm.com, Raya Horesh, Estepan Meliksetian, Paul Nevill, Jane Snowdon, Young Chae, Pawan Chowdhary, Jayant Kalagnanam, Fei Liu, Lianjun An, Huijing Jiang, Chandra Reddy, Nathaniel Mills

An analytic toolset is developed to systemically assess, track, benchmark, forecast, simulate and optimize energy consumption, efficiency and greenhouse gas (GHG) emission for a portfolio of commercial buildings through development of thermal models, multiple regression models, time series models, mathematical programming and simulation. The toolset is used to identify opportunities for energy savings and GHG emission reduction in commercial buildings.

4 - A Two-stage Non-linear Program for Optimal Electrical Grid Power Balance under Uncertainty
Dzung Phan, IBM Research, Thomas J. Watson Research Center, Yorktown Heights, NY, United States of America, phandu@us.ibm.com

We propose a two-stage non-linear stochastic formulation for the economic dispatch problem under wind-generation uncertainty. Each stage models dispatching and transmission decisions that are made on subsequent time periods. We propose two outer approximation algorithms to solve this problem. We show that under certain conditions the sequence of optimal solutions obtained under both alternatives has a limit point that is a globally-optimal solution to the nonconvex problem.

■ MA50

H - Ardrey Room - 3rd Floor

High Dimensional Statistical Inference

Sponsor: Data Mining

Sponsored Session

Chair: Peter Radchenko, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States of America, radchenk@marshall.usc.edu

1 - Scale Mixture of Uniform Priors for Covariance Matrix Estimation
Hao Wang, University of South Carolina, Columbia, SC, United States of America, wang345@mailbox.sc.edu, Natesh Philai

We use scale mixture of uniform to generate shrinkage priors for covariance matrices. This enjoys a number of advantages over the scale mixture of normals, including its flexibility and efficiency. We discuss the theory and computational details of this new approach. We then extend the basic model to a new class of spatial models for analyzing multivariate areal data. The new spatial model has a great flexibility at an appealing computational cost.

2 - Adaptively Weighted Large Margin Classifiers
Yufeng Liu, University of North Carolina, Chapel Hill, NC, United States of America, yfliu@email.unc.edu

Large margin classifiers are very useful in many applications. The Support Vector Machine is a canonical example. Despite their flexibility and ability in handling high dimensional data, many large margin classifiers have serious drawbacks when the data are noisy with outliers. In this talk, I will present a new weighted large margin classification technique. The weights are chosen adaptively with data, and the proposed classifiers are shown to yield competitive performance.

3 - A Generic Path Algorithm for Regularized Statistical Estimation
Yichao Wu, North Carolina State University, Department of Statistics, Raleigh, NC, 27695, United States of America, ywu11@ncsu.edu, Hua Zhou

A regularized optimization problem minimizes the weighted sum of a loss function and a penalty term, weighted by a tuning parameter. In this talk I will talk about an efficient solution path algorithm that works for any strictly convex loss function and can deal with generalized lasso penalties and more complicated regularization such as inequality constraints encountered in shape-restricted regressions and nonparametric density estimation.

4 - Adaptive Inference After Model Selection
Eric Laber, Assistant Professor, North Carolina State University, SAS Hall, 2311 Stinson Drive, Raleigh, NC, 27695, United States of America, laber@umich.edu

We develop adaptive confidence intervals for use with estimators based on penalized likelihood methods that induce model selection. Confidence intervals are shown to be adaptive to the underlying nonregularity and asymptotically smallest among regular bounds of this type.

■ MA51

H - Caldwell Room - 3rd Floor

Public Transit: Operations and Design

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Nicholas Lownes, Assistant Professor, University of Connecticut, 261 Glenbrook Rd, U-2037, Storrs, CT, 06269, United States of America, nlownes@engr.uconn.edu

1 - Incorporating Trip Chaining Into Transit Accessibility
Jeffrey LaMondia, Assistant Professor, Auburn University, 138 Harbert Engineering Center, Auburn, AL, 36849, United States of America, jlamondia@auburn.edu

Trip chaining is a critical component of selecting transit as a viable mode choice. However, this aspect of travel is often ignored in analyses of travel accessibility. This research develops transit accessibility measures based on trip chaining using fixed transit route data from CapMetro in Austin, Texas. Additionally, this research compares results of this new transit accessibility measure with those from traditional gravity-based accessibility measures.

2 - A Study on Holding and Boarding Limits Strategies to Improve Transit Performance
Ricardo Giesen, Assistant Professor, Universidad Catolica de Chile, Vicuna Mackenna 4860, Macul, Santiago, Chile, giesen@ing.puc.cl, Juan Carlos Munoz, Felipe Delgado

Bus bunching affects transit operations increasing passenger waiting times and its variability. We propose a math-programming model that considers holding and boarding limits to control buses, and can handle vehicle capacities. The results show that the proposed strategies outperform other control strategies, providing a more balanced load factor across vehicles, thus increasing users comfort. To operators the use of boarding limits reduces the average vehicle cycle time and its variability.

3 - Integrating Connectivity in Transit Network Design
Nicholas Lownes, Assistant Professor, University of Connecticut, 261 Glenbrook Rd, U-2037, Storrs, CT, 06269, United States of America, nlownes@engr.uconn.edu

The transit network design problem is addressed from a bi-level perspective, placing network coverage at odds with routing efficiency and connectivity. Each level represents a difficult problem - heuristic methods and new methods for integrating connectivity are explored along with a discussion of integrating multi-modal assignment.

4 - A Schedule-based Transit Assignment Using Gradient Projection
Mark Hickman, Associate Professor, University of Arizona, 1209 E. Second Street, Bldg. 72, Tucson, AZ, 85721-0072, United States of America, mhickman@email.arizona.edu, Hyunsoo Noh

We consider a schedule-based transit assignment method that includes capacity constraints. To do this, we propose a logit-based transit assignment model using gradient projection. Capacity constraints include a FIFO rule on transit vehicle boarding. In addition, we assume each path has an entropy term for stochastic behavior. The model is applied on a link-based transit schedule network.

5 - A Combined Optimization Problem for Public Transit Stop Locations and Service Coverage
Sha Mamun, Graduate Student, University of Conneticut, 261 Glenbrook Road, Unit 2037, Storrs, CT 06269, United States of America, msm08014@engr.uconn.edu

A multivariate public transit accessibility model was formulated to minimize the number of transit stops located at fixed construction cost. This model minimizes the cost components weighted by different demand classes. Demand coverage distribution was estimated using access distance between the assigned transit stop and the demand point.

■ MA52

H - North Carolina - 3rd Floor

Team Composition and Performance

Sponsor: Organization Science

Sponsored Session

Chair: Patricia Borchert, Assistant Professor, University of Minnesota, Duluth, Department Management Studies, LSBE 365K, 1318 Kirby Drive, Duluth, MN, 55812, United States of America, pborcher@d.umn.edu

1 - Understanding the Influence of Employee Team Characteristics in Micro-businesses
Patricia Borchert, Assistant Professor, University of Minnesota, Duluth, Department Management Studies, LSBE 365K, 1318 Kirby Drive, Duluth, MN, 55812, United States of America, pborcher@d.umn.edu, Mary Zellmer-Bruhn

One of the key attributes of a team that helps overcome disruptions and uncertainties is team identity. We examine behavioral, affective, and cognitive attributes of team members that influence the development of team identity (task and goal interdependence, cohesion and psychological safety). We also posit that team identity will positively influence performance, moderated by the growth aspirations of the owner.

2 - The Impact of Explicit Compositional Team Design on Team Performance
Linda Rochford, Associate Professor, University of Minnesota Duluth, 385K LSBE, 1318 Kirby Drive, Duluth, MN, 55812, United States of America, lrochfor@d.umn.edu, Anne Cummings, Sarah Ingle

This study examines the effects of membership diversity on group outcomes. We measure group members' pre-existing styles and orientations, and then examine the effects of intentionally composing group membership to benefit from diversity in these styles (stylistic heterogeneity). We hypothesize that groups intentionally designed for stylistic heterogeneity will outperform self-selected and homogeneously composed groups. Members share a common group goal (goal homogeneity) in all groups.

3 - The Effects of Team Diversity on Project Evaluation
Stylianos Kavadias, Georgia Institute of Technology, 800 West Peachtree St., Atlanta, GA, 30308, United States of America, stelios@gatech.edu, Nektarios Oraiopoulos

Senior executive committees that decide the funding of strategic initiatives are prone to two types of errors: foregoing a project opportunity that would have been successful, or pursuing a project that fails. We study how the corresponding probabilities change as the members become more diverse with respect to their individual preferences or interpretation. Unlike previous studies, we allow for strategic considerations that might lead a team member to vote against their individual preferences.

4 - The Impact of Team Effectiveness on Quality Management Processes in Micro Businesses
Thomas Lechler, Associate Professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, Thomas.Lechler@stevens.edu, Emer Ni Bhradaigh

Without a meaningful level of quality, small enterprises would disappear quickly. We propose that small businesses that achieve high scores on quality correction and prevention activities are more successful and that team effectiveness is a critical antecedent for both quality assuring activities. Growth aspirations and innovation goals are considered to test if the proposed relationships differ between entrepreneurial enterprises and small businesses without growth aspirations.

5 - A Decision Support Tool for Team Staffing Decisions
Deanna Kennedy, Assistant Professor, University of Washington Bothell, Box 358533, 18115 Campus Way NE, Bothell, WA, 98011, United States of America, dkennedy@uwb.edu, Sara McComb, P.V.(Sundar) Balakrishnan

Team performance is a consequence of its membership. In turn, team membership is dependent on the staffing policy used to assign members to teams. Herein we develop a team clustering algorithm to assign members to teams based on a staffing policy. We then examine the teams created across different staffing policies and the performance these teams may achieve. Implications are discussed.

■ MA53

H - South Carolina - 3rd Floor

Machine Learning, Games, and Data-Driven Decisions

Sponsor: Data Mining

Sponsored Session

Chair: Cynthia Rudin, Assistant Professor of Statistics, Massachusetts Insititute of Technology, Sloan School of Management, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rudin@mit.edu

1 - Sparse Single Index Mixed Model for Panel Data
Sijian Wang, University of Wisconsin, Statistics Department, Milwaukee, WI, United States of America, wangs@stat.wisc.edu

The single-index model is an important tool in multivariate nonparametric regression, which searches a univariate index of the multivariate predictors to capture important features of high-dimensional data. In this talk, we consider a sparse single index mixed model for panel data. By implementing certain regularizations, our method can not only identify important fixed effects to construct the index, but also identify important random effects which are useful to model the correlation structure.

2 - Machine Learning and the Traveling Repairman
Cynthia Rudin, Assistant Professor of Statistics, Massachusetts Insititute of Technology, Sloan School of Management, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rudin@mit.edu, Theja Tulabandhula, Patrick Jaillet

The goal of the Machine Learning and Traveling Repairman Problem (ML&TRP) is to determine a route for a "repair crew," which repairs nodes on a graph. The repair crew aims to minimize the cost of failures at the nodes, but as in many real situations, the failure probabilities are not known and must be estimated.

3 - Stability and Complementarities in Large Matching Markets
Itai Ashlagi, Assistant Professor, Massachusetts Insitute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, iashlagi@mit.edu, Mark Braverman, Avinatan Hassidim

We study the existence of stable outcomes in large matching markets, We introduce a new matching algorithm and show show that if the number of couples grow at a near-linear rate, a stable matching will be found with high probability. Furthermore, truth-telling is an approximated equilibrium in the game induced by the new matching algorithm. However if the number of couples grows at a linear rate, with constant probability no stable matching exists.

4 - A Supervised Ranking Approach to Sequential Event Prediction
Ben Letham, PhD Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, bletham@mit.edu, David Madigan, Cynthia Rudin

In sequential event prediction, a set of events take place sequentially and at each step we use previous events to predict the subsequent events. We present a general formulation for sequential event prediction using supervised ranking and propose several specific models. In the case of recommender systems, the prediction may alter the sequence of events, which leads to a non-convex problem. We develop methods for model fitting and show good performance when applied to real data.

■ MA54

H - Charlotte Hall - 3rd Floor

2011 INFORMS Prize – Sasol

Cluster: 2011 INFORMS Prize

Invited Session

Chair: Michele Fisher, Principal Operations Researcher, Sasol Technology (Pty) Ltd, 1 Klasie Havenga, Sasolburg, 1947, South Africa, michele.fisher@sasol.com

Co-Chair: Erica Klampfl, Technical Leader, Ford Research & Advanced Engineering, Room 3255, RIC Building, Dearborn, MI, 48124, United States of America, eklampfl@ford.com

1 - Operations Research at Sasol (The 2011 INFORMS Prize Winner)
Marlize Meyer, Principal Operations Researcher, Sasol Technology (Pty) Ltd, 1 Klasie Havenga, Sasolburg, 1947, South Africa, marlize.meyer@sasol.com, Michele Fisher, Patrick Veldhuizen, Johan de Bruyn, Hylton Robinson, Leilani Meijer

For 60 years, Sasol has demonstrated innovation in the energy and chemicals sectors in South Africa and around the world. Sasol's success requires that complex operations be managed across value chains, business units and sites. The company relies on OR to analyze logistics, simulate plants, improve reliability, model processes and optimize performance. Its multidisciplinary team of experts are recognized for applying advanced analytics to improve decision making and impact the bottom-line.

■ MA55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS: IT and Analytics: Hunting as a Pack

Sponsor: Analytics/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Zahir Balaporia, Director, Intermodal Operations, Schneider National Inc, 3101 South Packerland Drive, Green Bay, WI, 54313, United States of America, BalaporiaZ@schneider.com

Co-Chair: Doug Mohr, UPS, 1400 N. Hurstbourne Parkway, Louisville, KY, 40223, United States of America, DMohr@ups.com

1 - Hunting as a Pack: Roles and Responsibilities of IT and OR
Doug Mohr, UPS, 1400 N. Hurstbourne Parkway, Louisville, KY, 40223, United States of America, DMohr@ups.com

Analytics is seen as a complete business problem solving and decision making process that enables the creation of business value. This talk will discuss the roles and responsibilities of IT and OR in delivering business solutions.

2 - Hunting as a Pack
Mike Curran, Director, MISO, 55 Locust Street, Lynnfield, MA, 01940, United States of America, mikecurran2@verizon.net

Presents an approach to breaking down the barriers between the IT Organization and the OR/Analytics Professionals and transforming the relationship from one of competing interests to one of joint problem solving to bring maximum value to the organization. The approach will draw upon elements of William Urey's acclaimed book on negotiations, "Getting Past No."

3 - IT and OR at UPS: Delivering Benefit
Jeff Winters, Operations Research Division Manager, United Parcel Service, 2311 York Road, Timonium, MD, 21093, United States of America, JWinters@ups.com

Operations Research has been a key technology in UPS history, and working with UPS Information Services, the UPS OR group is poised to deliver tremendous benefit in the near future. Every company faces the challenge of effectively employing their unique capabilities in order to succeed. This talk will describe the path UPS has followed to combine and leverage the capabilities of UPS OR and UPS IT in order to create value that neither group could have developed individually.

■ MA56

H - Biltmore Boardroom - 2nd Floor

Modeling Disease

Contributed Session

Chair: Alireza Boloorirabani, Wayne State University, Department of Industrial & Systems Engineering, 4815 Fourth street, Detroit, MI, 48202, United States of America, alireza.boloori@wayne.edu

1 - Optimal Preventive Care Policies on Type 2 Diabetes Mellitus
Karca Duru Aral, PhD Student, INSEAD, INSEAD Bd. de Constance, Fontainebleau, 77300, France, karcaduru.aral@insead.edu, Alfons Grabosch, Stephen Chick

Type 2 Diabetes (T2D) is a chronic condition that affects over 285 million people worldwide. On the other hand, T2D and its related complications are preventable through healthier lifestyle and dietary choices. In this study, we introduce a population level progression model of T2DM. We report on progress to our investigation on optimal preventive policies for resource allocation decisions regarding screening, public awareness and patient education programs for self-management around T2DM.

2 - Modeling the Cardiovascular Disease Prevention – Treatment Tradeoff
George Miller, Institute Fellow, Altarum Institute, 3520 Green Court, Suite 300, Ann Arbor, MI, 48105, United States of America, george.miller@altarum.org

As a tool for understanding the appropriate allocation of healthcare spending among treatment, prevention, and research, we employ a simple Markov model of the flow of individuals among states of health, where the transition rates are governed by the magnitude of appropriately-lagged expenditures in each of these spending categories. We apply the model to explore interactions in the cost effectiveness of alternative investments in cardiovascular disease.

3 - Demonstrating Geographic Equity in Kidney Organ Allocation – Satisfying the Final Rule At Last
Ashley Davis, PhD Candidate, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, ashleydavis2012@u.northwestern.edu, John Friedewald, Mark Daskin, Michael Abecassis, Anton Skaro, Daniela Ladner, Sanjay Mehrotra

The US Department of Health and Human Services mandates that organ allocation cannot discriminate by geography, yet geographic inequities exist in kidney transplant rates. We compare present transplant rates to those of an alternative, optimized strategy for improved geographic equity. We enhance inter-DSA sharing while not affecting local allocation practices. With an optimized, ten year 600 mile sharing strategy, the geographic range of kidney transplant rates drops from 27% to 7.5%.

4 - Trade-off between IMRT Treatment Plan Quality and Delivery Effciency Using Aperture Modulation
Ehsan Salari, Postdoctoral research fellow, Massachusetts General Hospital and Harvard Medical School, Department of Radiation Oncology, 30 Fruit Street, Boston, MA, 02114, United States of America, esalari@ufl.edu, Edwin Romeijn

Beam-on-time is an important measure of the delivery efficiency of IMRT treatment plans. There is a trade-off between the treatment quality and the beam-on-time. To quantify this trade-off, the beam-on-time is incorporated into the Direct Aperture Optimization problem using a bi-criteria optimization framework. An exact solution method and an approximate technique, applicable to more classes of treatment-plan evaluation criteria, are developed to characterize the Pareto-efficient frontier.

5 - Analyzing The Kidney Transplantation System with Immediate and Long-term Effects
Alireza Boloorirabani, Wayne State University, Department of Industrial & Systems Engineering, 4815 Fourth street, Detroit, MI, 48202, United States of America, alireza.boloori@wayne.edu, Ekrem Murat, Ratna Chinnam

The literature on organ transplantation considers only pre- or post-transplantation from the perspectives of equity/efficiency measures and social planner/individual decision makers. The organ transplantation decision from both social and individual perspectives is a decision which has both immediate and long-term effects. We analyze transplantation assignment policies which jointly consider pre- and post-performance criteria and illustrate it with numerical example and experimental study.

■ MA57

W - Providence I- Lobby Level

Passenger Effects in the Airline Industry

Sponsor: Aviation Applications

Sponsored Session

Chair: Brittany Luken, Graduate Research Assistant, Georgia Institute of Technology, 855 Peachtree Street #3602, Atlanta, GA, 30308, United States of America, brittany.l.luken@gmail.com

1 - Hidden-city Ticketing: The Cause, Cost and Impact
Zizhuo Wang, Stanford University, 314T, Huang Engineering Building, Stanford, CA, 94305, United States of America, zzwang@stanford.edu, Yinyu Ye

We analyze the hidden-city phenomenon in airline ticketing practice. We show that the hidden-city opportunity arises from the difference in price elasticity of different itineraries. And when it is fully taken by passengers, the optimal price reaction of the airline is to eliminate such opportunities. The airline's revenue will decrease but up to a half and as a result, the fares will ultimately increase. The consequence of allowing hidden-city ticketing is bad for both airlines and consumers.

2 - Using Online Seat Map and Pricing Data to Model Air Passenger Itinerary Choice
Stacey Mumbower, Graduate Research Assistant, Georgia Institute of Technology, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, stacey.mumbower@gatech.edu, Laurie Garrow

Understanding air passenger choice behavior is important, as it can potentially impact scheduling of itineraries, pricing and revenue management strategies, and website screen designs. However, there have been few models that use detailed flight level data to capture air passenger choice behavior. This research uses a unique set of data, pulled from online menus and seat maps, to build discrete choice models of air passenger itinerary choice.

3 - A Study to Analyze the Distribution of Transits Included in Aviation Trips Using Time-space Networks
Rirka Takahashi, Chuo University, Bunkyo-ku, Tokyo, Japan, rtakahas@educ.ise.chuo-u.ac.jp, Shigeki Toriumi, Azuma Taguchi

The aim of this study is to simulate the trips in the aviation network and investigate the transits required for the trips. In order to treat time dependent traffic demand, we construct a time-space network which expresses the timetable of flights. We load the OFOD data (collected by ICAO) on this network as the real traffic demand, and compute the routes as well as the number of transits and the waiting time. We can find some regional features indicating the inconvenience of aviation trips.

4 - Relationship between Early Standby Fees and Missed Connections
Brittany Luken, Graduate Research Assistant, Georgia Institute of Technology, 855 Peachtree Street #3602, Atlanta, GA, 30308, United States of America, brittany.l.luken@gmail.com, Laurie Garrow

In recent years, US airlines have been charging add-on fees from many services. Early standby fees are imposed upon passengers arriving at the airport on the day of booking departure for flights departing earlier than the flight booked. This research discusses conceptual framework used to understand if these fees cause lost network revenue and/or increase denied boardings and missed connections.

■ MA58

W - Providence II - Lobby Level

DIME/PMESII Human Social Cultural Behavior I

Sponsor: Military Applications Society

Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - Optimizing Counterinsurgency Operations

Marvin King, Operations Research Analyst, United States Army Student Detachment, Colorado School of Mines, Golden, CO, 80401, United States of America, Marvking3@gmail.com, Alexandra Newman

We present a model that uses historic casualty information on counterinsurgents and insurgents, allied military force strengths, and economic data with modern counterinsurgency theories to aid in the estimate of force requirements for ongoing and future counterinsurgency campaigns through the use of a goal program. The insights of this model allow the military and government to make more informed decisions on the number of forces to deploy in future conflicts.

2 - Anticipation, Uncertainty and Robust Planning in Antiterrorism Operations

Maciej Latek, George Mason University, 4400 University Dr, Farifax, VA, 22030, United States of America, mlatek@gmu.edu, Seyed Rizi

Antiterrorists who face intelligent adversaries need to analyze the most likely and effective terrorist courses of action (COAs) and to determine which of their own COAs are robust to strategic uncertainty and to replanning contingencies. We present an approach to representing anticipation in such environments and test it in using a historical case rendered in a multiagent model. We conclude by discussing lessons learned on customizing cognitive architectures for a particular cultural setting.

3 - The Irregular Warfare Ontology

Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net, Lee Lacy, Paul Works

The US Army TRAC requested that we create an ontology of metrics for Irregular Warfare (IW). The ontology defines the controlled vocabulary of the metrics and their relationships in the Web Ontology Language (OWL). The metrics describe the status of actions, actors and the environment and are categorized by an extended PMESII taxonomy. The ontology allows placing the variables into multiple categories. This ontology has already been used by TRAC to improve their IW Tactical Wargame.

■ MA59

W - Providence III - Lobby Level

IT Service Industry

Sponsor: Service Science

Sponsored Session

Chair: Sameep Mehta, IBM Research, New Delhi, 110070, India, sameepmehta@in.ibm.com

1 - A System for Reconfiguration of Retail Bank Branch

Sameep Mehta, IBM Research, New Delhi, 110070, India, sameepmehta@in.ibm.com, Rakesh Pimplikar, Gyana Parija

We present a recommendation system which enables real time configuration of a retail bank branch. The system analyzes the real time data regarding the services requests, number of resources along with efficiency and type of customers to recommend the scheduling policy & configuration of resources to be used to optimize on the business metric of interest. We present the math formulation along with associated heuristics. The system is validated on real data to evaluate efficiency & efficacy.

2 - An Empirical Study of Development Level of Modern Service Industry in China

Lifang Peng, Professor, Xiamen University, Management School, Xiamen, China, lfpeng@xmu.edu.cn, Nannan Li, Qi Li

Since China experienced a transformation from traditional service industry to knowledge-intensive business services (KIBS), KIBS have developed to a certain extent in China. This paper establishes a set of comprehensive evaluation index system to evaluate modern service industry level, and adopts factor analysis method to evaluate modern service industry in China. This paper aims to provide reference to the further development of modern service industry in China.

3 - Business Intelligence and Business Model Design: An Exploratory Study Grounded on Literatures and Cases

Yea-Huey Su, Assistant Professor, National Central University, 300 Chung-Da Rd., Chung-Li, Taiwan - ROC, suesu@mgt.ncu.edu.tw, Ming-Hone Tsai

Business models are the creations of entrepreneurs or scholars of business schools with their business intelligent. This research attempted to explore components of business model for business model design. Grounded theory was imported to analyse over 300 literatures and five cases. An integrated conceptual framework with ten business model components was thus proposed by this study.

■ MA60

W - College Room - 2nd Floor

Advances in Network Optimization Methods

Sponsor: Optimization/Networks

Sponsored Session

Chair: J. Cole Smith, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, j.cole.smith@gmail.com

1 - Real-Time Network Optimization for Emergency Evacuation

Churlzu Lim, Assistant Professor, University of North Carolina at Charlotte, 9201 University City Blvd., Systems Engineering (Cameron Hall), Charlotte, NC, 28223-0001, United States of America, clim2@uncc.edu

Emergency evacuation problems are typically formulated as network problems as they consist of network components. Conventional evacuation optimization provides a prescribed evacuation solution based on static parameters. However, dynamics of system parameters such as traffic volume and propagation of emergency sources can greatly affect the evacuation performance. We present a real-time node partitioning problem, and its solution approaches.

2 - Interdicting Stochastic Evasion Paths with Asymmetric Information on Bipartite Networks

Kelly Sullivan, University of Florida, P.O. Box 116595, Gainesville, FL, 32611, United States of America, kmsullivan@ufl.edu, Feng Pan, J. Cole Smith, David Morton

We study a stochastic network interdiction model formulated by Morton et al. (IIE Transactions, 39:3-14, 2007) that aims to locate radiation sensors at border crossings in order to help prevent the smuggling of nuclear material. Our work focuses on a version of this model that seeks to take advantage of information asymmetry between interdictor and smuggler. We develop a class of valid inequalities and a corresponding separation procedure that can be used within a cutting-plane approach.

3 - Efficient Algorithms for the Linear Cost Cyclic Dynamic Lot-sizing Problem

Bala Vaidyanathan, Operations Research Advisor, FedEx Express, 3680 Hacks Cross Road, Memphis, TN, 38125, United States of America, bala.vaidyanathan@gmail.com

In the literature, researchers typically solve lot-sizing problems over a fixed planning horizon where the inventories at the start and the end of the finite horizon are zero. In this paper, we relax that assumption and study the cyclic (or infinite horizon) version of the dynamic lot-sizing problem when there are no production setup costs. This problem can be formulated as a minimum cost flow problem. We develop provably fast algorithms based on the successive shortest path algorithm.

■ MA63

W - Tryon North - 2nd Floor

Applications of Multiple Criteria Decision Making

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Murat Koksalan, Professor, Middle East Technical University and Aalto University, IE Department, METU, Ankara, TR, 06531, Turkey, koksalan@ie.metu.edu.tr

1 - Scholarly Communities of Research in Multiple Criteria Decision Making: A Bibliometric Research Profiling Study

Hannele Wallenius, Professor, Aalto University, P.O. Box 15500, 00076 Aalto, Otaniementie 17, Espoo, Finland, hannele.wallenius@tkk.fi, Jyrki Wallenius, Pekka Korhonen, Johanna Bragge

We have conducted a research profiling study of Multiple Criteria Decision Making using bibliometric data from the ISI Web of Science. We report statistics regarding how our field has developed. We have also produced correlation maps based on most cited authors for different decades, showing the birth and evolution of different schools of thought. Our study shows that our field has experienced exponential growth. At the same time it has penetrated other neighboring domains of knowledge.

2 - Can a Linear Value Function Explain Choices?

Pekka Korhonen, Professor, Aalto University, P.O. Box 21210, 00076 Aalto, Helsinki, Finland, Pekka.Korhonen@aalto.fi, Jyrki Wallenius, Anssi Oorni, Kari Kalifi

We study in a bi-criteria experiment, whether subjects are consistent with a linear value function, while making binary choices. Many inconsistencies appeared, but the impact of inconsistencies on the linearity vs. non-linearity of the value function was minor. A linear value function seems to predict choices for bi-criteria problems quite well. Predictability is independent of whether the value function is diagnosed linear or not.

3 - A Preference Based Multi Response Decision Tree Approach for Quality Improvement in Manufacturing

Leman Esra Dolgun, Anadolu University, Industrial Engineering Department, Eskisehir, Turkey, ledolgun@anadolu.edu.tr, Gulser Koksal

We propose a method for simultaneous consideration of multiple quality characteristics (QCs) in selection of product/process design parameter levels. The method maps the QCs into an overall preference score by Choquet integral interacting with decision maker. A decision tree algorithm is used to search for optimal variable levels that maximize this overall score. This study directs special attention to interaction phenomena among criteria and provides an extensive discussion on this issue.

4 - Bi-criteria Route Planning for Unmanned Air Vehicles

Diclehan Tezcaner, Research Assistant, Middle East Technical University, Orta Dogu Teknik üniversitesi,, Endüstri Müh. Bölümü, Oda No:324 «ankaya, Ankara, 06531, Turkey, diclehan@ie.metu.edu.tr, Murat Koksalan

Unmanned Air Vehicles typically visit several targets. Their route planning problem can be modeled as a combination of multi objective shortest path and traveling salesperson problems. We develop interactive algorithms to find best paths and best tour for a decision maker under linear and quasiconcave utility functions.

■ MA64

W - Queens Room - 2nd Floor

New Directions for Emergency Medical Services

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Laura McLay, Assistant Professor, Virginia Commonwealth University, Richmond, VA, 23284, United States of America, lamclay@vcu.edu

1 - Predicting Spatial Patterns of Heart Attack Incidence in Alberta

Armann Ingolfsson, University of Alberta, Alberta, QC, Canada, armann.ingolfsson@ualberta.ca, Amir Rastpour, Padma Kaul, Reidar Hagtvedt

Knowledge of how heart attack incidence rates vary geographically can help health authorities utilize treatment capacity effectively and efficiently. We use Poisson regression with a linear link function to estimate heart attack incidence rates in the province of Alberta, using age, education, and income level variables as predictors.

2 - Modeling Emergency Medical Systems in India

Lavanya Marla, Systems Scientist, Carnegie Mellon University, 5000 Forbes Avenue, HBH 2102C, PIttsburgh, PA, 15213, United States of America, lavanyamarla@cmu.edu, Ramayya Krishnan, Yisong Yue

We discuss the case-study of an emergency service provider in India, where the establishment of EMS presents new challenges for emergency logistics management. We present our data-driven resource allocation scheme which situates ambulances to better respond to emergencies. We further discuss unique situations arising from public acceptance of the EMS system, and present models to capture these interactions. We validate our models for real-world data and present results.

3 - An Integrated Facility Location and Vehicle Dispatching Model for EMS Systems

Maria Mayorga, Clemson University, Clemson, SC, United States of America, mayorga@clemson.edu, Sunarin Chanta

We propose an optimization model for locating and dispatching EMS vehicles. The model captures system busyness by using a queuing model with consideration for different dispatching policies based on customer preference and workload of facilities. The model seeks to simultaneously find optimal location and optimal dispatching policies. A heuristic solution is also provided.

4 - Analyzing the Volume and Nature of Emergency Medical Calls during Severe Weather Events

Laura McLay, Assistant Professor, Virginia Commonwealth University, Richmond, VA, 23284, United States of America, lamclay@vcu.edu, Ed Boone, Paul Brooks

An effective emergency medical service (EMS) response to medical calls during extreme weather events is an important public service. Public health risks become even more critical during extreme weather events, and hence, EMS systems must consider additional needs that arise during weather events in order to effectively respond to and treat patients. This paper seeks to characterize how the volume and nature of EMS calls are affected during extreme weather events using regression methodologies.

■ MA65

W - Kings Room - 2nd Floor

Applications of Operations Research in the Social Services

Sponsor: Service Science

Sponsored Session

Chair: Gerald Evans, Professor, University of Louisville, Department of Industrial Engineering, Louisville, KY, United States of America, gerald.evans@louisville.edu

1 - Dynamic Performance Evaluation of a Spatially-distributed Social Services Network

Alexandra Medina-Borja, Assistant Professor, University of Puerto Rico at Mayaguez, II-205 Industrial Engineering Bldg, Mayaguez, PR, 00680, Puerto Rico, alexandra.medinaborja@upr.edu, Joymariel Melecio, Joaquin Medin

Networked social service networks are significantly affected by changes in population. To evaluate how performance is affected we model their direct impact on financial income (e.g. grants, donations) and their capacity to transform this income into services. Can each service point be efficient over time? An optimization algorithm is incorporated to a spatial SD model with the desired state of the system defined by an efficient frontier generated by data envelopment analysis.

2 - Simulating the Client Flow of the Kentucky Cabinet for Health and Family Services

Russell Harpring, Student, University of Louisville, Department of Industrial Engineering, University of Louisville, Louisville, KY, 40292, United States of America, russ.harpring@gmail.com, Dorothy Goya, Gerard Barber, Stacy Deck, Gerald Evans

The Kentucky Cabinet for Health and Family Services (KCHFS) main office in Louisville, Kentucky deals with hundreds of clients every day with varying social needs. This presentation will describe the development and use of a simulation model for finding solutions to complex problems involving process flow and staffing.

3 - Excel Based Inventory Management System for a Food Bank
Arsalan Paleshi, Student, University of Louisville, 2204 James Guthrie CT Apt8, Louisville, Ky, 40217, United States of America, a0pale01@louisville.edu, Gail DePuy, Tvikram Rao, Bulent Erenay

A food bank in Cleveland, Ohio serves low income residents with household items. The food bank receives donations from churches, schools, etc. Volatility in the number of donated items results in inventory fluctuations and stockouts. This paper develops an Excel based tool to support the food bank with a low-cost ordering and inventory management system to overcome these problems.

■ MA69

W - Grand D - 2nd Floor

Issues in Sustainable Operations Management

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Atalay Atasu, Georgia Institute of Technology, Atlanta, GA, United States of America, atalay.atasu@mgt.gatech.edu

1 - The Impact of Socially Responsible Practices on Firm Performance
Amrou Awaysheh, IE Business School, Maria de Molina, 12-5, Madrid, 28006, Spain, Amrou.Awaysheh@ie.edu

This paper examines the relationship between the announcement of socially responsible practices (SRP) and the stock market response to these practices. Empirical results show a negative 1.11% Cumulative Abnormal Return (CAR) associated with the announcement of negative SRP. The announcement of positive SRP results in a positive CAR of 1.20%. Further analysis is presented.

2 - Green Attributes and Product Design/Introduction Decisions
Arda Yenipazarli, Doctoral Student, University of Florida, Department of ISOM, Gainesville, FL, 32605, United States of America, arda.yenipazarli@warrington.ufl.edu, Asoo Vakharia

There are a substantial number of consumers expressing their preferences for green products. In this research, we focus on the whether a firm should choose to expand its current portfolio of product offerings to include an environmentally "friendly" product which integrates multiple green attributes. Our approach considers not only the market preferences of consumers which are attribute specific but also the cost associated with including each environmental attribute in the green product.

3 - Optimal Policies for Recovering the Value of Consumer Returns
Paolo Letizia, Pensylvania State University, Business Building, University Park, PA, 16802-1913, United States of America, pletizia@psu.edu, Keith Crocker

This paper characterizes an optimal returns policy between a manufacturer and a retailer, when returns are privately observed by the retailer and can be reduced through a private investment by the manufacturer. The optimal returns policy entails a full refund of the wholesale price and a bonus that is decreasing in the number of returns from the retailer to the manufacturer.

4 - The Closed-loop Supply Chain Network with Competition, Distribution Channel Investment
Patrick Qiang, Assistant Professor, Pennsylvania State University, 30 E. Swedesford Rd., Malvern, PA, 19355, United States of America, qzq10@psu.edu, Ke Ke, Trisha Anderson, June Dong

A CLSC network is investigated with decentralized decision-makers consisting of suppliers, retail outlets, and the manufacturers that collect the recycled product directly from the demand market. We derive the optimality conditions of the decision-makers and establish the equilibrium conditions. An algorithm is proposed to analyze the effects of competition, distribution channel investment, yield rates, combined with uncertainties in demand, on equilibrium quantity transactions and prices.

Monday, 11:00am - 12:30am

■ MB01

C - Room 201A

Empirical Research on Service Quality and Performance

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Jose A. Guajardo, Doctoral Candidate, University of Pennsylvania, The Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104, United States of America, josegu@wharton.upenn.edu

Co-Chair: Morris A. Cohen, University of Pennsylvania, The Wharton School, Philadelphia, PA, United States of America, cohen@wharton.upenn.edu

1 - Measuring the Effect of Queues on Customer Purchases
Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 417, New York, NY, 10027, United States of America, molivares@columbia.edu, Yina Lu

This paper conducts an empirical study to analyze how waiting in a queue at a retail store affects customer purchasing behavior. Our methodology uses new data sources on store operational execution based on image recognition to record periodic information about the queueng system. Our econometric framework integrates these data with point-of-sales information to estimate the effect of queues on purchases, allowing for customer heterogeneity in their sensitivity to wait.

2 - Specialization and Variety in Repetitive Tasks: Evidence from a Japanese Bank
Bradley Staats, Assistant Professor, University of North Carolina-Chapel Hill, McColl Building, Chapel Hill, NC, 27599, United States of America, bstaats@unc.edu, Francesca Gino

Research points to two different work design related strategies for sustaining workers' productivity in the completion of repetitive tasks: specialization to capture the benefits of repetition on productivity or variety to keep workers motivated and allow them to learn. In this paper, we use two and a half years of transaction data from a Japanese bank's home loan application processing line to study how these two strategies may bring different benefits within the same day and across days.

3 - How do Incumbents Fare in the Face of Increased Service Competition?
Ryan Buell, Doctoral Candidate, Harvard Business School, Soldiers Field Road, Morgan Hall T37, Boston, MA, 02163, United States of America, rbuell@hbs.edu, Dennis Campbell, Frances Frei

We explore the conditions under which service competition leads to customer defection from an incumbent and which customers are most vulnerable to its effects. We find that customers defect at a higher rate following increased service competition only when the incumbent offers high quality service relative to existing competitors in a local market. Furthermore we show that it is the high quality incumbent's most valuable customers who are the most vulnerable to superior service alternatives.

4 - Joint Management of Product Quality and Service Quality in Service-intensive Manufacturing
Jose A. Guajardo, Doctoral Candidate, University of Pennsylvania, The Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104, United States of America, josegu@wharton.upenn.edu, Morris A. Cohen

The movement from a "pure manufacturing" paradigm to a model in which manufacturers enhance the role of supporting services opens up a number of strategic challenges. In this research, we empirically study the benefits of jointly managing the manufacturing quality of products and services, and the existence of complementary and compensatory effects. Our results highlight the important role of customer heterogeneity for the understanding of these effects.

■ MB02

C - Room 201B

Optimization in Finance II

Cluster: Optimization in Finance

Invited Session

Chair: Pavel Gapeev, Lecturer, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, United Kingdom, P.V.Gapeev@lse.ac.uk

1 - Joint Risk Neutral Laws and Hedging

Dilip Madan, Robert H. Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, dbm@rhsmith.umd.edu

Complex positions on multiple underliers are hedged using the options surface of all underliers. Our hedges require one to use a risk neutral law on the set of underlying risks. Under our joint law asset returns are a linear mixture of independent Lévy components. Hedges significantly reduce ask prices.

2 - Employee Stock Options: The Impacts Of Contractual Restrictions, Optimal Hedging and Early Exercises

Tim Leung, Assistant Professor, Columbia University, Department of IEOR, New York, NY, United States of America, tl2497@columbia.edu

Employee stock options (ESOs) have become an integral component of compensation in the U.S. In view of their cost to the granting firms, the Financial Accounting Standards Board (FASB) has mandated expensing ESOs since 2004. Due to the trading restrictions and other features of ESOs, there are major challenges in optimally hedging and exercising these options, as well as in estimating their costs. In this talk, I will discuss some recent developments in ESO valuation.

3 - Monte Carlo Method on American Option Sensitivities Estimation

Nan Chen, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Department of Industrial & System Engr, Singapore, Singapore, isecn@nus.edu.sg, Yanchu Liu

In this paper we develop efficient Monte Carlo methods for estimating American option sensitivities, or more generally sensitivities for optimal stopping problems. One important feature of the optimal exercising boundary, the continuous fit condition, is essential in constructing unbiased estimators. Combining this result with some stochastic optimazation technique, we further present a new model calibartion algorithm based on American option prices.

4 - Pricing of Perpetual American Options in Models with Stochastic Interest Rates and Volatility

Pavel Gapeev, Lecturer, London School of Economics and Political Science, Houghton Street, London, WC2A 2AE, United Kingdom, P.V.Gapeev@lse.ac.uk

We study the perpetual American option pricing problem in models with stochastic interest or volatility rates. The asset price dynamics evolve according to the extended Black-Merton-Scholes model, in which the interest or volatility rates are described by the Vasicek model or the Cox-Ingersoll-Ross model, respectively. We present a characterisation of the payoffs, for which closed form expressions for the option prices can be derived, and use them for the analysis of the initial option prices.

■ MB03

C - Room 202A

Panel Discussion: COIN-OR Technology Forum

Sponsor: Computing Society/ Open Source Software (Joint Cluster Optimization)

Sponsored Session

Chair: Ted Ralphs, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, United States of America, ted@lehigh.edu

1 - Panel Discussion: COIN-OR Technology Forum

Moderator:Ted Ralphs, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, United States of America, ted@lehigh.edu, Panelists: Matthew Saltzman, Kipp Martin, William Hart, Lou Hafer

Following up on last year's successful forum, this panel discussion will be an opportunity for users and developers of COIN-OR software to discuss recent and future developments within COIN-OR. If you want to get involved, provide feedback, or just learn about COIN-OR, please join us!

■ MB04

C - Room 202B

Alternating Direction, Progressive Hedging, and Splitting Methods

Sponsor: Computing Society

Sponsored Session

Chair: Jonathan Eckstein, Professor, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, jeckstei@rci.rutgers.edu

1 - An Experimental Analysis of Operator Splitting for Stochastic Programming

Jean-Paul Watson, Sandia National Laboratories, P.O. Box 5800, MS 1318, Albuquerque, NM, 87185, United States of America, jwatson@sandia.gov, David Woodruff

We describe a generic implementation of Eckstein and Svaiter's operator splitting algorithm for scenario-based decomposition of stochastic programs, which generalizes Rockafellar and Wets' Progressive Hedging algorithm. The implementation is distributed in the open-source Coopr software package, available from COIN-OR. We discuss experimental studies and quantify performance relative to Progressive Hedging, on both stochastic linear and - in the role of a heuristic - mixed-integer programs.

2 - Distributed Optimization and Statistical Learning via Alternating Direction Methods

Neal Parikh, Stanford University, 350 Serra Mall #243, Stanford, CA, 94305, United States of America, npparikh@cs.stanford.edu, Stephen Boyd

This talk will discuss applying the alternating direction method of multipliers to large-scale distributed optimization problems, focusing on machine learning and statistical applications. We will discuss some implementation details using frameworks like MPI and MapReduce and some numerical experiments carried out using Amazon Web Services.

3 - A Computational Evaluation of Alternating Direction Methods

Jonathan Eckstein, Professor, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, jeckstei@rci.rutgers.edu

We examine the computational behavior of a number of variations on the alternating direction method of multipliers (ADMM) for convex optimization, focusing on lasso problems whose structure is well-suited to the method. In particular, we compare the classical ADMM to minimizing the augmented Lagrangian essentially exactly by alternating minimization before each multiplier update, and to an approximate version of this strategy using the recent relative error criterion of Eckstein and Silva.

■ MB05

C - Room 203A

On the Analysis of Queueing Systems with Abandonments

Cluster: Tutorials

Invited Session

Chair: Amy Ward, Associate Professor, University of Southern California, Bridge Hall 401H, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu

1 - On the Analysis of Queueing Systems with Abandonments

Amy Ward, Associate Professor, University of Southern California, Bridge Hall 401H, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu

In this tutorial, we discuss approximation results for the GI/GI/N+GI queueing model. Our objective is to find situations in which simple performance measure approximations can be developed. To do this, we study the behavior of the GI/GI/N+GI queue in the conventional heavy traffic and Halfin-Whitt limit regimes, as well as the overloaded regime.

■ MB06

C - Room 203B

Forecast Information Sharing: The Role of Contracts Behavior and Timing

Cluster: Tutorials

Invited Session

Chair: Ozalp Ozer, Associate Professor, The University of Texas at Dallas, School of Management, 800 West Campbell Road, Richardson, TX, 75080, United States of America, oozer@utdallas.edu

1 - Forecast Information Sharing: The Role of Contracts Behavior and Timing

Ozalp Ozer, Associate Professor, The University of Texas at Dallas, School of Management, 800 West Campbell Road, Richardson, TX, 75080, United States of America, oozer@utdallas.edu

Forecast information sharing is among the most active research area because information affects fundamental decisions. This tutorial focuses on issues arising in forecast information sharing. We illustrate how contracts/incentives affect forecast communication. We take on a new perspective on information sharing by considering the role of trust in communication. We discuss when and how to share forecasts that are evolving over time. We conclude with a discussion on open research questions.

■ MB07

C - Room 204

Markov Lecture

Sponsor: Applied Probability

Sponsored Session

Chair: Aleksandr Stolyar, Bell Labs Research, 600 Mountain Ave., 2C-322, Murray Hill NJ 07974, United States of America, Sasha.Stolyar@alcatel-lucent.com

Routing on Point Processes

Francois Baccelli, Ecole Normale Superieure, ENS and INRIA, Paris 75005, France, florence.barbara@inria.fr

Consider a point process in the Euclidean space and a rule, either deterministic or random, defining the edges that exist between its points. This defines a random graph on the point process. Typical examples are the Delaunay graph of the point process, its Boolean graph, or its SIR (Signal to Interference Ratio) graph. A routing algorithm constructs, for all pairs of points of the point process, a route between these points, namely a path of this graph connecting them, when possible. Such an algorithm can be global, like in shortest path routing, or local, like in geographic routing which consists in making locally optimal hops on this random graph. Each route is a functional of the point process and is hence a random geometric object of the Euclidean space. This talk will discuss both local and asymptotic properties of routes defined on stationary point processes. We will show that shortest path routes can be analyzed in terms of first passage percolation and that some geographic routing algorithms on Poisson point processes can be analyzed using stochastic geometry and general state space Markov chains. We will also discuss the notions of spatial averages and route averages and show that they differ in general. We will finally describe dynamic extensions of these notions, namely routes built on a random graph whose edges vary over time.

■ MB08

C - Room 205

Quality of Service in Cloud Computing

Cluster: Cloud Computing

Invited Session

Chair: Cathy Xia, Associate Professor, Ohio State University, 210 Baker Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, xia.52@osu.edu

1 - On Efficiently Placing Applications and Contents

Natarajan Gautam, Professor, Texas A&M University, College Station, TX, United States of America, gautam@tamu.edu, Samyukta Sethuraman, Lewis Ntaimo

One of the trade-offs faced by data centers and cloud computing platforms is to balance between quality of service (QoS) and energy costs. By solving the multi-timescale problem of strategically placing applications and contents in devices and managing resources in real-time, we show that expected operational costs (mainly due to power consumption) can be minimized while probabilitistically satisfying QoS constraints.

2 - Asymptotic Service Availability in Large-scale Service Networks

Cathy Xia, Associate Professor, Ohio State University, 210 Baker Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, xia.52@osu.edu, Mark S. Squillante, David George

We study the asymptotic behavior of a general class of product-form closed queueing networks as the population size grows large. We derive the exact order asymptotic behavior and establish new, computationally simple approximations for performance measures that significantly improve upon the existing approximations for large-scale networks. While cloud computing is going mainstream, our analysis provides engineering insights on achievable service levels of service systems in large scale.

3 - Design of a Power Efficient Cloud Computing Environment: Heavy Traffic Limits and QoS

Ness Shroff, Professor, Ohio State University, Department of Electrical Engineering, Columbus, OH, United States of America, shroff@ece.osu.edu, Prasun Sinha, Yousi Zheng, Jian Tan

We build a model of the cloud environment based on different QoS requirements. We develop a new set of heavy-traffic-limit-based results and use the insights gained to help determining the minimum number of operational machines needed in the cloud to satisfy its QoS requirement. We analyze the limiting expected completion time and expected waiting times for Poisson arrivals. Using numerical studies we show that different numbers of operational machines are critical for different QoS requirements

■ MB09

C - Room 206A

Innovations in Pricing and Revenue Management Application

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Seonah Lee, Revenue Analytics, 3100 Cumberland Blvd, Suite 1000, Atlanta, GA, 30339, United States of America, slee@revenueanalytics.com

1 - Customer Centric Pricing and Revenue Management

Dev Koushik, Director, Global Revenue Optimization, IHG, 3 Ravinia Drive, Suite 100, Atlanta, GA, 30346, United States of America, dev.koushik@ihg.com

Revenue Management has been traditionally viewed as an inventory management problem. IHG was the first hospitality company, that addressed the Revenue Management problem as a pricing and inventory management problem. Integrating customer data within a pricing paradigm, will lead to a Marketing based Pricing and Revenue Management approach aligning the customer and product perspective. This presentation will surface the business issues within the context of customer centric pricing.

2 - Estimation of Cancellation Rates Using Survival Models

Dan Iliescu, Operation Research Consultant, Revenue Analytics, 3100 Cumberland Blvd., Suite 1000, Atlanta, GA, 30339, United States of America, diliescu@revenueanalytics.com

This study explores the application of survival methods to estimate cancellation rates. In contrast to industry practice of estimating memoryless cancellation rates, we incorporate the time of reservation and the time until arrival. We estimate a discrete time proportional odds model and generate transitional probabilities of cancelled reservations given survival up to that point. Finally, we compare out-of-sample predictive performance of survival methods to a series of binary logit models.

3 - Retail Price Optimization at Marriott International

Michael Nehme, Marriott International, 10400 Fernwood Road, Bethesda, MD, 20817, United States of America, Michael.Nehme@marriott.com

Marriott International currently uses a variation of the passenger-mix problem proposed by Glover et al. (1982) to manage inventory at its hotels. The model takes rates as input and outputs bid prices which drive a heuristic to recommend restrictions on rate discounts. We describe an extension to this model in which the rates are decision variables. The resulting model is a non-convex QP if rates are continuous but can be written as a linear MIP if the set of allowable rates is discrete.

4 - Modeling Customer Choice to Optimize Price
Helen (Xianzhi) Wang, Operations Research Consultant, Revenue Analytics, Inc, 3100 Cumberland Blvd, Suite 1000, Atlanta, GA, 30339, United States of America, hwang@revenueanalytics.com

Price optimization has been successfully applied utilizing demand curves by continuous regression analysis. However, when customers face discrete choices, a better characterization of the demand would be by evaluating individual customer behavior. We show that a good estimate of the demand in terms of price and customer attributes can be achieved with a discrete choice model. We also discuss the ways to finding the optimal price efficiently and the tactic to recommend the prices in practice.

■ MB10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - LINDO Systems, Inc. - Optimization Modeling Made Easy
Mark Wiley, VP Marketing, LINDO Systems, Inc., 1415 North Dayton, Chicago, IL, 60642, United States of America, mwiley@lindo.com, Gautier Laude

LINDO will demonstrate our optimization software known for exceptional ease of use and comprehensive range of capabilities. We'll show our versatile, intuitive interfaces and demonstrate our powerful solvers for linear, integer, quadratic, general nonlinear, global and stochastic optimization. Come find out why our software is the tool of choice for thousands of OR professionals.

2 - SAS - Discrete Event Simulation with SAS Simulation Studio
Ed Hughes, Product Manager, SAS Institute Inc., 500 SAS Campus Dr., Cary, NC, 27513, United States of America, ed.hughes@sas.com, Emily Lada

We survey the capabilities of SAS Simulation Studio, an application for discrete-event simulation that integrates with SAS and JMP for data management, distribution fitting and experimental design. Simulation Studio features a hierarchical, entity-based approach to resource modeling that enables extensive control over complicated resource requirements such as scheduling and preemption.

■ MB11

C - Room 207A

Algorithmic and Probabilistic Aspects of Inference, Graphical Models and Optimization

Sponsor: Applied Probability

Sponsored Session

Chair: Devavrat Shah, Associate Professor, Massachusetts Institute of Technology, 32-D670, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, Devavrat@mit.edu

1 - Budget-optimal Task Allocation for Reliable Crowdsourcing Systems
Sewoong Oh, Massachusetts Institute of Technology, 32 Vassar St. D780, Cambridge, MA, 02139, United States of America, swoh@mit.edu, Devavrat Shah, David Karger

In crowdsourcing, numerous tasks are distributed to numerous information piece-workers. Since the workers can be unreliable, taskmasters need to devise schemes to increase confidence in their answers by assigning each task multiple times and combining the answers. We consider a general model of crowdsourcing and give new algorithms for deciding how to assign tasks to workers and for inferring correct answers. Our algorithms significantly outperform majority voting and are asymptotically optimal.

2 - Flows, First Passage Percolation and Random Disorder in Networks
Shankar Bhamidi, Assistant Professor, University of North Carolina, 304 Hanes Hall, Department of Statistics and OR, Chapel Hill, NC, 27599, United States of America, bhamidi@email.unc.edu

Consider a connected network and suppose each edge in the network has a random edge weight. Understanding the structure and weight of the shortest path between nodes in the network is one of the most fundamental problems studied in modern probability. This talk describes a heuristic based on continuous time branching processes which gives very easily, a wide array of asymptotic results for random network models in terms of the Malthusian rate of growth of associated branching process.

3 - The LASSO Risk: Asymptotic Results and Real World Examples
Mohsen Bayati, Assistant Professor of Operations, Information and Technology, Stanford University, 655 Knight Way, Stanford, CA, 94305, United States of America, bayati@stanford.edu, Andrea Montanari

We consider the problem of learning a high-dimensional sparse vector from a small number of noisy observations and study a well-known solution for that known as LASSO. We obtain the first rigorous derivation of an explicit formula for the asymptotic mean squared error of LASSO when the entries of the instance matrix are iid Gaussians. The proof technique is based on the analysis of AMP, a recently developed efficient algorithm that is inspired from graphical models ideas.

4 - Non-parametric Approximate Dynamic Programming via the Kernel Method
Nikhil Bhat, Columbia GSB, 3022 Broadway, New York, NY, United States of America, nbhat15@gsb.columbia.edu, Vivek Farias, Ciamac Moallemi

We present a "kernelized" variant of a recently proposed family of LP-based approximate DP algorithms. Our scheme is non-parametric: it automatically produces an approximation architecture whose complexity scales with the number of "sampled" states. We develop sample complexity bounds and approximation guarantees that extend state of the art guarantees for ADP to the non-parametric setting. We believe this is the first practical "non parametric" ADP algorithm with performance guarantees.

■ MB12

C - Room 207BC

Joint Session Optimization/ICS: Advances in Stochastic Programming

Sponsor: Computing Society - Computational Stochastic Optimization/Computing Society

Sponsored Session

Chair: Boris Defourny, Princeton University, Oper. Res. & Fin. Eng., Sherrerd Hall, Princeton, NJ, 08544, United States of America, defourny@princeton.edu

1 - A Multi-stage Stochastic Integer Programming Model for Dynamic Extensible Bin Packing
Bjorn Berg, North Carolina State University, Raleigh, NC, 27695, United States of America, bpberg@ncsu.edu, Brian Denton

We discuss a stochastic version of the extensible bin packing problem in which decisions about allocations to bins must be made over time with uncertainty about the number and size of items. We present a multi-stage stochastic integer programming model formulation. We discuss the structure of the problem and bounds that can be used to achieve computational advantages. Results of numerical experiments are presented based on an application to scheduling of outpatient procedure centers.

2 - Scalable Stochastic Programming
Cosmin G. Petra, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439, United States of America, petra@mcs.anl.gov, Miles Lubin, Mihai Anitescu

We present a scalable approach for solving stochastic programming problems, with application to the optimization of complex energy systems under uncertainty. Our novel hybrid parallel implementation PIPS is based on interior-point methods and uses a Schur complement technique to obtain a scenario-based decomposition. Strong scaling efficiency of 96% is obtained on 131k cores when solving a stochastic economic dispatch problem with more than 1 billion variables on Intrepid BG/P system.

3 - A Closed-form Solution to Stochastic Linear Programming Problems with Fixed Constraint Coefficients
Elmor L. Peterson, Systems Science Consulting, 3717 Williamsborough Court, Raleigh, NC, 27609, United States of America, elpeters@ncsu.edu

Given fixed constraint coefficients and an input probability distribution jointly describing the other input constraint and objective-function data, formulas derived via LP duality for the induced output probability distributions describing problem consistency, boundedness, and optimality provide new SLP approaches that compete with the simulation approaches, the chance-constrained and multi-stage-with-recourse approaches, and the deterministic approaches based on moment information.

4 - Inference of Decision Policies from Solved Scenario Trees
Boris Defourny, Princeton University, Oper. Res. & Fin. Eng., Sherrerd Hall, Princeton, NJ, 08544, United States of America, defourny@princeton.edu, Louis Wehenkel, Damien Ernst

Multistage stochastic programs can be solved in theory by using a large enough scenario tree or by selecting a priori a good scenario tree. We consider a pragmatic solution procedure based on randomization and empirical validation. We use machine learning for inferring decision policies from data sets of optimal decisions on randomized scenario tree structures. We show on particular problems how the approach allows to rank candidate solutions.

■ MB13

C - Room 207D

Group Buying, Pricing and Competition

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Ming Hu, University of Toronto, Rotman School of Management, Toronto, ON, Canada, Ming.Hu@Rotman.Utoronto.Ca

1 - Group Buying with Endogenous Quantity
Cuihong Li, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States of America, Cuihong.Li@business.uconn.edu, Rachel Chen, Rachel Zhang

When a seller offers quantity discounts, buyers may aggregate their purchasing quantities to obtain lower prices, referred to as group buying. Due to buyer externality in group buying, the purchasing quantity of a buyer depends on the quantity choices of other buyers. This paper studies group-buying for buyers given a seller's quantity discount schedule. It analyzes the buyers' purchasing quantities and surplus in group-buying, and reveals insights into the seller's pricing decision.

2 - Consignment Contracts with Retail Competition
Nantaporn Ratisoontorn, University of Illinois at Chicago, Mechanical and Industrial Engineering, Chicago, IL, 60607, United States of America, nratis2@uic.edu, Elodie Adida

Under consignment contracts, items are sold at a retailer's but the supplier retains the full ownership of the inventory until purchased by consumers; the supplier collects payment from the retailer based on actual units sold. We investigate how competition among retailers influences the supply chain decisions and profits under different consignment arrangements. We also study how consignment contracts and a price only contract compare from the perspective of each supply chain partner.

3 - Simultaneous vs. Sequential Group-buying Mechanisms
Ming Hu, University of Toronto, Rotman School of Management, Toronto, ON, Canada, Ming.Hu@Rotman.Utoronto.Ca, Mengze Shi, Jiahua Wu

We study group-buying mechanisms in a two-period game where cohorts of consumers arrive at a deal with a minimum signup requirement and make signup decisions sequentially. A firm can adopt either a sequential mechanism under which the firm discloses the number of sign-ups in the first period to second-period arrivals, or a simultaneous mechanism under which the firm does not. Our analysis shows that the sequential mechanism leads to higher deal success rates than the simultaneous mechanism.

4 - An Empirical Study of Online Group Buying Diffusion
Jiahua Wu, Rotman School of Management, University of Toronto, Toronto, ON, Canada, Jiahua.Wu09@rotman.utoronto.ca, Ming Hu, Mengze Shi

We analyze a unique dataset of time series of cumulative number of signups for each group-buying deal across 180 local markets from Groupon and Livingsocial over months. We identify a consistent signup pattern across all local markets/cities from both websites. We model the time to takeoff and the duration of takeoff with a "joint frailty" hazard rate model, and investigate the impact of several independent variables.

■ MB14

C - Room 208A

Energy Market Modeling

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Steven Gabriel, University of Maryland, 1143 Martin Hall, Department of Civil & Env. Eng., College Park, MD, 20742, United States of America, sgabriel@umd.edu

1 - Natural Gas Modeling for the Daily Houston Ship Channel Index
Jean Andre, Senior Research Scientist, Air Liquide, 200 GBC Drive, Newark, DE, 19702, United States of America, Jean.andre@airliquide.com, Yohan Shim, Steven Gabriel

Industrial gas companies needs to interact with energy markets and long term contracts for feeding their production assets. As Natural Gas is the feedstock to produce hydrogen through Steam Methane Reformers, large quantities of natural gas are purchased to fulfill the customers' demands. Natural Gas prices are characterized with seasonal cycles, volatility, and rare but irregular spikes. This paper focuses on capturing the multiple seasonalities of gas prices.

2 - Impact of Shale Gas Policy on Natural Gas Markets
Andrew Blohm, CIER-University of Maryland, 2101 Van Munching Hall, College Park, MD, 20742, United States of America, andymd26@umd.edu, Mark Olsthoorn

The production process for recovering shale gas is controversial in the US with claims that the chemicals used in hydraulic fracturing contaminate water sources. In this paper, we analyze the impact of shale gas in the Marcellus play on regional, national, and international gas markets. Because shale gas is so abundant across such a small region, the impact of action at the city, county, and state governance level can have a larger impact on gas markets than might otherwise be anticipated.

3 - A Stochastic Multi-objective Optimization Model for Biogas Production at the Blue Plains AWTP
Chalida U-tapao, The University of Maryland-College Park, 209 Thistle Dr., Silver Spring, MD, United States of America, cutapao@umd.edu, Steven Gabriel

We present a stochastic multi-objective mixed-integer optimization model that considers operational and investment decisions under uncertain such as natural gas and electric power price for an advanced wastewater treatment plant (AWTP). The Blue plains AWTP operated by District of Columbia Water and Sewer Authorities (DC Water) will be used as a case study. These decisions involve converting uncertain amount of biosolids into biogas, and/or electricity for internal or external purposes.

4 - Market-based Decision-making for Investments on Natural Gas Pipeline and LNG Network Expansions
Hakob Avetisyan, University of Maryland, College Park, MD, 20740, United States of America, havetisy@umd.edu, Steven Gabriel

In this paper a decision support model for strategic investments on natural gas network capacity expansions as a two-level leader-follower problem known as Stackelberg game is developed, in which the lower-level problem solves an equilibrium problem, which when combined with upper-level problem is known as mathematical problems with equilibrium constraints (MPEC). To illustrate the use of the model a case study on a proposed natural gas supply pipeline from Russia to China is analyzed.

■ MB15

C - Room 208B

Portfolio Decision Analysis II

Sponsor: Decision Analysis

Sponsored Session

Chair: Alec Morton, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, A.Morton@lse.ac.uk

Co-Chair: Jeff Keisler, Associate Professor, University of Massachusetts-Boston, College of Management, 100 Morrissey Blvd., Boston, MA, 02125-3393, United States of America, Jeff.Keisler@umb.edu

Co-Chair: Ahti Salo, Professor, Aalto University, Systems Analysis Laboratory, Aalto, 00076, Finland, ahtisalo@cc.hut.fi

1 - Modeling Economic Interactions in Decision Analysis with Function-valued Variables

Jeff Keisler, Associate Professor, University of Massachusetts-Boston, College of Management, 100 Morrissey Blvd., Boston, MA, 02125-3393, United States of America, Jeff.Keisler@umb.edu, Erin Baker

Decision analysis generally involves discrete variables and continuous real-valued variables. Applying definitions from mathematical analysis, DA tools and methods can also work with function-valued variables. We discuss these ideas in the context of valuing R&D investments in GHG reducing technology, whose outcomes help determine the marginal abatement cost (MAC) curve for CO2.Each technology's value depends depends on both the MAC and the uncertain damage cost curve.

2 - Ranking or Selection?

Eric Bickel, Operations Research / Industrial Engineering Center for International Energy and Environmental Policy, The University of Texas at Austin, Austin, TX, 78712, United States of America, ebickel@mail.utexas.edu, Kun Zan

In this paper, we consider VOI within the context of a portfolio of project opportunities, which we call portfolio VOI (PVOI). We formulate PVOI analytically and develop insights in closed-form, under certain assumptions. In particular, we show PVOI is composed of two components: the value that stems from pure ranking and the that comes from being able to exclude projects. We detail the situations in which each of these components dominates.

3 - Supervising Projects You Don't understand

Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, c.loch@jbs.cam.ac.uk, Magnus Mähring, Svenja Sommer

Senior managers on steering committees (SCs) of large strategic projects bear responsibility but cannot understand all the details of what is going on. The PM discipline understands what project managers should do, but not SCs because of hidden information, multiple expertise areas and non-aligned interests. Based on interviews with 21 senior managers in 4 countries, we make recommendations to senior managers on the composition of a good steering committee and how it should conduct itself.

4 - When Mean-variance Satisfies Second Order Stochastic Dominance

Philippe Delquié, George Washington University School of Business, Washington, DC, United States of America, delquie@gwu.edu, Alessandra Cillo

Mean-Variance analysis has the drawback of potentially violating SSD under arbitrary probability distributions. We show a necessary and sufficient condition under which Mean-Variance will comply with SSD ordering for arbitrary, bounded probability distributions. The condition can be used in reverse: to set a risk aversion parameter that would ensure SSD compliance when Variance is used as a risk measure.

■ MB16

C - Room 209A

Forest Modeling, Climate Change and Ecosystem Services

Sponsor: Energy, Natural Resources and the Environment/ Forestry

Sponsored Session

Chair: Marc McDill, Associate Professor, Pennsylvania State University, 310 Forest Resources Bldg, University Park, PA, 16802, United States of America, mem14@psu.edu

1 - Addressing Climate Change Scenarios in Eucalypt Forest Management Scheduling

Jordi Garcia-Gonzalo, Post-doc, Instituto Superior de Agronomia, Universidade Técnica de Lisboa, Tapada da Ajuda, 1349-017, Lisbon, 1349-017, Portugal, jordigarcia@isa.utl.pt, Jose G Borges

Climate change may substantially impact Portugal's forest sector. Our research assesses climate change impacts on Eucalypt forest management planning, integrating a process-based model that is sensitive to environmental changes and a multi-objective optimization model to identify optimized management plans under changing environmental conditions. Results demonstrate the potential of the approach to provide information to support landscape analysis and planning under scenarios of climate change.

2 - Quantifying the Economic and Landscape Implications of Clearcut Size Restrictions w/ Branch-and-cut

Nóra Könnyu, University of Washington, School of Forest Resources, Box 352100, Seattle, WA, 98195, United States of America, nk6@uw.edu, Sàndor Tóth

Clearcut size restrictions are promoted as a way to reduce forest harvest concentrations. One effect of this policy can be forest fragmentation. Quantifying the relationship between clearcut size, fragmentation, and net present value has been a computational challenge due to the difficulty of solving harvest scheduling models with varying opening size restrictions. We show, via real case studies, how a novel branch-and-cut algorithm can produce quality solutions to these problems fast.

3 - An Epidemiological Model for Optimal Control of Emerald Ash Borer in Urban Areas

Robert Haight, USDA Forest Service, Northern Research Station, St. Paul, MN, United States of America, rhaight@fs.fed.us, Rodrigo J. Mercader, Kent Kovacs

We model the spatial-dynamics of emerald ash borer (EAB) in St. Paul, MN, using a susceptible- infectious-resistant (SIR) framework for neighborhood ash trees. The model accounts for susceptible and infested trees over time and space based on growth and dispersal of EAB adults and phloem consumption by larvae. We couple the SIR model with optimization to determine the location and timing of treatments and removals to maximize public benefits subject to the city's EAB control budget.

4 - Lessons Learned from 10 Years of Modeling

Kendrick Greer, Analyst, Mason, Bruce & Girard, Inc., 707 SW Washington St., Suite 1300, Portland, OR, 97205, United States of America, lkgreer1@rmci.net, Bruce Meneghin

This paper reviews past efforts in conducting optimization-based analyses to support the revision of National Forest land management plans. We identify critical success factors that result in time and cost savings while meeting analysis objectives. The lessons learned span both technical and artful application of operations research practice to challenging forest management problems.

■ MB17

C - Room 209B

Value of Information and Multiattribute Utility

Sponsor: Decision Analysis

Sponsored Session

Chair: Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 South Matthews Avenue, Urbana, IL, 61801, United States of America, aliabbas@illinois.edu

1 - The Biological Clock Decision with Different Preferences

Lauren Klak, Stanford University, Management Science and Engineering Department, 475 Via Ortega, Stanford, CA, 94305, United States of America, klak@stanford.edu, Ron Howard, Ali Abbas

The optimal time to have a child depends on preferences and uncertainties related to career goals, wealth, and family relationships. Various Multiattribute Utility functions can capture this decision with different accuracy and different numbers of assessments. We analyze the biological clock decision using the utility over value approach. We use a Cobb-Douglas value function with two attributes, family state and wealth. We also use risk aversion functions for a wide range of decision makers.

2 - The Value of Information with and without Control

Gordon Hazen, Professor of Industrial Engineering and Management Sciences, Northwestern University, 2145 Sheridan Road Room D237, Evanston, IL, 60208, United States of America, hazen@iems.northwestern.edu, Mayank Mohan, Robert Kavet, Detlof von Winterfeldt

External stakeholders not in control of policy decisions may find it valuable to fund research to inform these decisions. The resulting value of information without control differs from the canonical value of information with control. We develop a set of reasonable assumptions under which the VOI without control is positive. We illustrate with an example of funding research to examine the relationship between electromagnetic fields exposure and health effects.

3 - Utility Trees and Double-sided Utility Copula Functions

Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 South Matthews Avenue, Urbana, IL, 61801, United States of America, aliabbas@illinois.edu

We introduce the notion of a multiattribute utility tree; a graphical display of the asssessments needed to construct the utility function using conditional utility assessments over the individual attributes. We use this formulation to define a new family of utility copula functions that has the flexibility to model the conditional utility functions at all boundary values of the domain of the attributes while allowing for partial utility independence and a wide range of trade-off assessments.

4 - Effects of Risk Aversion on the Value of Perfect Information in a Two-action Problem

Zhengwei Sun, University of Illinois at Urbana-Champaign, 104 South Mathews Avenue, Urbana, IL, 61801, United States of America, zsun4@illinois.edu, Ali Abbas

We discuss the effects of risk aversion on the value of perfect information in a two-action problem. We show that if two investors accept an investment without information, then the more risk averse investor will value information higher than the less risk averse one and vice versa. A decision maker who is indifferent to the two actions will value information higher than any decision maker with less or more risk aversion. We also provide the bounds on the value of information in this setting.

5 - The Value of Information in Portfolio Problems with Dependent Projects

Debarun Bhattacharjya, IBM T. J. Watson Research Center, Ossining, NY, United States of America, debarunb@us.ibm.com, Jo Eidsvik, Tapan Mukerji

Decision problems that involve choosing among probabilistically dependent projects are common in several domains; particularly in the earth sciences, due to spatial proximity among projects. Applications include choosing well locations for oil production, conservation sites for species preservation, etc. I will present some analytical results for information value when projects are multi-variate Gaussian, and also discuss methods that involve other spatial models such as Markov random fields.

■ MB18

C - Room 210A

Scheduling and Project Management

Cluster: Scheduling and Project Management

Invited Session

Chair: Nicholas G. Hall, Professor, The Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, hall_33@fisher.osu.edu

1 - Energy Aware Scheduling: Minimizing Energy Cost and Completion Time by Alpha-points and Alpha-speeds

Rodrigo Carrasco, Columbia University, Mudd 313, 500W 120th Street, New York, NY, 10027, United States of America, rac2159@columbia.edu, Cliff Stein, Garud Iyengar

Controlling power consumption in the context of scheduling is fast becoming a very important research problem. Here we present new approximation algorithms for energy aware scheduling, where we allow a very general class of energy cost functions which capture the price of energy as opposed to just energy consumption. Our algorithms can also be used with a weighted tardiness objective. These algorithms have small approximation factors and perform close to optimality in our numerical experiments.

2 - Scheduling Products with Subassemblies and Changeover Cost

James Blocher, Assoc Professor, Indiana University, 1309 E Tenth Street, Kelley School of Business, Bloomington, IN, 47405, United States of America, dblocher@indiana.edu, Feng Zhou, H. Sebastian Heese, Xinxin Hu

We consider the problem of scheduling products with two subassemblies on a common resource, where changeovers imply fixed costs. The objective is to minimize the weighted sum of flow time and changeover cost. We provide properties of optimal solutions and a characterization of the optimal schedule. Our results have interesting implications for practice, primarily that the structure of the optimal schedule is robust to changes in demand.

3 - Total Cost Control in Project Management via Satisficing

Joel Goh, Stanford University, Stanford, CA, United States of America, joelgoh@stanford.edu, Nicholas G. Hall

We consider the problem of controlling time and cost in project management. Projects have uncertain activity times, and the project manager may take costly action to expedite activities. The distribution of activity times is only known to reside within a family, defined by its support, mean, and covariance. We solve the model by robust optimization with a CVaR-satisficing measure. Numerical tests reveal that our method performs well against PERT and Monte Carlo simulation procedures.

4 - Scheduling Problems with Unreliable Jobs and Machines

Alessandro Agnetis, Universit‡ di Siena, Dipartimento di Ingegneria, dell'Informazione, Siena, 53100, Italy, agnetis@dii.unisi.it, Marco Pranzo, Paolo Detti, Patrick Martineau

We address a machine scheduling problem in which jobs have a certain chance of success and a certain revenue (if successfully carried out). Given m identical machines, the problem is to allocate and sequence the jobs in order to maximize expected revenue. For this problem, which is strongly NP-hard, we give some approximation results for the case m=2, and discuss the special case of exponentially distributed machine failures.

■ MB19

C - Room 210B

Financial Risk Management

Sponsor: Financial Services Section

Sponsored Session

Chair: Yonggan Zhao, Professor, Dalhousie University, 6100 University Avenue, Halifax, NS, B3H 3J5, Canada, yonggan.zhao@dal.ca

1 - Selective Hedging in Hydro-based Electricity Companies

Stein-Erik Fleten, Professor, Norwegian University of Science and Technology, Department of Industrial Econ & Techn Mgm, Trondheim, Norway, stein-erik.fleten@iot.ntnu.no, Gaute Egeland Sanda, Eirik Tandberg Olsen

We analyse risk management based on generation and trade data, and formal hedging policy documents of a dozen Norwegian power producers. Hedging reduces the "cash flow at risk" for ten of the firms. We find evidence that the use of market views in hedging transactions are extensive among the companies - both founded in their formal policies and indicated by substantial profits from hedging along with hardly any volatility reduction.

2 - Energy Portfolio Management with Abandonment Option
Zhen Liu, Engineering Management & System Engineering, University of Missouri-Rolla, Rolla, MO, 65409, United States of America, zliu@mst.edu

We study the optimal time to abandon a plant of a rm with a portfolio of plants to maximize the expected prot. We formulate the problem as a mixed optimal stopping/control problem, and characterize the optimal strategies through numerical experiments.

3 - Fortune's Formula: How Does Kelly's Strategy Perform?
Len MacLean, Herbert Lamb Chair, Dalhousie University, 6100 University Avenue, Halifax, NS, B3H 3J5, Canada, L.C.MacLean@DAL.CA

We consider the performance of the "Kelly" strategy and its associated "fractional Kelly" strategies in a variety of investment scenarios. The short and long term capital accumulation is characterized, with an emphasis on downside risk.

4 - An Investment Model via Regime Switching Economic Indicators
Yonggan Zhao, Professor, Dalhousie University, 6100 University Avenue, Halifax, NS, B3H 3J5, Canada, yonggan.zhao@dal.ca, John Mulvey

This paper develops a novel dynamic optimization model for constructing a long-short equity portfolio. A hidden Markov model captures the critical market sentiments, with expected asset returns highly dependent on the associated economic regimes. Expected equity returns are characterized by a set of eight economic factors within a regime-switching auto-regressive approach.

■ MB20

C - Room 211A

Joint Session OPT Global/OPT Integer: Nonlinear 0-1 Programming: Algorithms and Applications

Sponsor: Optimization - Global Optimization/Optimization – Integer Programming

Sponsored Session

Chair: Zhen Zhu, Purdue University, West Lafayette, IN, 47906, United States of America, zzhu@purdue.edu

1 - Tightening Concise Linear Reformulations of 0-1 Quadratic and Cubic Programs
Richard Forrester, Associate Professor of Mathematics, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States of America, forrestr@dickinson.edu

We present a new strategy for linearizing certain classes of 0-1 quadratic and cubic programs that yields a model which posses the desirable properties of concise size and tight relaxation strength. Specifically, using a repeated application of Glover's linearization for quadratic programs, we generate a compact linear model that has the strength of the level-2 RLT of Adams and Sherali. Preliminary computational experience is provided.

2 - Irregular Polyomino Tilings via Integer Programming
Serdar Karademir, University of Pittsburgh, Swanson School of Engineering, Pittsburgh, PA, United States of America, sek73@pitt.edu, Oleg A. Prokopyev

Periodicity of rectangular subarrays in Wideband Array Antennas creates quantization lobes which degrade obtained image. It has been shown that random tiling of polyomino-shaped subarrays can suppress quantization lobes considerably. We define a randomness metric based on information theoretic entropy concept and develop nonlinear and linear MIP formulations. We provide heuristic and exact solution methods. Results of our computational experiments are also discussed.

3 - A Branch-and-cut Algorithm for Capacitated Max K-Cut, with Application to Multitrack Scheduling
Matthew Oster, Rutgers Center for Operations Research (RUTCOR), 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, matthewoster@gmail.com, Jonathan Eckstein

We model the scheduling of a multi-track conference as a capacitated version of the Maximum K-Cut (MKC) problem. We solve this NP-hard problem to optimality by a branch-and-bound algorithm using the usual semidefinite programming relaxation of MKC, enhanced with triangle cuts, clique cuts, new cuts which we call capacity cuts, and a new heuristic for generating feasible solutions at most tree nodes.

4 - A Hypercube-based Framework for Obtaining Compact Forms of Special Combinatorial Restrictions
Warren Adams, Professor of Mathematical Sciences, Clemson University, O-327 Martin Hall, Clemson, SC, 29634, United States of America, wadams@clemson.edu, Frank Muldoon

Special combinatorial restrictions, such as SOS1 and SOS2, allow for the replacement of binary variables with continuous through the introduction of a logarithmic number of new 0-1 variables and auxiliary constraints. We give a novel interpretation of such replacements, obtaining smaller forms that preserve relaxation strength. Computational experience is provided.

■ MB21

C - Room 211B

Applications and Algorithms for Stochastic Optimization

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Ruiwei Jiang, University of Florida, 303 Weil Hall, University of Florida, Gainesville, FL, 32608, United States of America, rwjiang@ufl.edu

1 - Chance Constrained Optimal Bidding Strategy with Uncertain Wind Power Output
Qianfan Wang, University of Florida, Gainesville, FL, United States of America, qfwang@ufl.edu, Yongpei Guan, Jianhui Wang

This paper proposes an optimal bidding strategy with uncertain wind power output for independent power producers (IPPs) in the electricity market. The IPPs are assumed to be price takers in the market. The problem is formulated as a stochastic programming problem which incorporates the two-stage and chance-constrained optimization technologies together Sample Average Approximation (SAA) is applied to solve the problem.

2 - Transportation Planning under Uncertainty
Bo Zhang, Ph.D. Candidate, The Pennsylvania State University, 240 Leonhard Building, University Park, PA, 16802, United States of America, bzz104@psu.edu, Tao Yao, Byung Do Chung

This paper provides a Stochastic Programming approach for transportation planning which are robust to traffic demand uncertainty. Since the problem is computationally prohibitive in nature, we reformulate the problem as a deterministic convex program which is then proved to be safe and computationally tractable. Numerical experiments are conducted and the results show the outperformance of our model compared to the state-of-the-art.

3 - The Bullwhip Effect and Profit in a Two-Stage Supply Chain
Yiqiang Su, Industrial and Systems Engineering, University of Florida, Gainesville, United States of America, ysu1987@ufl.edu, Joseph Geunes

We consider a two-stage supply chain in which a supplier periodically promotes a product via a wholesale price discount, and a retailer may pass some or all of this discount on to consumers. We consider how these discounts impact supply chain profit and the bullwhip effect under demand uncertainty, both with and without substitutable products. A stylized supply chain profit model shows conditions under which firms will accept some degree of bullwhip effect in order to increase expected profit.

4 - Benders Decomposition for the Two-Stage Security Constrained Robust Unit Commitment Problem
Ruiwei Jiang, University of Florida, 303 Weil Hall, University of Florida, Gainesville, FL, 32608, United States of America, rwjiang@ufl.edu, Muhong Zhang, Guang Li, Yongpei Guan

In this talk, we propose a two-stage robust integer programming model to address the security constrained unit commitment problem under demand uncertainty, which is described by a given polyhedral uncertainty set. We study cases with and without transmission capacity and ramp-rate limits, and develop a Benders decomposition scheme to solve each case, including an exact and an efficient heuristic solution approaches providing a tight lower bound, verified by extensive computational experiments.

■ MB22

C - Room 212A

Statistical Perspectives of Nonlinear Programming

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Alexandre Belloni, Duke University, 100 Fuqua Drive, Durham, NC, United States of America, abn5@duke.edu

1 - Minimum Rank Factor Analysis and Ellipsoid Fitting

Pablo Parrilo, Professor, Massachusetts Institute of Technology, Cambridge, MA, United States of America, parrilo@mit.edu, James Saunderson, Alan Willsky

In this talk, we will discuss the minimum rank factor analysis problem, in the high-dimensional setting. We study its natural convex relaxation, namely, the minimum trace factor analysis problem, and state conditions under which this relaxation is exact. In our analysis, we emphasize a geometric interpretation in terms of the interpolation of a point configuration using a convex ellipsoid.

2 - Noisy Matrix Completion

Constantine Caramanis, Assistant Professor, The University of Texas at Austin, Department of Electrical and Comp. Engineering, Austin, TX, 78712, United States of America, caramanis@mail.utexas.edu

In this talk we consider the matrix completion problem — a popular approach for applications like collaborative filtering — under various noise and corruption regimes. We give provably correct efficient algorithms able to recover a matrix under large numbers of missing and corrupted entries, as well as entirely corrupted columns.

3 - Pivotal Estimation of Nonparametric Functions via Conic Programming

Alexandre Belloni, Duke University, 100 Fuqua Drive, Durham, NC, United States of America, abn5@duke.edu, Lie Wang, Victor Chernozhukov

In a nonparametric linear regression model we study a conic programming variant of LASSO which does not require the knowledge of the scaling parameter of the noise. In many non-Gaussian noise cases, we rely on moderate deviation theory for self-normalized sums to achieve Gaussian-like results. We derive new finite sample bounds for its performance, for the post-model selection estimator accounting for possible misspecification, and for two extreme cases (noiseless and unbounded variance).

■ MB23

C - Room 212B

Joint Session Homeland/MAS: New Models in Homeland Security and Couter-terrorism

Cluster: Homeland Security - Emergency Prep/ Military Applications Society

Invited Session

Chair: Roberto Szechtman, Naval Postgraduate School, Monterey, CA, United States of America, rszechtm@nps.edu

1 - When do Armed Revolts Succeed: Lesson from Lanchester Theory

Michael Atkinson, Naval Postgraduate School, Operations Research Department, Monterey, CA, United States of America, mpatkins@nps.edu, Moshe Kress, Alexander Gutfraind

Building on the classic Lanchester theory of combat we introduce a model of conflicts where the population plays a central role (e.g., armed revolts and insurgencies). We assume two forces, Red and Blue, engage in combat over a territory divided into regions according to the population's preferences (pro-Red or pro-Blue). The model suggests that the outcomes of such conflicts are independent of the initial distribution of forces and that stalemates are likely in many situations.

2 - Subsidizing to Disrupt a Terrorism Supply Chain – A Four Player Game

Xiaojun Shan, University at Buffalo, SUNY, Buffalo, NY, United States of America, xshan@buffalo.edu, Jun Zhuang

Terrorism with weapons of mass destruction (WMDs) is an urgent threat to homeland security. We consider two subgames: a proliferation game (where one terrorist group handling the black market for profits proliferates to the other one to attack) and a subsidization game (where one potential victim government subsidizes the other host government, who can interfere with terrorist activities). Then we integrate these two subgames to study the usefulness of strategy of subsidy in counter-terrorism.

3 - A Principal-agent Perspective on Counterinsurgency Situations

Roberto Szechtman, Naval Postgraduate School, Monterey, CA, United States of America, rszechtm@nps.edu, Federico Perez Duenias

We model a situation where the government forces pay the local tribes to help reduce violence, when the only observable are the number of violent acts. Knowing that more cooperation makes violence less likely, the problem for the government is to design a menu of payments, depending on the observed level of violence over some predetermined period of time, that make it appealing for the local population to exert sufficient effort in reducing the violence.

■ MB24

C - Room 213A

Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Ricardo Fukasawa, Assistant Professsor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, rfukasaw@math.uwaterloo.ca

1 - Some Experiments on Separation of with Multi-row Cuts

Daniel Espinoza, Assistant Professor, Universidad de Chile, 701 Republica, Santiago, Chile, daespino@dii.uchile.cl, Felipe Serrano

Multi-row cuts have been widely studied, and have been proved to dominate other classical families of inequalities. However, computational results have been mixed. In this talk we will concentrate on the problem of, given a row-relaxation and bounds on the variables, how to separate these inequalities numerically. We will evaluate both exact and approximate separation, taking into account numerical issues as well as the use of convexity constraints in the separation problem.

2 - Some Properties of Convex Hulls of Integer Points Contained in General Convex Sets

Santanu S. Dey, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30318, United States of America, santanu.dey@isye.gatech.edu, Diego Moran

We present properties of general closed convex sets that determine the closed-ness and polyhedrality of the convex hull of integer points contained in it. The necessary and sufficient conditions for closed-ness leads to useful results for special class of convex sets like pointed cones, strictly convex sets, and sets containing integer points in their interior. The sufficient conditions for the convex hull of integer points to be polyhedron are shown to be necessary under a simple condition.

3 - Using Symmetry to Optimize over Extended Formulations

James Ostrowski, Argonne National Lab, 9700 S. Cass Avenue, Argonne, IL, 60439, United States of America, jostrowski@anl.gov

We improve upon the LP relaxation bounds by computing the bound given by the Sherali-Adams extended formulation for highly symmetric MILP problems. Typically the extended formulations of Sherali-Adams relaxations can be very large. Symmetry can be used to generate an LP with significantly fewer variables that has an identical objective value. We demonstrate this by computing the bound associated with the level 1, 2, and 3 relaxations of several highly symmetric BIP problems.

4 - Cover Inequalities for Nearly Monotone Quadratic MINLPs

Noam Goldberg, Argonne National Laboratory, Argonne, IL, United States of America, noamgold@mcs.anl.gov, Sven Leyffer, Ilya Safro

We consider MINLPs arising from novel network optimization formulations with a quadratic objective as well as nonlinear constraints which satisfy certain monotonicity conditions. We derive valid cover inequalities for these formulations and their linearized MIP counterparts. In the case that the constraints are quadratic and possess a special structure we relax the monotonicity requirement. We consider the separation problem and suggest heuristics for generating cuts in practice.

■ MB25

C - Room 213BC

Vaccine Supply Chains: Economics, Operations, Epidemiology

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Sarang Deo, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, 500032, India, sarang_deo@isb.edu

1 - Vaccine Supply Chain: Operational Issues and Negative Network Effects under Production Uncertainty

Elodie Adida, Assistant Professor, University of Illinois at Chicago, Mechanical and Industrial Engineering, 842 W. Taylor St. (MC 251) Room 3025 ERF, Chicago, IL, 60607, United States of America, elodie@uic.edu, Debrabata Dey, Hamed Mamani

Vaccines are the most effective means for preventing infectious diseases. However, negative network externalities on the consumption side and operational issues (such as yield uncertainty) on the supply side do not provide the incentives required to reach the socially optimal vaccine coverage. We investigate how a central policy-maker can induce a socially optimal coverage through the use of a two-part subsidy scheme.

2 - Consumption Externality and Yield Uncertainty in the Influenza Vaccine Supply Chain

Kenan Arifoglu, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, kenanarifoglu2011@u.northwestern.edu, Sarang Deo, Seyed Iravani

We consider the inefficiency in flu vaccine supply chain and study the impact of two critical factors: yield uncertainty (supply side) and self-interested consumers (demand side). Contrary to previous economic models, we find that consumers may demand more vaccinations than is socially optimal when they jointly consider the availability and infection externalities. We study two partially-centralized supply chains to investigate the benefits of government interventions on demand and supply side.

3 - A Newsvendor Model with Pricing for Public Interest Goods

Gal Raz, University of Virginia, Darden Business School, 100 Darden Blvd., Charlottesville, VA, 22903, United States of America, razg@darden.virginia.edu, Anton Ovchinnikov

The supplying of a public interest good (e.g. safety products, energy efficient appliances, and health-related products) is a game that includes three players, the firm supplying the good, the consumers that are buying it and the government that can intervene in the transaction by imposing regulations. In this paper, we study this supply chain using a newsvendor model with pricing setting, taking a social planner perspective and examining the possible government actions and their implications.

4 - A Portfolio Approach to HIV Control in South Africa

Elisa Long, Yale University, Yale School of Management, New Haven, CT, United States of America, elisa.long@yale.edu, Robert Stavert

With 5.7 million HIV+ people in South Africa, reducing new infections and increasing antiretroviral therapy (ART) access is an urgent national priority. Recent clinical trials indicated partially effective interventions may soon be available. Using a dynamic HIV epidemic model with Monte Carlo simulation, we evaluated the effectiveness and cost-effectiveness increased HIV screening, ART, male circumcision, vaccination, topical microbicide use, and a combination of the interventions.

■ MB26

C - Room 213D

Competition and Cooperation in Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Greys Sosic, Associate Professor, University of Southern California, Marshall School of Business, Bridge Hall 401, Los Angeles, CA, 90089, United States of America, sosic@marshall.usc.edu

1 - The Strategic Perils of Low-cost Outsourcing

Lauren Xiaoyuan Lu, Assistant Professor, University of North Carolina at Chapel Hill, McColl Building, Chapel Hill, NC, United States of America, Lauren_Lu@unc.edu, Annabelle Feng

The existing outsourcing literature has generally overlooked the cost differential and contract negotiations between manufacturers and suppliers. One fundamental question that yet to be addressed is whether upstream suppliers' cost efficiency is always beneficial to downstream manufacturers in the presence of competition and negotiations. To answer this question, we adopt a multunit bilateral bargaining framework to investigate competing manufacturers' sourcing decisions.

2 - Bundled Procurement for (Free) Technology Acquisition and Future Competition

Leon Chu, University of Southern California, Marshall School of Business, University Park Campus, Los Angeles, CA, 90089, United States of America, leonyzhu@usc.edu, Yunzeng Wang

We study a bundled procurement mechanism that acquires both product and technology. Under the two-supplier case, each supplier has a dominant technology provision strategy. Moreover, the supplier's behavior is not continuous with respect to the ratio between the current project size and the future market size. As the ratio crosses some bound, the supplier response jumps to the best technology. While the buyer may pay a higher price, he will be adequately compensated in the future market.

3 - Supplier Alliances under Default Risk

Xiao Huang, Assistant Professor, Concordia University, John Molson School of Business, 1455 de Maisonneuve Blvd West, Montreal, QC, Canada, xiaoh@jmsb.concordia.ca, Mehmet Gumus, Tamer Boyaci, Dan Zhang, Saibal Ray

We study the role of alliances in dealing with default risks in supply chains by considering a set of complementary/substitutable suppliers selling to an assembler/buyer. The suppliers face the trade-off of joining larger alliances that have better chance to survive vs. smaller ones that result in higher profit allocations. Coalition-proof stable alliance structures are characterized. We also analyze the distinction between assembler/buyer's incentive in investing in upstream risk structures.

4 - Inventory Collaborations Among n-Independent Parties with Asymmetric Demand

Xinghao Yan, Assistant Professor, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond Street North, London, ON, N5X 4P6, Canada, xyan@ivey.uwo.ca, Hui Zhao

This paper is the first to analyze an n-retailer inventory sharing system with asymmetric information. We develop a coordination mechanism (nRCM) which: (1) is in the core and leads to complete sharing of residuals from all retailers; (2) can be implemented with or without demand information sharing; (3) Although retailers still have incentives to share untruthful information, it guarantees retailers obtain profits very close to their first-best solution even if they do not share information.

■ MB27

C - Room 214

Logistics Management and Planning – Models and Algorithms

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Retsef Levi, Massachusetts Institute of Technology, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, retsef@mit.edu

1 - Exact and Approximation Algorithms for Air Ambulance Routing and Deployment

Tim Carnes, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, tcarnes@mit.edu, David Shmoys

We present a primal-dual 2-approximation algorithm for the k-location routing problem, that models choosing k locations for vehicles and routing each vehicle in a tour to serve a set of requests, where the cost is the total tour length. This is the first constant approximation algorithm for this problem and has real-world applications; this is part of a broader effort for Ornge, which transports medical patients. Our work builds and improves upon work of Goemans & Williamson and Jain & Vazirani.

2 - Network Design under Equilibrium Flow

Georgia Perakis, Massachusetts Institute of Technology, Cambridge, MA, United States of America, georgiap@mit.edu, Retsef Levi, Gonzalo Romero

We study new class of models, in which a central planner invests in a given network, subject to per component and total investments budget constraints. The investment induces a 'traffic' equilibrium. The goal is to minimize the total cost of the induced equilibrium 'flow'. We obtain structural results and near optimal solutions in various important cases. Finally, we use the model to compare the efficiency of co-payment and technology investment subsidies in markets with price competition.

3 - Maintenance Scheduling for Modular Systems with Submodular Costs

Retsef Levi, Massachusetts Institute of Technology, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, retsef@mit.edu

We study models of maintenance scheduling for modular systems, consisting of multiple cycle limited components. Cycle limits specify the time interval in which components must be maintained. Typical costs are submodular which makes the model computationally challenging. We develop an efficient and operationally tenable approximation algorithm. We prove a tight constant factor worst-case guarantee and present computational results that show the algorithm performs close to optimality.

■ MB28

C - Room 215

Behavioral and Empirical Models in Operations and Revenue Management

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Noah Gans, University of Pennsylvania, OPIM Department - Wharton, 3730 Walnut St, Suite 500, Philadelphia, PA, 19104, United States of America, gans@wharton.upenn.edu

1 - Pricing and Revenue Management: The Value of Coordination

Ioana Popescu, INSEAD, 1 Ayer Rajah Avenue, Singapore, Singapore, ioana.POPESCU@insead.edu, Catalina Stefanescu, Ayse Kocabiyikoglu

We investigate the value of coordinating pricing and revenue management decisions in a static setting, relative to a sequential approach which first optimizes prices and then uses these as inputs for availability decisions. First, we provide regularity conditions on general stochastic demand models which ensure that various hierarchical and coordinated models are well behaved. Then, we use industry data to assess the value of joint price and revenue management optimization.

2 - Supply Chain Contract Design: Impact of Bounded Rationality and Individual Heterogeneity

Kay-Yut Chen, Hewlett-Packard Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, kay-yut.chen@hp.com

We show that the optimal supply chain contract depends on the level of bounded rationality of the downstream retailer. We model two aspects of bounded rationality: probabilistic choice and anchoring. Human experiments were conducted under four supply chain contracts. We found that subjects are heterogeneous, and levels of bounded rationality distributes in a wide range, highlighting the need to calibrate contracts to behavior. In addition, bounded rationality is found to be consistent over time.

3 - Dynamic versus Static Pricing in the Presence of Strategic Consumers

Pnina Feldman, University of California, Berkeley, Berkeley, CA, 94720, United States of America, feldman@haas.berkeley.edu, Gerard Cachon

Dynamic pricing can be used to align supply with demand. Our paper shows that there is a limitation to dynamic pricing - by imposing price risk on consumers, they might not even consider purchasing, thereby lowering the firm's potential demand. Although static pricing does not react to demand, we show that it may be better than dynamic pricing. An even better policy is "constrained dynamic pricing" where the firm reacts to demand with moderate price adjustments.

4 - What's in a Five-Star Ranking?

Marco Scarsini, LUISS, Viale Romania 32, Roma, 00197, Italy, marco.scarsini@gmail.com, Omar Besbes

Consumer reviews and rankings of products and services have become ubiquitous on the internet. The objective of this talk to analyze whether reported rankings truthfully represent actual consumer preferences, given the sequential nature of the reports and the possible behavioral biases involved.

■ MB29

C - Room 216A

Quantitative Portfolio Optimization

Cluster: Quantitative Finance

Invited Session

Chair: Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu

1 - Gradient-based Bounds for Convex Dynamic Programs

David Brown, Duke University, Fuqua School of Business, 100 Fuqua Drive, Durham, NC, 27708, United States of America, dbbrown@duke.edu, Jim Smith

We consider the approach of bounding convex stochastic dynamic programs by using information relaxations and penalty functions. We study classes of penalties based on gradients and show that this approach has several useful properties: it (1) preserves convexity; (2) may be used with any approximate value function in simulation; (3) provides, in theory, tight bounds to the original DP; (4) improves bounds based on Lagrange relaxations. We illustrate the method in portfolio optimization.

2 - Dynamic Portfolio Choice with Transaction Costs and Return Predictability: Linear Rebalancing Rules

Mehmet Saglam, PhD Candidate, Columbia University, 3022 Broadway 4F, New York, NY, 10027, United States of America, MSaglam13@gsb.columbia.edu, Ciamac Moallemi

We consider a broad class of dynamic portfolio optimization problems that allow for complex models of return predictability, transaction costs, trading constraints, and risk considerations. Determining an optimal policy in this setting is intractable. We propose a class of linear rebalancing rules, and describe an efficient computational procedure to optimize with this class. We illustrate this method in the context of portfolio execution, and show that it achieves near optimal performance.

3 - A Model of Dynamic Portfolio Choice with Market Impact Costs

Poomyos Wimonkittiwat, University of California-Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720-1777, United States of America, poomyos@berkeley.edu, Andrew Lim

We formulate a model of dynamic portfolio choice that incorporates liquidity effects as a stochastic linear quadratic control problem where liquidity costs are modeled as a quadratic penalty on the trading rate. We derive a multiple time scale asymptotic expansion of the value function and optimal trading rate in the regime of vanishing market impact costs. This expansion reveals an intuitive relationship between the illiquid problem and the classical Merton problem in perfectly liquid markets.

■ MB30

C - Room 216B

Operations and Finance Interfaces

Sponsor: Manufacturing & Service Oper Mgmt/ iFORM SIG

Sponsored Session

Chair: John Birge, Professor, University of Chicago, Booth School of Business, Chicago, IL, United States of America, john.birge@chicagobooth.edu

1 - Linear-quadratic Control and Information Relaxations

Martin Haugh, Columbia University, 332 S. W. Mudd Building 500 W. 120th Str, New York, NY, 10027, United States of America, mh2078@columbia.edu, Andrew Lim

We apply recently developed duality methods to the classic linear quadratic control problem. We derive two dual optimal penalties and compare them to the dual penalty of Davis and Zervos (1994). We emphasize that while the three penalties are dual optimal, they are not identical. This has significant implications when the penalties are used via Monte-Carlo to evaluate sub-optimal policies for constrained LQ problems.

2 - The Newsvendor Problem and Price-only Contract When Bankruptcy Costs Exist

Wenhui Zhao, Assistant Professor, Shanghai Jiao Tong University, Room 103, Bldg 4, 535 Fahuazhen Road, Shanghai, 200052, China, zhaowenhui@sjtu.edu.cn, Panos Kouvelis

We study a supply chain of a supplier selling to a capital constrained retailer, who can borrow from a bank. The bank offers a fairly priced loan. Failure of loan repayment leads to a costly bankruptcy. We identify the retailer's optimal order quantity as a function of the wholesale price and his wealth. The analysis of the supplier's optimal wholesale price leads to unique equilibrium solutions in wholesale price and order quantity, with the quantity smaller than the traditional newsvendor one.

3 - Supply Chain Financing Mechanisms under Default Risks
Min Wang, Columbia University, 2270 Broadway, New York, NY, 10025, United States of America, mwang13@gsb.columbia.edu, Awi Federgruen

In recent work, considering infinite horizon models with a supplier and a retailer, we have derived systematic comparisons of three fundamental financing schemes. Our base models assumed that the risk of the retailer defaulting is negligible. In this talk, we discuss two generalized models in which the retailer is subject to a general stochastic default and reorganization process with either only the supplier or both the supplier and the bank exposed to the resulting default risks.

■ MB31

C - Room 217A

Nurse Scheduling Problems

Sponsor: Health Applications

Sponsored Session

Chair: Gino J. Lim, Associate Professor, University of Houston, E211, Egr. Bldg 2, 4008, Houston, TX, 77004, United States of America, ginolim@uh.edu

Co-Chair: Arezou Mobasher, University of Houston, Houston, TX, 77004, United States of America, amobasher@uh.edu

1 - Hospital Capacity Planning: A Business Case for Higher Quality of Care
Kurt Bretthauer, Professor, Indiana University, Operations & Decision Technologies Department, Kelley School of Business, Bloomington, IN, 47405, United States of America, kbrettha@indiana.edu, David Cho, Jan Schoenfelder

Despite the considerable attention given to healthcare in operations management and operations research, there has been limited effort to take advantage of results from the medical, nursing, and healthcare services literature to make the research more patient and nurse oriented. Thus, we present a nurse staffing model that incorporates patient outcomes, nurse burnout, and costs when making hospital capacity planning decisions such as patient to nurse ratios and usage of float and agency nurses.

2 - Nurse Scheduling Problem in an Operating Suite
Gino J. Lim, Associate Professor, University of Houston, E211, Egr. Bldg 2, 4008, Houston, TX, 77004, United States of America, ginolim@uh.edu, Arezou Mobasher

We introduce multi-objective nurse scheduling models in an Operating suite, Nurse Assignment Model (NAM) and Nurse Lunch Model (NLM). NAM is developed to assign nurses to different surgery cases in an operating suite without compromising the success of surgery cases and jeopardizing nurse job satisfaction. NLM utilizes the results from nurse assignment model to develop lunch schedules. The solution pool feature and preemptive goal programming approach are used to solve the problem.

3 - Post-Anesthesia Care Unit Nurse Scheduling Sensitivity to Nurse to Patient Ratio at Peak Census
Franklin Dexter, Professor, University of Iowa, Department of Anesthesia, 200 Hawkins Drive, 6JCP, Iowa City, IA, 52242, United States of America, franklin-dexter@uiowa.edu

Phase I PACU nurse scheduling chooses # of nurses for >15 shifts while reducing days with delays in admission. Complete enumeration takes <0.5 hr and has been done at scores of facilities (see review Journal of PeriAnesthesia Nursing 2005;20:92). Power (time series) analysis showed 100 workdays is suitable period (J PeriAnesth Nursing 2002;17:84). Results are sensitive to patient:nurse ratio (J PeriAnesth Nursing 2006;21:303). We show electronic medical record data simplifies acuity estimation.

■ MB32

C - Room 217BC

Recent Advances in Transportation

Sponsor: Railway Applications

Sponsored Session

Chair: Ravindra Ahuja, President, Innovative Scheduling, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, United States of America, ravi@innovativescheduling.com

1 - A Hump Yard Planning System and Its Application for Yard Capacity Expansion Studies
Krishna Jha, Vice President-Research & Development, Innovative Scheduling, 2153 Hawthorne Road, Suite 130, Gainesville, FL, 32641, United States of America, krishna@innovativescheduling.com, Jeremiah Dirnberger

We have developed a detailed hump yard simulation system which models all the important yard resources and can simulate a yard's operation very realistically. This system can be used to identify yard bottlenecks and identify the most cost-effective way to increase a yard's throughput capacity. This presentation will give an overview of system, its demonstration, and application to improve a yard's capacity.

2 - Real-time Inter-modal Strategies for Airline Schedule Perturbation Recovery & Congestion Mitigation
Yu Zhang, University of South Florida, 4202 Fowler Avenue, Tampa, United States of America, yuzhang@usf.edu, Mark Hansen

This study proposes an analytical framework and supporting optimization models that will encourage the aviation industry to incorporate alternative transportation modes when major airports in the system encounter temporary closures or severe capacity deficiencies. This framework can provide a way to reduce passenger disutility due to delay and misconnection and to help airlines reduce operating cost and recover schedule more promptly.

3 - Solving Linehaul Planning Problems for Less-than-Truckload Carriers
Ravindra Ahuja, President, Innovative Scheduling, 2153 SE Hawthorne Road, Suite 128, Gainesville, FL, United States of America, ravi@innovativescheduling.com, Amit Agarwal

Less-Than-Truckload (LTL) carriers are very similar to railroad carriers and consolidate small packages into full truck loads. In this presentation, we describe the similarity between linehaul planning/scheduling problems and railroad planning/scheduling problems, and the difficulty of these problems. We also describe how we have adapted our railroad optimization algorithms to solve LTL planning/scheduling problems.

■ MB33

C - Room 217D

QSR Poster Session

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Roshan Joseph Vengazhiyil, Associate Professor, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, Room 337, Groseclose Bldg., 765 Ferst Dr, Atlanta, GA,30332, United States of America, roshan@isye.gatech.edu

1 - A Functional Time-Warping Approach for Degradation Modeling
Rensheng Zhou, Georgia Institute of Technology, 1903 Drew Dr NW Apt 1202, Atlanta, GA, 30318, United States of America, rzhou8@gatech.edu, Nicoleta Serban, Nagi Gebraeel

In most engineering systems, degradation signals can be observed up to the failure threshold resulting in truncated degradation signals. We present a functional time warping model suitable for modeling truncated degradation signals. In this model, the observed differences in degradation processes are viewed as a consequence of different speeds of deterioration and aging of materials. Our model is demonstrated to perform well in residual life predictions through various case studies.

2 - Computer Modeling & Experiments of Glycosylation Modulation Dynamics in Cardiac Electrical Signaling
Dongping Du, University of South Florida, 14329 Wedgewood Circle Apt.202, Tampa, FL, 33613, United States of America, dongpingdu@mail.usf.edu, Hui Yang

Physics-based simulation models are developed mathematically to simulate multi-scale cardiac electrical signaling. The glycosylation modulation parameters from physical experiments are incorporated into computer models at the level of ion channels to predict the variations of electrical conductions in cells and tissues. Computer and physical experiments are intertwined in this study.

3 - Improved MCMC Sampling for Bayesian CART

Michael Seo, Duke University, P.O. Box 97292, Durham, NC United States of America, mike.seo@duke.edu

I propose a new transition step that will improve the mixing and convergence properties of the Bayesian CART. My idea comes from the original swap step. However, it is more conservative than swap and it is more easily accepted even when the change is made at the top portion of the tree. Using the Gelman and Rubin diagnostic, we compare the convergence of the algorithm with and without this new step.

4 - Making the Important Measurable

Rhythm Wadhwa, PhD, NTNU, Leif Tronstads Veg 19, Trondheim, 7051, Norway, rhythm.s.wadhwa@ntnu.no

Performance measurements related to manufacturing industry energy consumption typically focuses on what is easy to quantify and not necessarily what is important to measure. This research tests a new model for designing performance measurement indicators DPMI. Furthermore, a performance allocation tracker is developed as a result of applying the DPMI method. The proposed model has been successfully demonstrated for the metalcasting manufacturers in Norway.

5 - Mining of Neuroimaging Data for Alzheimer's Disease Study by Novel Statistical Methods

Shuai Huang, Research Assistant, Arizona State University, 2343 West Main Street, Apt. 2080, Mesa, AZ, 85201, United States of America, shuang31@asu.edu, Jing li

Rapid advances in neuroimaging techniques provide great potentials for study of neurodegenerative diseases, such as the Alzheimer's disease (AD). These techniques produce ultra-high-dimensional (millions of variables), noisy (low signal-to-noise ratio) data sets, which make many conventional statistical models fall short. In this poster, we show how novel statistical models can be developed and how they can be used for knowledge discovery of AD from neuroimaging datasets.

6 - Model Calibration through Minimal Adjustments

Chia-Jung Chang, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Room 217,, Georgia Institute of Technology,, Atlanta, GA, 30332, United States of America, cchang43@gatech.edu, Roshan Joseph Vengazhiyil

Model calibration refers to estimating unknown parameters in a physics-based model from real data. When model assumption is violated, the estimates become inaccurate leading to poor model prediction. Besides, all works ignore the potentially important bias that can occur in the observations. In this work, we develop a methodology for calibrating the physical model in the presence of both model and experimental biases. Two real case studies are presented to demonstrate the prediction ability.

7 - Optimal Reliability Design of Multi-Sensor Systems Using Bayesian Networks

Shahrzad Faghih Roohi, Department of Industrial & Systems Engineering, National University of Singapore, Blk E1, #07-26, Engineering drive 2, Singapore, Singapore, shahrzad.faghihroohi@nus.edu.sg, Min Xie, Kien Ming Ng

This paper presents an efficient approach for reliability analysis of the kind of safety monitoring systems calling multi-sensor systems. The main purpose is to find an optimal reliable configuration of the system which minimizes the total loss caused by abnormality. Using Bayesian Networks, the state probabilities of the sensors are estimated at different trials to be applied for system modelling and optimal decision making. The numerical example shows the proposed approach with more details.

8 - Optimal Supersaturated Design for Penalized Variable Selection Methods

Dadi Xing, Optimal Supersaturated Design for Variable Selection, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States of America, dxing@purdue.edu, Hong Wan, Yu Zhu

In the supersaturated design(SSD)study, most existing criteria for constructing optimal SSD are motivated and further justified from the estimation perspective. We will propose a number of optimality criteria for the construction of SSD from the perspective of penalized variable selection methods. The properties of these criteria will be discussed. A computing algorithm will be used to construct such optimal SSD, examples of simulation and an application of tue algorithm will also be presented.

9 - An Examination of the IRAC Technology List with Fuzzy Analysis

Tiwana Walton, NASA Langley Research Center, 1 N. Dryden St.,Mail Stop 442, Bldg.1209, Hampton, VA, 23681-2199, United States of America, tiwana.l.walton@nasa.gov

The paper focuses on quantitative methods for ranking the Integrated Resilient Aircraft Control (IRAC) Technologies, using the Fuzzy Analysis method. This will be done using a prior study that mapped the IRAC research portfolio (product list) to a set of loss of control events scenarios (IRAC adverse events).

10 - Schooling Genetic Algorithms

Patrick Wanko, PhD Student, North Carolina Agricultural and Technical State University, 1601 E Market Street, McNair Hall, Greensboro, NC, 27411, United States of America, ptwanko@ncat.edu, Paul Stanfield

Genetic Algorithm is a search heuristic that is used to generate useful solutions to optimization and search problems by simulating various processes of natural evolution. When looking at a product from a systemic view, the transpiring analogies with a biological entity suggest quality improvement opportunities through a biological framework. Schooling Genetic Algorithms is a proposed GA based heuristics model that mimics fish schooling to enhance the quality of a product design and life cycle.

11 - A Framework for Variation Visualization and understanding in Complex Manufacturing Systems

Lee J. Wells, Virginia Tech, 250 Durham Hall, Blacksburg, 24061, United States of America, leejay@vt.edu, Jaime A. Camelio, Fadel M. Megahed, William H. Woodall

We provide a framework for visualizing the most significant variation patterns in manufacturing processes using 3D animation software. This framework complements Phase I monitoring methods by enabling users to: 1) acquire detailed understanding of common-cause variability; 2) quickly visualize the effects of this variability with respect to the final product; and 3) identify opportunities for process improvement. The framework is illustrated with data from a US automotive assembly plant.

12 - Analysis of Cell Adhesion Experiments Based on Hidden Markov Models

Yijie Wang, Georgia Tech, 765 Ferst Dr Mainbuilding 233, Atlanta, GA, 30318, United States of America, dylan.jie@gmail.com, Jeff Wu, Ying Hung

This study is motivated by cell adhesion experiment at Georgia Tech. Cell adhesion is mediated by interactions between adhesion proteins and the molecules to which they bind. More than one type of bond is commonly observed. Existing approach is not robust and can only detect one type of bond. A hidden Markov model is proposed by assuming that the probe fluctuates differently according to the binding states. Applications of HMM to real data demonstrate accuracy of estimating kinetic parameters.

13 - Kriging Metamodels in Optimization via simulation

Marilia Perez, UPRM, Mauricio Cabrera-Rios, P.O. Box 9000, ININ, Mayaguez, 00681-9000, Puerto Rico, marilia.perez@upr.edu, Mauricio Cabrera-Rios

This work evaluates the performance of kriging metamodels in optimization via simulation. Of particular interest is the use of simulation models that take long times to run, precluding their intensive use. A simulation optimization method developed by our group makes use of regression metamodels, thus, it is important to know which one is a better metamodeling strategy, using kriging or regression models? Convergence and the quality of the final solution will be the performance measures.

14 - Replacement Decisions with Imperfect Condition Information

Xi Kan, Rensselaer Polytechnic Institute, 285 Sunset Ter., Apt. B-13, Troy, United States of America, cathykan126@gmail.com

We establish a threshold-based replacement policy for a functioning device using real-time sensor information observed through condition monitoring. A two-dimensional Wiener process is used to model device degradation. This model captures the reality that the observed degradation signal may not perfectly capture the true degradation of the device.

15 - Utilizing MADA Methods for Effective Selection of Focus Areas in Critical Infrastructure Recovery

Okan Pala, UNC Charlotte, 9201 University City Blvd, Charlotte, NC, 28213, United States of America, opala@uncc.edu, David Wilson, Ertunga Ozelkan

We present a framework that explores the performance of various Multi-Attribute Decision Analysis (MADA) methods that make recommendations to decision makers for critical infrastructure (CI) recovery. We measure the performance of selected MADA techniques for various outage situations with various preference settings. We have validated our approach by creating lookup table to compare selected MADA methods across various types of CI scenarios in a representative emergency situation.

16 - The Timken Company: Assembly Quality Improvement Project

Sean Whetsel, Quality Engineer, The Timken Company, 3151 Washington Ridge Way, Knoxville, TN, 37917, United States of America, srwhets@g.clemson.edu

One of the key business objectives of The Timken Company is quality. In the rail bearing business, there are four main failure modes for bearing assembly that pose the greatest risk for catastrophic failure. This project involves identifying those risks, planning corrective actions, and implementing a quality improvement project.

■ MB34

C - Room 218A

Operations Research Modeling and Analysis in Healthcare

Sponsor: Health Applications

Sponsored Session

Chair: Keith Willoughby, University of Saskatchewan, 25 Campus Drive, Saskatoon, SK, S7N 5A7, Canada, willoughby@edwards.usask.ca

1 - Evaluating Blood System Logistics Using Operations Research

John Blake, Canadian Blood Services, 5269 Morris Street, Halifax, NS, B3J 2X4, Canada, john.blake@dal.ca

In this presentation we present the results of a year long program to evaluate a proposed change to Canadian Blood Service's logistics network in Atlantic Canada. A physical test comparing current transportation arragements with proposed delivery plans was combined with a simulation to evaluate the impact of network changes on customer service levels.

2 - Improving Hospital-Based Environmental Services Response Times

Murray Côté, Associate Professor, Texas A&M Health Science Center, Health Policy & Management, 1266 TAMU, College Station, TX, 77843, United States of America, cote@srph.tamhsc.edu, Zach Robison

A statistical staffing model for environmental services was developed using well-known queuing relationships. The model, which balances appropriate staffing levels with predicted hourly bed requests, resulted in documented faster response times, without compromising quality, safety, or requiring additional resources. Secondary gains indicated an increase in patient satisfaction scores, employee flexibility, and contributed to decreases in the median discharge time and patient bed placement time.

3 - A Three Step Approach for Analyzing Workflow in Hospital Emergency Departments

Mustafa Ozkaynak, University of Wisconsin-Madison, 301 Eagle Heights #J, Madison, WI, 53705, United States of America, mozkaynak@gmail.com, Patricia F. Brennan

108 patient care episodes were observed in three emergency departments to evaluate a health information exchange initiative. Each patient care episode is denoted by a workflow representation. The collected data was then analyzed using three methods: descriptive summary, visualization and clustering. Each of these methods individually are useful to analyze workflow. In this presentation, we will discuss how using these methods together can be complementary to characterize patient care.

4 - On the Modeling of Location Decisions

Keith Willoughby, University of Saskatchewan, 25 Campus Drive, Saskatoon, SK, S7N 5A7, Canada, willoughby@edwards.usask.ca

Providing institutional services represent multi-million dollar investments for entities throughout the world. We applied operations research to assist an organization in determining the best plant locations under a variety of network configurations. We also identified the factors that most influenced the optimal solution.

■ MB35

C - Room 218B

Nanomanufacturing and Nanoinformatics II

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER 240, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

Co-Chair: Lijuan Xu, PhD Student, University of Southern California, Los Angeles, CA, United States of America, lijuanxu@usc.edu

1 - A Two-stage Modeling Strategy to Quantify Potential Distribution on 2D Nanowire Topography Surface

Xinwei Deng, Assistant Professor, Department of Statistics, Virginia Tech, 406A Hutcheson Hall, Blacksburg, VA, 24061, United States of America, xdeng@stat.wisc.edu, Peter Qian, Xudong Wang, Qiong Zhang

The potential distribution of nanowires can be largely affected by the topography structures of nanowires. A theoretical model using physical laws may not be applicable to describe such complicated relations. We propose a statistical approach to modeling the nanowire's potential in terms of its 2D topography surface. A two-stage interpolation modeling strategy using different kernels is used to fix the singularity problem in fitting and address the nonstationary response in prediction.

2 - Defect Modeling of Silicon Nanowires Towards Improved Nanodevice Reliability

Haitao Liao, Assistant Professor, University of Tennessee, 211 Pasqua Building, Knoxville, TN, 37996, United States of America, hliao4@utk.edu, Jingyan Dong, Yong Zhu

This research explores the interrelationship between various fabrication defects of Silicon nanowires (NWs), mechanical properties of such NWs, and the reliability of NW-based devices. An empirical model is proposed to model defect generation in an NW growth process.

3 - Nanostructure Local Interactions Analysis with Incomplete Measurement

Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER 240, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu, Lijuan Xu

Nanostructure interactions contribute strongly to structure uniformity and defect formation. Our previous study has demonstrated their modeling and estimation based on complete feature measurement. However, because the measurement is time consuming even for a small region, only partial data is practically obtainable. In this talk, we present methods to analyze nanostructure interactions under the constraint of incomplete feature measurement.

4 - Estimation of Length of Nanowires Grown on a 3D Substrate

Honghao Zhao, City University of Hong Kong, Department of Manufacturing Engineering, 83 Tat Chee Avenue, Kowloon, Hong Kong - PRC, honghzhao2@student.cityu.edu.hk, Abhishek Shrivastava, Kwok-Leung Tsui, K.S. Hui

Accurate estimation of nanowire lengths is prerequisite to controlling the fabrication process. In this work, we consider the case where few nanowires can be measured from a single SEM image of the sample. Such a situation may occur when nanowires are grown on a 3D substrate, such as Ni foam. We present a data-driven approach for obtaining good estimates of nanowire lengths in such a case.

5 - Bayesian Modeling of Stochastic Strength for Carbon Nanotubes

Tao Yuan, Assistant Professor, Ohio University, 279 Stocker Center, Athens, OH, 45701, United States of America, yuan@ohio.edu, Suk Joo Bae

One of the main building blocks of nano-devices is the carbon nanotube. A major challenge in the production of nanotubes is controlling and analyzing the important qualities such as length, diameter and strength. This study proposes a Bayesian method of modeling s-distributed strength of carbon nanotubes, based on observations of defect frequency and measured degradation.

■ MB36

C - Room 219A

Computational Intelligence Applications

Sponsor: Telecommunications

Sponsored Session

Chair: Abdullah Konak, Associate Professor, Penn State Berks, Tulpehocken Road, P.O. Box 7009, Reading, PA, 19610, United States of America, konak@psu.edu

1 - Multi-Commodity k-splittable Survivable Network Design Problems with Relays

Ozgur Kabadurmus, PhD Student, Auburn University Department of Industrial and Systems Engineering, 3333 Shelby Center, Auburn, AL, 46849, United States of America, ozk0001@auburn.edu, Alice E. Smith

The network design problem is a well known optimization problem with applications in telecommunication networks, infrastructure designs and military operations. This paper contributes to the literature by devising a formulation and a solution methodology for the multi-commodity k-splittable two edge disjoint survivable network design problem with relays. An exact method and two effective and practical heuristic methods are presented and results are discussed.

2 - Improving Connectivity in Ad Hoc Networks Using Autonomous Agents

Abdullah Konak, Associate Professor, Penn State Berks, Tulpehocken Road, P.O. Box 7009, Reading, PA, 19610, United States of America, konak@psu.edu

This paper presents a decentralized approach to improve the connectivity of Mobile Ad Hoc Networks (MANET) using autonomous, intelligent agents. Autonomous agents are expected to dynamically relocate themselves as the topology of the network changes over the mission time of the network. A flocking-based heuristic algorithm is proposed to determine agent locations. A computational study is performed to investigate the effect of basic flocking behaviors on the connectivity of MANET.

3 - Application of Stochastic Modelling in Identifying Malicious Devices through Unintended Emissions

Shikhar Acharya, Graduate Assistant, Missouri University of Science and Technology, 600 W. 14th St., Rolla, MO, 65409, United States of America, spa2p7@mst.edu, Ritesh Arora, Ivan Guardiola

Emission produced by electronic devices when they are active is called intended electromagnetic emissions whereas emissions produced when the device is switched on but not active is called unintended electromagnetic emissions. Unintended Emissions is different for each device. Using Hidden Markov Model, we can identify the devices through its unintended emissions. Using Hidden Markov Model, we have identified three devices from a distance of 10ft with an accuracy of more than 90%.

■ MB37

C - Room 219B

New Directions in Statistical Process Control Research

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Kaibo Wang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, China, kbwang@tsinghua.edu.cn

Co-Chair: Fadel M. Megahed, PhD Candidate, Virginia Tech, 250 Durham Hall, Blacksburg, 24061, United States of America, fmegahed@vt.edu

1 - Monitoring Bernoulli Processes

William H. Woodall, Professor, Virginia Tech, 406 Hutcheson Hall, Blacksburg, 24061, United States of America, bwoodall@vt.edu

A Bernoulli process is often used to model a series of inspections where items are classified conforming or non-conforming. The effect of estimation of the in-control proportion non-conforming on control chart performance is reported. The required sample sizes are much larger than previously recognized. There is a discussion of Bernoulli CUSUM charts and comparisons using steady-state analysis. We recommend a method of Steiner and MacKay (2004) for identifying a continuous variable to monitor.

2 - Directional Control Schemes for Multivariate Categorical Processes

Jian Li, HKUST, Flat C, 11/F, Block 3, On Ning Garden, 10 Sheung Ning Road, Tseung Kwan O, Hong Kong, Hong Kong - PRC, jianli@ust.hk, Fugee Tsung, Changliang Zou

A novel Phase II log-linear directional control chart is proposed, which exploits directional shift information and integrates the monitoring of multivariate categorical processes into the unified framework of multivariate binomial and multivariate multinomial distributions. A diagnostic scheme is also suggested for identifying the shift direction. Both the control chart and the diagnostic approach are simple and quick to compute. Numerical simulations demonstrate their effectiveness.

3 - A Spatial Scan Statistic for Specific Populations

Xiaobei Shen, PhD Candidiate, Hong Kong University of Science and Technology, 205A,Tower B,HKUST, Hong Kong, China, fayshen@ust.hk, Wei Jiang, Fugee Tsung

To detect the abnormal pattern caused by certain factors we are interested in, a spatial scan statistic for specific populations is proposed to search possible clusters emerging in some special populations affected by those factors while simultaneously considering the information from remaining populations.

4 - Using GLR Control Charts for Process Monitoring

Marion R. Reynolds, Jr., Professor Emeritus, Virginia Tech, 411 Hutcheson Hall, Blacksburg, 24061, United States of America, mrr@vt.edu, Jianying Lou, Jaeheon Lee

Generalized likelihood ratio (GLR) control charts are well-known to many researchers, but are not well known to practitioners for standard problems such as monitoring the mean and variance. It is argued here that GLR charts effectively detect a wide range of shift sizes and provide an attractive option. In addition, GLR charts do not require practitioners to specify multiple control chart design parameters. Tables of control limits make it very easy for practitioners to design GLR charts.

■ MB38

H- Johnson Room - 4th Floor

Facility Location under Uncertainty II

Sponsor: Location Analysis

Sponsored Session

Chair: Larry Snyder, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, larry.snyder@lehigh.edu

1 - Mitigation of Hub Congestion: Temporary Hubs and Dynamic Routes

Yu An, University of South Florida, 4202 Fowler Avenue, Tampa, FL, United States of America, yan2@mail.usf.edu, Bo Zeng, Yu Zhang

One of the most significant issue of hub-spoke systems is hub congestion, which causes a huge amount of loss in air industry. We develop a hub-spoke model with temporary hubs and routes to deal with peak traffic. A non-linear mixed integer programming formulation is proposed with the congestion modeled as an exponential function. Algorithm using generalized Benders Decomposition is developed to solve the problem successfully

2 - The Impact of Cost Uncertainty on the Location of a Distribution Center

Seokjin Kim, Assistant Professor, Suffolk University, Sawyer Business School, 8 Ashburton Place, Boston, MA, 02108, United States of America, kim@suffolk.edu, Mozart Menezes, Rongbing Huang

A distribution center is to be located on a demand-populated unit line or plane with pre-located suppliers offering uncertain prices following some distributions. Switching freely among suppliers, the buyer of a product attempts to minimize the sum of the inbound and outbound transportation costs, and the price charged by a chosen supplier. We characterize the optimal location of the buyer's distribution center and show that the buyer benefits from the price variability.

3 - A Joint Location-inventory Model with Supply Disruptions

Tolga Seyhan, PhD Candidate, Lehigh University, Industrial and Systems Eng. Department, 200 W Packer Avenue, Bethlehem, PA, 18015, United States of America, tolgaseyhan@lehigh.edu, Larry Snyder, Z. Max Shen

We incorporate inventory costs and potential supply disruptions into the facility location problem. These factors favor conflicting business strategies (risk pooling vs. diversification) and network structures (centralized vs. decentralized). We demonstrate how to combine them in a single model and present a mixed integer programming formulation. Our model finds the right balance between the network structures by employing the right business strategies at the right place.

■ MB39

H - Morehead Boardroom -3rd Floor

Panel Discussion: Becoming an O.R./ Analytics Newsmaker

Cluster: INFORMS Members who Succeed in Media Relations

Invited Session

Chair: Barry List, Director of Communications, INFORMS, 7240 Parkway Dr., Hanover, MD, 21076, United States of America, Barry.List@INFORMS.org

1 - Becoming an O.R./Analytics Newsmaker

Moderator: Barry List, Director of Communications, INFORMS, 7240 Parkway Dr., Hanover, MD, 21076, United States of America, Barry.List@INFORMS.org, Panelists: Sheldon Jacobson, Margaret Brandeau, Jack Levis, Anna Nagurney

With interest greatly increasing in operations research and analytics, INFORMS members are reaching larger audiences through newspapers, business and science magazines, radio, TV, and, of course, social media. In this panel discussion, INFORMS Communications Director Barry List talks with INFORMS newsmakers about their experience with the media, how they work with their organizations' public information officers, what it's like interacting with reporters, and how other operations researchers can bring their important work to the attention of the public.

■ MB40

H - Walker Room - 4th Floor

Knowledge Learning and Intellectual Capital (KLIC)

Sponsor: Technology Management

Sponsored Session

Chair: Charles Weber, Associate Professor, Portland State University, P.O. Box 751, Engineering and Technology Management, Portland, OR, 97207, United States of America, webercm@gmail.com

1 - Experiments on Workaround Behaviors

Anita Tucker, Associate Professor, Harvard University, 413 Morgan Hall, Soldiers Field, Boston, MA, 02163, United States of America, atucker@hbs.edu

A series of laboratory experiments on workaround behaviors were conducted to understand the conditions under which employees will seek to address the underlying system problem rather than just working around obstacles.

2 - The Impact of Learning-curve Heterogeneity and Workload on Orthopedic Procedure Times

Michael Lapre, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States of America, michael.lapre@owen.vanderbilt.edu, David Moore

Prior studies of service times have investigated the impact of (1) individual, team, and organizational learning; (2) learning-curve heterogeneity; and (3) workload. However, evidence for each factor has been reported without controlling for the other factors. We study the combined impact of all three factors on orthopedic procedure times.

3 - Knowledge in Multi-Disciplinary Teams

Zeynep Erden, Post Doctoral Researcher, ETHZ, Zuerich, Switzerland, zerden@ethz.ch, Georg von Krogh, Andreas Schneider

Prior research accepted and repeatedly emphasized that communication and collaboration across various scientific domains critically depend on distinct levels of overlap between their knowledge bases. However, less is known on different types of knowledge and shared experience across scientists in multidisciplinary teams. The purpose of this research project is to close this gap by gaining an in-depth understanding on the nature of knowledge in multidisciplinary teams.

4 - Towards a Knowledge-based View of the Nation

Charles Weber, Associate Professor, Portland State University, P.O. Box 751, Engineering and Technology Management, Portland, OR, 97207, United States of America, webercm@gmail.com, Pattravadee Ploykitikoon

A study of the national laboratories in Thailand suggests that different success factors affect national absorptive capability at different stages of the R&D process. Many of the concepts of the Knowledge-Based View of the Firm can be applied at the national level.

■ MB41

H - Waring Room - 4th Floor

Innovation and the Global Economy

Cluster: New Product Development

Invited Session

Chair: Erica Fuchs, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, erhf@andrew.cmu.edu

1 - Democratizing Scientific Communities? from Peer-to-Peer to Formal Organizations

Jeff Furman, Boston University, 595 Commonwealth Avenue #653a, Boston, MA, 02215, United States of America, furman@bu.edu, Fiona Murray

The production of scientific knowledge is shaped through both informal structures and formal structures. In this paper, we take advantage of a series of natural experiments involving culture collections to investigate whether the introduction of a formal institution governing the exchange of research inputs has a democratizing impact on scientific production. We find that more open access leads to an expansion in the research community, particularly among lower status actors.

2 - Economic Downturns, Technology Trajectories and the Careers of Scientists

Eyiwunmi Akinsanmi, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 129, Pittsburgh, PA, 15213, United States of America, eyiwunmi@cmu.edu, Ray Reagans, Erica Fuchs

This research explores the relationship between the telecommunications bubble burst and the rate and direction of U.S. innovation. We focus on "optoelectronics", a general purpose technology, and the emerging "integration" technologies that facilitate optoelectronics application to fields outside telecommunications. Using USPTO patents and inventor CVs, we analyze the relationship between an inventor's pre-bubble characteristics and his patenting post-burst and thereby the national trend.

3 - When are There Not Bubbles?

Brent Goldfarb, University of Maryland, Robert H. Smith School of Business, College Park, MD, 20742, United States of America, bgoldfarb@rhsmith.umd.edu, David Kirsch

Many studies of financial manias and crises fail to compare times of turmoil to times of stability, and hence, by design, cannot ascertain root causes bubbles. We document financial and industrial histories and the presence or absence of speculation of a variety of new technologies introduced since 1880. Several factors are empirically associated with manias and crises: novice investors, belief-coordinating events and market liquidity. We explore consequences of manias and policy implications.

4 - Organizational Determinants of Technology Commercialization Strategy Given Greenfield Competition

Matt Marx, Massachusetts Institute of Technology, 100 Main St, Cambridge, MA, United States of America, mmarx@mit.edu

How do entrepreneurs select among alternative paths for commercializing new technologies? Past studies of technology commercialization strategy have focused primarily on the external environment, neglecting the role of organizational factors. We summon evidence from a census of the 645 speech recognition firms, and find that founders with experience in the technology are more likely to select a cooperative commercialization mode, and that they are more likely to evolve their strategy.

■ MB42

H - Gwynn Room - 4th Floor

The Dynamics of Online Social Network

Sponsor: Information Systems Society

Sponsored Session

Chair: Yingda Lu, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, yingdal@andrew.cmu.edu

1 - Crowdsourcing "Blockbuster" Ideas: A Dynamic Structural Model of Ideation

Yan Huang, PhD Student, Heinz College, Carnegie Mellon University, Pittsburgh, PA, 15213, United States of America, yanhuang@andrew.cmu.edu, Kannan Srinivasan, Param Vir Singh

We propose and estimate a structural model of users' idea contribution dynamics in crowdsourcing initiatives. We find that users tend to significantly underestimate firm's costs of implementation of their ideas in the beginning and thus post many unviable ideas. However, users learn about their abilities to generate "blockbuster" ideas and the cost structure of the firm from peer voting and firm's response to all posted ideas. As a result, the average quality of ideas improves over time.

2 - Information overload and Network Evolution

Lu Yan, University of Washington, Foster School of Business, Seattle, WA, United States of America, lucyyan@uw.edu, Jianping Peng, Yong Tan

This paper investigates how people in an online health social network identify and connect to other people so as to obtain useful and timely information. We are particularly interested in examining one of the driving forces for network formation and evolution: homophily phenomena at the dyadic level. By incorporating unobserved latent spaces among patients into the model, we find that an individual's visibility (prestige) in the online network will increase the probability of being contacted.

3 - Auto-probit Model for Multiple Regimes of Social Network Effects
Bin Zhang, Carnegie Mellon University, 3036 Hamburg Hall, Pittsburgh, PA, 15213, United States of America, binzhang@cmu.edu, Andrew Thomas, David Krackhardt, Ramayya Krishnan

Current methods to investigate autocorrelated network effects on the actors are primitive. An actor often is under influence of multiple social networks. If we want to compare which one is more influential in actor's binary decision, nearly no model exists. We developed two new auto-probit solutions using MLE and Bayesian that can accommodate multiple network structures. The behaviors of the solutions, such as the impact of prior distribution on parameter estimation, are also studied.

■ MB43

H - Suite 402 - 4th Floor

Joint Session ENRE/Optimization: Operations and Planning Problems in Energy Markets: MPEC/EPEC Approaches

Sponsor: Energy, Natural Resources and the Environment - Energy/Optimization-Stochastic Programming

Sponsored Session

Chair: Antonio J. Conejo, Professor, University Castilla - La Mancha, Electrical Engineering, Ciudad Real, 13071, Spain, antonio.conejo@uclm.es

1 - Strategic Generation Investment in a Pool-based Electricity Market: An MPEC Approach
S. Jalal Kazempour, PhD Student, University of Castilla La Mancha, Electrical Engineering, Ciudad Real, Spain, jalal.kazempour@gmail.com, Antonio J. Conejo, Carlos Ruiz Mora

We study the strategic generation investment problem in a network-constrained electricity pool. A single target year is considered while uncertainties are modeled via scenarios. A bilevel model represents the behavior of the strategic producer that maximizes its expected profit subject to market clearing conditions per demand block and scenario. Replacing each lower-level problem with its equivalent KKT conditions renders an MPEC that can be recast as a tractable MILP.

2 - Wind Power Investment: An MPEC Approach
Luis Baringo, PhD Student, University of Castilla-La Mancha, Campus Universitario s/n, E.T.S.I. Industriales, Ciudad Real, 13071, Spain, Luis.Baringo@uclm.es, Antonio J. Conejo

A relevant problem for wind power investors is determining the optimal location and sizing of new wind plants to be built within an existing transmission network. We consider a pool-based electricity market and formulate this problem as a stochastic MPEC, which can be recast as a tractable MILP problem. Uncertain data involve future load and wind production.

3 - A Stochastic Complementarity Model for Pipeline Transport Booking with Disruptable Services
Asgeir Tomasgard, professor, NTNU, Alfred Getz vei 1, Trondheim, 7024, Norway, asgeir.tomasgard@iot.ntnu.no, Marte Fodstad, Ruud Egging, Kjetil Midthun

We study booking of transportation capacity in a natural gas network. In the first stage the large producers book firm capacity within their predefined capacity rights. They can also book disruptable capaity fom the ISO. In the second stage there is a redistribution of capacity in a bilateral secondary market, where also a competitive fringe participates. Here the network operator can sell remaining capacity in the system and withdraw capacity from the disruptable service.

4 - Modelling the Interaction between Electricity Generation Portfolios
Fernando Oliveira, Associate Professor of Operations Management, ESSEC Business School, Avenue Bernard Hirsch - BP 50105, Cergy-Pontoise CEDEX, 95021, France, oliveira@essec.fr

We present a game-theoretical model to analyze the relationship between spot and forward markets, taking into account generation constraints and price caps. We then use an evolutionary model to test the stability of the different equilibria. We then extend our results to consider start-up and shut-down costs, and to model the technologies owned by the different generators. We present an application of our model to the analysis of typical trading days in the Iberian electricity market.

■ MB44

H - Suite 406 - 4th Floor

Undergraduate II

Cluster: Undergraduate Operations Research Prize

Invited Session

Chair: Feryal Erhun, Stanford University, MS&E, Stanford, CA, United States of America, feryal.erhun@stanford.edu

1 - A Reliability System for Staffing Ambulances During Blizzards with System Adaptation
Amber Kunkel, Rice University, Houston, TX, United States of America, agkunkel@gmail.com, Laura McLay

Emergency medical services (EMS) provide a vital service during severe weather events such as snowstorms. Snow events cause increased load on the system by both increasing call volumes and lengthening service times. We examine how to set staffing levels during and immediately following blizzards using simulation and reliability models. In addition, we evaluate the effect that system adaptation to snow and increased call volumes has on the simulations.

2 - An Investigation Into Instructor Staffing at Oklahoma State University Fire Service Training
Austin Buchanan, Oklahoma State University, Stillwater, OK, United States of America, austin.buchanan@okstate.edu, Adrian Smith

Oklahoma State University Fire Service Training (OSU FST) provides training for Oklahoma's emergency responders. OSU FST employs a set of 239 independently contracted part-time instructors to teach the classes. Through integer programming models and heuristics, the team identified four instructor cadres (or sets), each with no more than 80 instructors. The design team then used simulation to evaluate these cadres for robustness of instructor experience and travel costs under randomized course demands. The final recommended instructor cadre requires only 1/3rd of the original instructors and has an average instructor experience 2.5 times that of the current list.

3 - Logistics of Mobile Blood Donation Collection at the Turkish Red Crescent
Feyza Sahinyazan,Bilkent University, Ankara, Turkey, sahinyazan@bilkent.edu.tr, Bahar Yetis Kara, Mehmet R. Taner

This study analyzes the logistics and scheduling blood donation activities via mobile units at Turkish Red Crescent. The objective is to maximize the blood collected while keeping the associated logistics costs low. Nature of the blood collection process causes the models to involve both a VRP component to determine the routes of the collector vehicles and an integrated TSP for the daily routes of the transporter vehicle. The VRP also has a time dimension due to the possible stay-overs of the collectors at certain locations. The purpose of our study is to develop alternative mathematical models to solve the problem and to perform computational experimentation to compare their performance. These experimentations are performed using real-life distance and blood data of Ankara, the capital city of Turkey.

■ MB45

H - Suite 407 - 4th Floor

Procurement Auctions and Combinatorial Exchanges

Cluster: Auctions

Invited Session

Chair: Damian Beil, Associate Professor, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, dbeil@umich.edu

1 - Models for understanding the Role of Incentives in Transportation Procurement Auctions
Diwakar Gupta, University of Minnesota, 111 Church Street SE, Minneapolis, MN, United States of America, guptad@me.umn.edu, Justin Azadivar

We present an abstract mathematical framework for deciding when a state transportation agency (STA) should offer quality incentives in transportation procurement auctions for construction projects. We find that, given good knowledge about the types of contractors who will bid, an STA can choose an incentive structure to reduce costs, but the incentive offered is frequently less than the actual value of quality to the STA.

2 - Gathering Pre-auction Intelligence on Suppliers
Yan Yin, Doctoral Candidate, University of Michigan, Stephen M. Ross School of Business, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, yinyan@umich.edu, Hyun-Soo Ahn, Damian Beil

We study whether buyers should undertake costly efforts to learn suppliers' costs directly, versus relying on an auction's downward pricing pressure to reveal this information. This work is inspired by real world techniques that allow buyers to improve their estimates of suppliers' costs (such as rapid plant assessments). We characterize how the buyer's preference depends on the number of suppliers, suppliers' cost structures and her prior information.

3 - Division of Surplus in Combinatorial Exchanges
Bob Day, Assistant Professor, University of Connecticut, 2100 Hillside Rd, Unit 1041, Storrs, CT, 06269-1041, United States of America, bob.day@business.uconn.edu

I propose a new approach for determining budget-balanced payments in an efficient combinatorial exchange, with one-sided core-selected payments that match counter-offers. We compare this new method to the two prominent alternative algorithms discussed in the recent literature, showing some substantial benefits of this new variation.

4 - Deploying Test Auctions to Assist with Supplier Qualification Decision-making
Brendan See, Graduate Student, University of Michigan, Industrial & Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, bdsee@umich.edu, Izak Duenyas, Damian Beil

Potential suppliers must undergo a costly qualification process prior to competing in a procurement auction. We evaluate when a buyer can benefit from holding multiple auctions when the supply base consists of both qualified and not-yet-qualified suppliers with asymmetric costs. The buyer faces a trade-off between increased supplier competition and revealing supplier cost information through the use of a test auction. We then allow the buyer to implement a credible reserve price and TIOLI offer.

■ MB46

H - Suite 403 - 4th Floor

Joint Session INFORM-ED/ Analytics: Panel Discussion: Role of OR/MS in Undergraduate Business Education Today

Sponsor: INFORM-ED/Analytics

Sponsored Session

Chair: Susan Palocsay, Professor, James Madison University, 800 S. Main Street, MSC 0202, CIS & MS Department, Harrisonburg, VA, 22807, United States of America, palocssw@jmu.edu

1 - Role of OR/MS in undergraduate Business Education Today
Moderator: Susan Palocsay, Professor, James Madison University, 800 S. Main Street, MSC 0202, CIS & MS Department, Harrisonburg, VA, 22807, United States of America, palocssw@jmu.edu, Panelists: Ina Markham, Kellie Keeling, Michael Gorman, Eric Huggins

This panel will discuss the role of OR/MS in accredited business school curricula at the undergraduate level. Topics include the current state of OR/MS in business education, interdisciplinary relationships with statistics and operations management, identification of quantitative skills sets needed, and connections with business analytics. Both academic and industry perspectives will be discussed.

■ MB47

H - Dunn Room - 3rd Floor

Topics in Vehicle Routing

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Tom Van Woensel, Professor of Freight Transport and Logistics, Eindhoven University of Technology, School of Industrial Engineering, Eindhoven, BR, Netherlands, t.v.woensel@tue.nl

1 - The Split Delivery Capacitated Team Orienteering Problem
Grazia Speranza, University of Brescia, C.da S.Chiara 50, Brescia, Italy, speranza@eco.unibs.it, Claudia Archetti, Nicola Bianchessi, Alain Hertz

In the Capacitated Team Orienteering Problem (CTOP) a set of customers has to be identified to maximize the profit, with constraints on route duration and vehicle capacity. We study the Split Delivery Capacitated Team Orienteering Problem (SDCTOP). We show that the profit collected in the SDCTOP may be as large as twice the profit collected in the CTOP. We present a branch-and-price algorithm and two heuristics and computational results.

2 - The Driver Routing Problem
Johan Oppen, Associate Professor, Molde University College, PO Box 2110, Molde, 6402, Norway, johan.oppen@hiMolde.no

A transportation service is offered to bring people home in their own vehicles. The company uses several modes of transportation to bring drivers between locations. The associated planning problem can be modelled as a dynamic and stochastic Vehicle Routing Problem with multiple transportation modes. We present a mathematical model and discuss solution methods for the simplified version where all demand is known in advance.

3 - Vehicle-routing Problems with Min-Max Objective and Stochastic Travel Times
Tim Urban, Professor, The University of Tulsa, Operations Management, 800 South Tucker Drive, Tulsa, OK, 74104, United States of America, timothy-urban@utulsa.edu

A familiar variant of the vehicle-routing problem is one with an objective of minimizing the time to complete the longest route. Stochastic travel times add substantial complexity, as the use of extreme-value theory becomes necessary to identify the minimum of several random variables; the correlation of travel times further complicates the analysis. We examine the effect of correlated stochastic travel times on the min-max objective and solution of VRPs and other node- and arc-routing problems.

4 - Dynamic Routing in the Vehicle Routing Problem with Stochastic Demands
Lei Zhao, Associate Professor, Tsinghua University, Department of Industrial Engineering, Beijing, China, lzhao@tsinghua.edu.cn, Yue Tong, Chen Zhang, Tom Van Woensel, Jan C. Fransoo

With the fast development in the accessibility of geographic and traffic information, communication, and computing power, dynamic re-routing of vehicles during the delivery or pickup process becomes possible. We study the application of approximate dynamic programming in dynamic routing in the vehicle routing problem with stochastic demands and analyze the value of information.

■ MB48

H - Graham Room - 3rd Floor

Advances in Traffic Networks

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Yi-Chang Chiu, Associate Professor, Department of Civil Engineering and Engineering Mechanics, 1209 E 2nd Street, Tucson, AZ, 85721, United States of America, chiu@email.arizona.edu

1 - Optimization of Work-zone Scheduling with Traffic Equilibrium
Hong Zheng, Postdoc Researcher, University of Arizona, 1209 E. Second Street, Tucson, AZ, 85721-0072, United States of America, hzheng@email.arizona.edu, Yi-Chang Chiu, Chengdong Cai, Vinayak V. Dixit, Eric Nava, Essam Radwan

In this talk we present an optimization model of work zone scheduling to minimize traffic delay (user costs) considering traffic divergence. The developed method considers day and night effects as wells as agency costs. We use an approximation approach to estimate the new user equilibrium (UE) travel time under divergence to calculate the traffic delay, instead of solving UE from scratch to speed up computational time. A numerical example is presented.

2 - A Routing Behavior Model for Vacant Taxi Cabs in Urban Traffic Networks

Song Gao, Assistant Professor, University of Massachusetts Amherst, 130 Natural Resources Road, 214C Marston Hall, Amherst, MA, 01003, United States of America, songgao@ecs.umass.edu, Yi-Chang Chiu, Dung-Ying Lin, Xianbiao Hu

In this rsearch, we propose a vacant taxi routing model that is conceived based on the above behavior propositions, where taxi drivers are assumed to minimize expected search time for customers when making routing decisions at intersections. A probabilistic dynamic programming formulation of the problem and the solution algorithm are presented. We conduct numerical analysis on a hypothetical network inspired by the traffic network structure in the City of Taipei. The outcome of this study has shed light on routing decisions of taxi drivers, which will directly support area-wide traffic management. Further research on how to incorporate ITS technologies such as taxi fleet GPS data to effectively collect vehicle position, action, and behaviour data for model calibration is also discussed.

3 - Modeling Within-day Activity Rescheduling Decisions Considering Time-varying Network Conditions

Yunemi Jang, University of Arizona, Tucson, AZ, United States of America, Yunemi@gmail.com, Yi-Chang Chiu, Hong Zheng

In this talk, we present a utility maximization activity schedule adjustment decision problem formulation, which captures the internal decision dynamics between activity scheduling problem and time-varying network conditions. A solution algorithm is proposed to ensure solution consistency when considering time-varying travel cost. Numerical cases are demonstrated through the integration of the DTA model DynusT.

4 - A Stochastic Model of Traffic Flow

Henry Liu, Associate Professor, University of Minnesota, Minneapolis, MN, United States of America, henryliu@umn.edu, Saif Jabari

In a variety of applications of traffic flow, one requires a probabilistic model of traffic flow. The usual approach to constructing such models involves the addition of random noise terms to deterministic equations, which could lead to negative traffic densities and mean dynamics that are inconsistent with the original deterministic dynamics. In this talk, we will present a new stochastic model of traffic flow that addresses these issues.

■ MB49

H - Graves Room - 3rd Floor

Joint Session Simulation/APS: Simulation Optimization

Sponsor: Simulation/Applied Probability

Sponsored Session

Chair: Shane Henderson, Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu

1 - Approximation to Probability Optimization Problems Using Monte Carlo Sampling Methods

Sujin Kim, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Singapore, 11757, Singapore, iseks@nus.edu.sg, Dali Zhang

We propose a sample average approximation scheme for solving probability optimization problems. Mathematical analysis shows that the stationary points of the approximate problem converge to the true stationary points, as sample size increases. For problems in which the analytical forms of the objective functions are unavailable, we explore a direct search algorithm based on the approximation scheme. Numerical experiments illustrate how the proposed algorithm can be implemented.

2 - Stochastic Approximation over Multi-dimensional Discrete Sets

Eunji Lim, University of Miami, 281 McArthur Bldg, Coral Gables, FL, United States of America, lim@miami.edu

We propose new methods to solve simulation optimization problems over multi-dimensional discrete sets. The proposed methods are based on extending the objective function from a discrete domain to a continuous domain and applying stochastic approximation to the extended function. The extension of the objective function is constructed using a piecewise linear interpolation of the original objective function. We discuss asymptotic properties of the proposed methods and present numerical results.

3 - On the Exploration-exploitation Trade-off in Simulation-optimization Algorithms

Raghu Pasupathy, Virginia Institute of Technology, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, pasupath@vt.edu

Many simulation-optimization algorithms explicitly or implicitly include two repeating steps: (i) select a system to simulate according to a specified probability law; and (ii) execute simulation(s) on the chosen system, and update relevant estimators. In such algorithms, what can be said about the nature of (i) and (ii) to guarantee efficiency? We extend Glynn and Juneja's influential 2004 paper towards answering this question, with interesting implications for algorithm development.

4 - A Bayesian Approach to Stochastic Root Finding

Shane Henderson, Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu, Peter Frazier, Rolf Waeber

We study a stylized model of stochastic root finding in one dimension using Bayesian ideas to obtain algorithms. One class of algorithms repeatedly updates a density giving, in some sense, one's belief about the location of the root. We demonstrate how the algorithm works, and provide some convergence results.

■ MB50

H - Ardrey Room - 3rd Floor

Optimization Models in Data Mining with Applications

Sponsor: Data Mining

Sponsored Session

Chair: Petros Xanthopoulos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32601, United States of America, petrosx@ufl.edu

1 - Predictive Model for Alzheimer's Disease and Mild Cognitive Impairment

Eva Lee, Professor & Director, Georgia Insitute of Technology, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu, Tsung-Lin Wu

This work is joint with Emory Center for Neurodegenerative Disease and Alzheimer's Disease Center and the Department of Neurology. Early detection of cognitive impairment or Alzheimer's Disease is key to successful treatment. In this study, we present an optimization-based classification model and feature selection algorithms to predict the cognitive status of a group of individuals. The study is intended for clinical decision making for early diagnosis and successful treatment.

2 - Clusterwise Linear Regression with L1 Norm: An MIP Approach

Nan Kong, Purdue University, School of Biomedical Engineering, West Lafayette, IN, United States of America, nkong@purdue.edu, Zhen Zhu

The clusterwise linear regression problem is intended to estimate parameters in multiple linear regression models. Meanwhile, the observation data form clusters, each of which corresponds to a regression line. In this paper, we show that by using the absolute distance (L1 norm), we can reformulate the problem as an MIP. Based on the MIP reformulation, we develop an unsupervised algorithm that simultaneously determines the number of clusters, data point membership, and outliers.

3 - Robust Optimization in Supervised Learning

Petros Xanthopoulos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32601, United States of America, petrosx@ufl.edu

Data imprecision and uncertainties make essential the need for robust methods. It is possible that such impurities affect the solutions quality. When it comes to supervised learning this is interpreted in poor classification accuracy. Robust optimization aims to deal with this problem. In this work we present some robust optimization models applied in supervised learning theory.

4 - Optimization Approach in Biomedical Problem

Dmytro Korenkevych, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, korenkevych@gmail.com

Modern medical examination techniques and devices provide vast amount of data containing valuable information about the patient. The large size of the data however often makes it challenging to efficiently derive this information. Optimization techniques may prove to be beneficial in analyzing such data in terms of both computational efficiency and quality of the results.

■ MB52

H - North Carolina - 3rd Floor

SpORts (Sports Analytics) I

Sponsor: SpORts (Sports Analytics)

Sponsored Session

Chair: Joel Oberstone, Professor, Business Analytics, University of San Francisco, School of Management, Department of Analytics & Technology, 2130 Fulton Street, Malloy Hall 219, San Francisco, CA, 94117, United States of America, joel@usfca.edu

1 - Data Driven Decisions on the Diamond

Sig Mejdal, Director, Amateur Draft Analytics, St. Louis Cardinals, St. Louis, MO, 63102, United States of America, smejdal@cardinals.com

Many baseball teams are bringing in persons with quantitative backgrounds to assist in the decision making process. Mr. Mejdal is one of those lucky few. He will share a bit about the data available, the processes and analysis used, and some examples of how this quantitative analysis has played a part in the Cardinals decision making.

2 - Luck and Winning on the PGA Tour

Mark Broadie, Carson Family Professor of Business Administration, Columbia University, Graduate School of Business, New York, NY, 10027, United States of America, mnb2@columbia.edu, Richard J. Rendleman, Jr.

Golfers need to be highly skilled in order to compete on the PGA Tour, let alone to win an event. Connolly and Rendleman (2008) have shown that it takes approximately ten strokes of favorable random variation in scoring for most golfers to win a typical PGA Tour event. Using the strokes gained measure in Broadie (2011), we analyze the extent that favorable random variation experienced by tournament winners reflects luck versus a temporary increase in skill.

3 - Teaching Sports and Entertainment Analytics

Srinivas Krishnamoorthy, University of Western Ontario, Richard Ivey School of Business, London, ON, Canada, skrishnamoorthy@ivey.ca

This talk will focus on the design and delivery of the Sports and Entertainment Analytics course offered at The Richard Ivey School of Business. The course focuses on the use of data and models for improving decision making in the sports and entertainment industries. Students also obtain an analytics perspective of sports related phenomena like "The Hot Hand". The course consists of three modules: Chance Analytics, Game Analytics and Business Analytics.

■ MB54

H - Charlotte Hall - 3rd Floor

Daniel H. Wagner Prize for Excellence in Operations Research

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research

Invited Session

Chair: Allen Butler, Daniel H Wagner Associates, 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, Allen.Butler@va.wagner.com

1 - iSchedule to Personalize Learning

Adeline Kuo, Analytics Operations Engineering, Inc., Boston, MA, United States of America, akuo@nltx.com, Anjuli Kannan, Gerald van den Berg

We present a tool to assist schools in the NYC Innovation Zone with generating student-centered course schedules. The core algorithm breaks the scheduling problem into a series of sub problems and applies graph-based randomized heuristics, then outputs a diverse set of schedules among which the school principal can ultimately choose. Our tool reduces the annual work load for each school from 8 weeks to 2 weeks, while affording administrators more choice and flexibility.

2 - Product Line Design and Scheduling at Intel

Karl Kempf, Intel Corporation, Decision Engineering Group, 5000 W. Chandler Blvd., Chandler, AZ, 85226, United States of America, karl.g.kempf@intel.com, Evan Rash

We described a holistic model for the product line design and scheduling problem that incorporates market requirements, design engineering capabilities, manufacturing costs, and temporal dynamics. The key idea is the decomposition of the problem into 1) an outer genetic algorithm layer handling resource constraints, scheduling, and financial optimization and 2) an inner mathematical programming layer optimizing product design as classic set-covering. The resulting algorithm solves problems of larger size and higher complexity than previously possible.

■ MB55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS: Analytics in the Petrochemical Industry

Sponsor: Analytics/ CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Marlize Meyer, Principal Operations Researcher, Sasol Technology (Pty) Ltd, 1 Klasie Havenga, Sasolburg, 1947, South Africa, marlize.meyer@sasol.com

1 - Value Chain Process Modeling for Sasol, a South African Petrochemicals Company

Johan de Bruyn, Chief Process Engineer, Sasol Technology (Pty) Ltd, North Park Offices, Synfuels Road, Secunda, 2302, South Africa, johan.debruyn@sasol.com

Sasol has developed a spreadsheet model, tracking over 400 molecules across more than 40 operating units. Due to the highly integrated fuels and chemicals businesses, a molecular basis was required. Process steps were modeled with the aid of Visual Basic programming. This model has facilitated factory-wide impact and optimization studies, the integration of new operating units, as well as expansion programs, ensuring that market demands are being met at the required qualities.

2 - Analytics at Chevron

Margery Connor, Chevron, 6001 Bollinger Canyon Road, Room G-2016, San Ramon, CA, 94583, United States of America, MHCO@chevron.com

Chevron has been capitalizing on analytics for many years, and this talk will present it's many broad applications, including: analyzing seismic data to find more oil; managing our supply chains to reduce our costs; applying game theory to improve our outcomes in negotiations and bids; incorporating decision analysis in our project management practice. We will discuss how we are using analytics today as well as where we are going in this area.

3 - Using Stochastic Operations and Reliability Modeling in the Design of Chemical Processing Facilities

Leilani Meijer, Senior Operations Researcher, Sasol Technology (Pty) Ltd, North Park Offices, Synfuels Road, Secunda, 2302, South Africa, leilani.meijer@sasol.com

A new chemical processing plant is usually complex and requires large capital expenditure. If it must integrate into an existing facility the risks can be high. During operations the facility will be subject to variable feed volumes and composition, variable failure patterns and operating philosophies. How can we ensure that the proposed plant has sufficient processing and storage capacity, both now and in future without adding unnecessary redundancy and costs?

■ MB56

H - Biltmore Boardroom - 2nd Floor

Health Care, Modeling and Optimization

Contributed Session

Chair: Raja Jayaraman, Assistant Professor, Khalifa University of Science, Technology & Research, P O Box 127788, Abu Dhabi, United Arab Emirates, raja.jayaraman@kustar.ac.ae

1 - Optimality of Transshipment Policy for Perishable Medical Goods Using a Semi-Markov Decision Process

Carl Morris, Student, Georgia Institute of Technology, 19 Buck Egger Rd, Caledonia, MS, 39740, United States of America, carl.morris@gatech.edu, Mingzhou Jin

This paper considers the inventory problem of expensive, critical, slow-moving, perishable medical goods. We study transshipment to reduce expiration, using a semi-Markov decision process to create an optimal transshipment policy. Ages of goods define process states, with transition probabilities from discretized exponential distributions for demand interarrival times. Numerical experiments demonstrate significant cost savings from transshipment. Structure of the optimal policy is investigated.

2 - Optimization Models for Allocating Medical Supplies under Severe Uncertainty

Dongxue Ma, University of Louisville, Department of Industrial Engineering, Louisville, 40292, United States of America, d0ma0001@louisville.edu, Lijian Chen, Sunderesh Heragu

A unique combined method named "Resource Reservation" will be proposed to address the problem of medical supplies allocation in the aftermath of a pandemic influenza or other viral attack. This method can yield optimized and robust results with robust risk control mechanism in real time, especially under severe uncertainty.

3 - Supply Chain Network Design of a Sustainable Blood Banking System

Amir Masoumi, Doctoral Student, University of Massachusetts Amherst, Department of Finance and Operations Mgt, Isenberg School of Management, Amherst, MA, 01003, United States of America, amasoumi@som.umass.edu, Anna Nagurney

We develop a sustainable network design/redesign model for the complex supply chain of human blood, which is a valuable yet highly perishable product. Our multicriteria system-optimization approach on networks with arc multipliers captures critical concerns associated with blood banking systems such as the determination of the optimal capacities and allocations, and the induced cost of discarding potentially hazardous blood waste, while the uncertain demand is satisfied as closely as possible.

4 - Using Markov Models to Support the Identification of Risk in Healthcare Systems

Laila Cure, Western Michigan University, 14517 Prism Circle, Tampa, FL, United States of America, laila.cure@wmich.edu, José L. Zayas-Castro

Patient safety demands for the timely identification, analysis and treatment of risks in healthcare processes. Patient safety interventions (PSIs) are potential risk sources whose performance should be monitored to prevent unsafe deviations. We propose a Markov model to represent the behavior of PSIs. The model is built from experts' assessments and is used for the analysis of available data, in order to support risk identification and analysis efforts in healthcare operations.

5 - A Decision Support Tool for Healthcare Providers to Evaluate Readiness and Impacts of Supply Chain Data Standards Adoption

Raja Jayaraman, Assistant Professor, Khalifa University of Science, Technology & Research, P O Box 127788, Abu Dhabi, United Arab Emirates, raja.jayaraman@kustar.ac.ae, Eghbal Rashidi, Ronald Rardin, Nebil Buyurgan, Vijith Malayil Varghese, Angelica Burbano, Nabil Lehlou, Paiman Farrokhvar

Despite unanimous consensus across global healthcare supply chain that standardized identification of location and products referred to as data standards enhances system interoperability, visibility and improves operations and patient safety. We present a decision support tool quantifying the impact of different levels of data standards adoption in healthcare supply chain. The model summarizes the healthcare provider readiness to a particular adoption level and quantifies benefits and impacts.

■ MB57

W - Providence I- Lobby Level

Airspace Design Optimization and Analysis

Sponsor: Aviation Applications

Sponsored Session

Chair: Babak Khorrami, Senior Analyst, Metron Aviation Inc, 45300 Catalina Court, Suite 101, Dulles, VA, 20166, United States of America, Khorrami@metronaviation.com

1 - Dynamic Airspace Configuration Models and Algorithms in Response to Weather

Arash Yousefi, Principal Analyst, Metron Aviation, 45300 Catalina Court, Suite 101, Dulles, VA, 20166, United States of America, yousefi@metronaviation.com, Ali Tafazzoli, Girishkumar Sabhnani, Babak Khorrami

We extend Dynamic Airspace Configuration (DAC) concepts and models to directly consider uncertainties in weather and produce robust airspace configuration.

2 - Effectiveness of Dynamic Airspace Configuration to Manage Airspace Capacity

Babak Khorrami, Senior Analyst, Metron Aviation Inc, 45300 Catalina Court, Suite 101, Dulles, VA, 20166, United States of America, Khorrami@metronaviation.com, Arash Yousefi, Girishkumar Sabhnani

We present experimental results to gain insight into how dynamic airspace capacity management can alleviate or support Traffic Flow Management (TFM) initiatives. We explore mechanisms by which Dynamic Airspace Configuration (DAC) and TFM models can interact to provide airspace capacity where and when it is needed.

3 - Airspace Safety Analysis Using Dynamic Event Tree

Richard Xie, Senior Analyst, Metron Aviation Inc, 45300 Catalina Ct, Dulles, VA, 20166, United States of America, Richard.Xie@metronaviation.com, Arash Yousefi

Safety is of the most important metric for a NextGen airspace ConOps. This research looks into the likelihood of a flight being involved into a conflict within the framework of a given ConOps, and evaluates conflict risk using dynamic event tree methodology. A generic structure of dynamic event tree is developed and a supporting simulation environment is build to model a ConOps and derive the probability values to populate a dynamic event tree.

4 - Using Column Generation to Optimize Airspace Configuration Plans for Terminal Area Airspace

Bill Hall, Mosaic ATM Inc, 801 Sycolin Rd., Ste. 306, Leesburg, VA, 20175, United States of America, whall@mosaicatm.com

The configuration of airspace, including the route network design and the assignment of routes to flights, is a particularly complicated optimization problem. Several studies show that a large percentage of the inefficiencies in flight trajectories are due to terminal area operations. We optimize an airspace configuration plan, consisting of a time sequence of airspace designs, to minimize the flight-related costs in response to changing traffic loads and weather capacity events.

■ MB58

W - Providence II - Lobby Level

DIME/PMESII Human Social Cultural Behavior II

Sponsor: Military Applications Society

Sponsored Session

Chair: Dean Hartley, Principal, Hartley Consulting, 106 Windsong Ln, Oak Ridge, TN, 37830, United States of America, DSHartley3@comcast.net

1 - A Multiagent Model for Evaluating the Impact of Development Projects in Insurgencies

Maciej Latek, George Mason University, 4400 University Dr, Farifax VA 22030, United States of America, mlatek@gmu.edu, Seyed Rizi

In insurgencies development projects can raise violence, because they provide soft targets for insurgents or decrease violence, because insurgents may not want to aggravate the population that needs basic services provided by such projects or local power brokers and insurgents who receive income from such project via patronage prefer a secure environment. We investigate such conjectures by simulating regional development trajectories, and project execution in Afghanistan during 2004-2009.

2 - Using Expert Judgment to understand the Rare Event Threat Space of Homeland Security

Paul Szwed, Professor, U.S. Coast Guard Academy, 15 Mohegan Avenue, Department of Management, New London, CT, 06320, United States of America, Paul.S.Szwed@USCGA.edu

The Department of Homeland Security performs terrorism risk assessments. Because many of these threats are rare and/or lack data, some key inputs are elicited from the intelligence community. For judgments regarding rare or highly uncertain events, this paper will describe the elicitation process, the state of the science, and a research agenda for such areas as: de-biasing, quantifying and handling uncertainty, relative versus absolute judgments, and combining results from multiple experts.

3 - Topology of Military C2 Systems: Where Axioms and Action Meet

Herman Monsuur, Netherlands Defence Academy, Het Nieuwe Diep 8, Den Helder, 1781 AC, Netherlands, H.Monsuur@nlda.nl, Rene Janssen, Tim Grant

We relate aggregate qualities found in the military C2 literature to the axiomatic approach in network theory. The paper addresses multi-layered networks and metrics for network control and for the feedback of operational links, as well as the merging of network metrics and C2 socio-technical covariates.

■ MB59

W - Providence III - Lobby Level

Customer Value

Sponsor: Service Science

Sponsored Session

Chair: Roland T. Rust, Distinguished University Professor, Robert H. Smith School of Business, University of Maryland, Department of Marketing, 3451 Van Munching Hall, College Park, MD, 20742-1815, United States of America, rrust@rhsmith.umd.edu

1 - Will the Frog Change Into a Prince?: Predicting Future Customer Profitability

Roland T. Rust, Distinguished University Professor, Robert H. Smith School of Business, University of Maryland, Department of Marketing, 3451 Van Munching Hall, College Park, MD, 20742-1815, United States of America, rrust@rhsmith.umd.edu, V. Kumar, Rajkumar Venkatesan

We present a new approach to predicting customer profitability in future periods. Using data from a high-tech company in a business-to-business context, we show that a model based on simulation of customer futures provides large improvements over other models, based on performance on a holdout sample.

2 - A Configuration View of New Service Adoption

Gaia Rubera, Michigan State University, Eli Broad School of Business, East Lansing, MI, 48824, United States of America, rubera@bus.msu.edu, Andrea Ordanini, A. Parasuraman

We propose a holistic framework to investigate consumers' evaluations of and intentions to adopt new services. It includes elements of service outcomes and processes, as well as coproduction options, to identify which configurations of drivers are associated with positive evaluations of new services. We apply the framework to luxury hotel services and use fuzzy set qualitative comparative analysis (QCA), a set-membership analytical technique that is suitable for complex configuration analyses

3 - Process Monitoring and Analysis – Mechanism to Enable Service Delivery Excellence

Sai Zeng, Research Scientist, IBM Watson Research Center, 19 Skyline Dr., Hawthorne, NY, 10598, United States of America, saizeng@us.ibm.com, Miao He, Tao Qin, Amir Geva, Lei Yuan, Wenkai Chen, Changrui Ren, Zhi Jun Wang

The key to service delivery excellence is to understand all the elements involved in the process, and identify the areas for improvements. In this paper, we present a framework to monitor people, system, and activities in the service delivery, and provide actionable insights to drive service delivery excellence and superior customer experience.

4 - Business Model Structure and the Evolution of Business Model: A Grounded Theory Study of Google

Yea-Huey Su, Assistant Professor, National Central University, 300 Chung-Da Rd., Chung-Li, Taiwan - ROC, suesu@mgt.ncu.edu.tw, Yu-De Lin

The study proposes a new systematic method for identifying a specific company's business model structure and exploring the natural evolution of business model. Google was selected to demonstrate this new method. Grounded theory qualitative research method with causal mapping, core element analysis, and social network analysis were imported to analyse data. We found that the evolution of Google's business model is path dependency over four phases in a dual-gene-balance business system.

■ MB60

W - College Room - 2nd Floor

Adaptive Algorithms for Pricing of Mobile Data Services

Sponsor: Optimization/Networks

Sponsored Session

Chair: Iraj Saniee, Director, Bell Labs, Alcatel-Lucent, Room 2C-326, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, iis@research.bell-labs.com

1 - Stochastic Learning of (near-)optimal Data Service Prices

Iraj Saniee, Director, Bell Labs, Alcatel-Lucent, Room 2C-326, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, iis@research.bell-labs.com

We outline a stochastic learning mechanism for determination of (near-)optimal (dynamic) prices of data services in mobile communication systems. The model allows for a variety of innovations, such as teletraffic quality constraints as well as volume-price elasticity and spatio-temporal cross-elasticities. Finally, we quantify expedited convergence of the learning scheme via variations on Kesten's approach.

2 - Semidefinite and Two Stage Stochastic Programming for Wireless OFDMA Networks

Ismael Soto, Universidad de Santiago de Chile, Departamento de Ingenieria Eléctrica, Avenida Ecuador 3519, Santiago, Chile, ismael.soto@usach.cl, Abdel Lisser, Pablo Adasme

In this paper, we propose a two stage stochastic binary quadratic program for OFDMA wireless networks. The aim is to minimize the total power consumption of the network subject to user bit rates, sub-carrier and modulation constraints. We derive from the quadratic model a linear (LP) and a semidefinite programming (SDP) relaxation. Our numerical results show tight bounds for the SDP relaxation in contrast to those obtained with the LP ones. Although at a higher computational cost.

3 - How to Play the Goore Game via the Kiefer-Wolfowitz Algorithm

Iraj Saniee, Director, Bell Labs, Alcatel-Lucent, Room 2C-326, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, iis@research.bell-labs.com, Phil Whiting

The optimal strategy for the game of Goore, due to Tsetlin, is traditionally derived from sophisticated finite state learning machines. The game poses the question of learning the optimum of a (unimodal) function where independent non-communicating players are (repeatedly) rewarded based on their collective guesses. We show that this game can be solved via stochastic learning where each player naively treats the collective action of all other players as noise.

■ MB63

W - Tryon North - 2nd Floor

Evolutionary Multi-Objective Optimization 1

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Ranji Ranjithan, Professor, North Carolina State University, CB 7908, 309 Mann Hall, Raleigh, NC, 27695, United States of America, ranji@ncsu.edu

1 - A New Genetic Algorithm for Multicriteria Project Selection and Scheduling

Natalia Viktorovna, Graduate Teaching Assistant, North Carolina State University, 2152 Burlington Labs, 2500 Stinson Drive, Raleigh, 27695-7913, United States of America, nviktor@ncsu.edu, Reha Uzsoy, Juan Gaytàn I

A new Genetic Algorithm for Multicriteria Project Selection and Scheduling problem is proposed. This Algorithm uses Random Keys and a Greedy Algorithm to decode these keys into the known NSGA II procedure. The performance of this new algorithm is evaluated with computational experiments comparing the approximations of the Pareto-optimal frontier obtained by NSGA II and PS-NSGA II. PS-NSGA II outperforms NSGA II in terms of quality of solutions and computational time.

2 - Generating Alternative Non-inferior Sets Using the Multi-objective Niching Co-evolutionary Algorithm

Marcio Giacomoni, Research Assistant, Texas A&M University, 1201 Harvey Rd #23, College Station, TX, 77840, United States of America, ghmarcio@tamu.edu, Emily Zechman, M. Ehsan Shafiee

The Multi-Objective Niching Co-Evolutionary Algorithm (MNCA) is an evolutionary algorithm-based approach to address multi-modality in engineering multi-objective problems. MNCA identifies alternative sets of solutions that uniformly cover the Pareto front and are located at maximally different regions of the decision space. Multiple sub-populations evolve to alternative approximations of the Pareto front through maximizing both the hypervolume and the diversity within sub-populations.

3 - Spatial Evolutionary Algorithm (SEA) for Optimizing a Large-scale Irrigation Pumping Strategy

Ximing Cai, University of Illinios, 2535c Hydrosystems Laboratory, 301 N. Mathews Avenue, Urbana, IL, 61801, United States of America, xmcai@illinois.edu, Albert Valocchi, Jihua Wang

This study develops a SEA for optimizing decisions on operating a large-scale pumping plan. This method incorporates the spatial patterns of wells and hydrogeological conditions into EA to determine the pumping rates of 10,000 wells simultaneously. The SEA employs a hierarchical tree structure and special EA operators to make it computationally more efficient. The results from a real case study basin show that the large-scale groundwater model can be solved by the SEA efficiently.

4 - Diversity Preserving Evolutionary Multi-objective Search

Shahrzad Azizzadeh, PhD Candidate, North Carolina State University, 346 Daniels Hall, Raleigh, NC, 27695, United States of America, sazizza@ncsu.edu, Ranji Ranjithan, Hana Chmielewski

While the primary goal of multi-objective search algorithms is to generate a set of Pareto-optimal solutions that are diverse in the objective space, solution diversity in the decision space is important when identifying solutions during decision-making associated with real-world problems. An evolutionary multi-objective algorithm that generates simultaneously a set of Pareto-optimal solutions is extended to generate sets of Pareto-optimal solutions that are different from each other.

■ MB64

W - Queens Room - 2nd Floor

Humanitarian Logistics and Disaster Relief I

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Irina Dolinskaya, Assistant Professor, Northwestern University, 2145 Sheridan Road, IEMS, Evanston, IL, 60208, United States of America, dolira@northwestern.edu

1 - The Hard Lessons from Haiti and Japan for Humanitarian Logistics

Jose Holguin-Veras, Rensselaer Polytechnic Institute, 110 8th St Room JEC 4030, Troy, NY, 12180, United States of America, jhv@rpi.edu, Miguel Jaller, Noel Perez

This presentation discusses the key lessons that ought to be learned from the humanitarian logistics efforts that followed the Haiti and Japan efforts. The presentation is based on the field work conducted by the authors and his colleagues.

2 - Dynamic Multi-Period Humanitarian Relief Routing

Luis de la Torre, Ph.D Candidate, Northwestern University, 2145 Sheridan Road, IEMS, Evanston, IL, 60208-3119, United States of America, ledelatorre@u.northwestern.edu, Irina Dolinskaya, Karen Smilowitz

We model a multiple-relief organization distribution problem over a multi-day planning horizon, where beneficiaries may be visited multiple times and uncertainty in travel and service times add stochasticity. We solve the problem by decomposing it into (1) an assignment and routing model that assigns each relief organization to a set of beneficiaries for the planning horizon and (2) a single-organization dynamic routing model within each assigned zone.

3 - Disaster Preparedness and Response for Power Systems

Pascal Van Hentenryck, Brown University, Providence, RI, United States of America, pvh@cs.brown.edu, Carleton Coffrin, Russell Bent

This talk presents optimization models for mitigating the effect of disasters on the power system infrastructure. It describes how to stockpile supplies before the disaster and how to use the supplies after the disaster hits in order to minimize the size of the blackouts. Experimental results on the infrastructure of the United States demonstrate the benefits of the models.

■ MB65

W - Kings Room - 2nd Floor

Product-Service System

Sponsor: Service Science

Sponsored Session

Chair: Howard Lightfoot, h.w.lightfoot@cranfield.ac.uk

1 - Technology Enabled Product-Centric Service Delivery

Howard Lightfoot, h.w.lightfoot@cranfield.ac.uk

Product-service offerings, from manufacturers, have been studied by operations, marketing and service researcher communities. This paper illustrates the provision of such services and explores the application of existing and developing technologies to support the supply chain in the effective and efficient delivery of product-centric services.

2 - A Data Mining Framework for Product and Service Migration Analysis

Wei Jiang, Professor, Shanghai Jiao Tong University, Room 623 Antai Building SJTU, Shanghai, China, jiangwei@sjtu.edu.cn, Siu-Tong Au, Rong Duan

With new technologies or products, customers may migrate from a legacy to a new one. This paper discusses a framework and application of time series data mining to product and service migration analysis. We develop a co-integration-based classifier to identify customers associated with migration and evaluate their business impacts. We illustrate a case study of IP migration in telecommunications.

3 - Product-Service System Blueprint: Visualization of Value Creation Mechanism

Chie-Hyeon Lim, POSTECH, Department of Industrial and Management, Pohang, Korea, Republic of, arachon@postech.ac.kr, Kwang-Jae Kim, Yoo-Suk Hong, Kwangtae Park

Product-Service System (PSS) is a novel type of business model integrating products and services so that they are jointly satisfying customer needs. PSSs can add economic, environmental, and social values for diverse stakeholders. This research proposes a PSS blueprint, which is a representation scheme to visualize a PSS model with a focus on its value creation mechanism. Existing PSS cases are represented and analyzed using the proposed PSS blueprint.

■ MB66

W - Park Room - 2nd Floor

Efficiency and Performance Analysis: Current Issues and Future Research Opportunities

Cluster: Data Envelopment Analysis

Invited Session

Chair: Kostas Triantis, Professor/Director, Virginia Tech/National Science Foundation, 7054 Haycock Road, Falls Church, VA, 22201, United States of America, triantis@vt.edu

1 - Dynamic Efficiency Measurement

Saeideh Fallah-Fini, Post-Doctorate Associate, Virginia Tech, 250 Durham Hall (0118), Blacksburg, VA, 24060, United States of America, fallah@vt.edu, Kostas Triantis, Hazhir Rahmandad, Jesus de la Garza

This paper develops a model for measuring efficiency of dynamic systems where input consumption/production decisions in one period depend on both input consumption/production decisions in previous periods and the possible outputs in future periods. In contrast to other models that assume systems reach a steady state at the end of a planning horizon T, this model handles systems that are dynamic and include non-steady state behaviors of interest.

2 - Semantic Extraction of On-line Opinions for Tourist Destination Evaluation Using DEA

Alexandra Medina-Borja, Assistant Professor, University of Puerto Rico at Mayaguez, II-205 Industrial Engineering Bldg, Mayaguez, PR, 00680, Puerto Rico, alexandra.medinaborja@upr.edu

A conceptual model to guide investments for the Caribbean hospitality industry was initially hypothesized. Tourists' qualitative evaluations were semantically extracted from customer review websites and classified into perceptions on community, facilities, service and value. Value perceptions are highly correlated to growth on tourist arrivals. The major contribution arises from the methodology proposed to introduce qualitative customer expressions into quantitative performance evaluation.

3 - Measurement Scales and DEA

Kostas Triantis, Professor/Director, Virginia Tech/National Science Foundation, 7054 Haycock Road, Falls Church, VA, 22201, United States of America, triantis@vt.edu, Joseph Godfrey

Performance measurement often involves categorical and/or ordinal scale data. These data present a challenge when using DEA, as DEA requires data to be at least interval scaled. Various proposals have appeared to extend DEA to support use of categorical and ordinal data. We argue that none provide a solution. The issue is not with DEA, but with how categorical and/or ordinal data can be represented using interval scale data. We examine some possible remedies.

■ MB69

W - Grand D - 2nd Floor

Emerging Topics in Sustainability

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Ravi Subramanian, Georgia Institute of Technology, 800 West Peachtree St. NW, Atlanta, GA, United States of America, ravi.subramanian@mgt.gatech.edu

Chair: Canan Savaskan, Southern Methodist University, Cox School of Business, Dallas, TX, United States of America, csavaskan@cox.smu.edu

1 - Pollution Regulation and Production

Francois Giraud-Carrier, University of Utah, David Eccles School of Business, 1645 E. Campus Center Drive, Salt Lake City, UT, 84112, United States of America, f.giraud-carrier@business.utah.edu, Krishnan Anand

Pollution regulation invariably stirs up opposition from the targeted industries on the basis that pollution controls increase production costs causing firms to downsize and increase prices. We analyze whether pollution controls hurt the economy using mathematical models. Specifically, do pollution controls cause a reduction in production levels, and are there regulatory mechanisms that do not hurt output? Our results show that pollution regulation impacts production in intricate ways.

2 - Sustainability Leadership and Environmental and Market Performance

Ravi Subramanian, Georgia Institute of Technology, 800 West Peachtree St. NW, Atlanta, GA, United States of America, ravi.subramanian@mgt.gatech.edu, Manpreet Hora

We examine how organizational leadership in sustainability associates with environmental and market performance.

Monday, 12:30pm - 2:30pm

Interactive Session

Grand Ballroom, Prefuntion

Interactive Poster Session – Monday

Contributed Session

Chair: Ertunga C. Ozelkan, University of North Carolina-Charlotte, ecozelka@uncc.edu

Co-Chair: Nilay Tanik Argon, , University of North Carolina-Chapel Hill, nilay@unc.edu

Co-Chair: Brian Denton, North Carolina State University, Edward P. Fitts Department of Industrial, Engineering, Raleigh, NC, 27695, United States of America, bdenton@ncsu.edu

1 - A Decision Support Methodology for Operational Planning in Urban Bus Transit

Fernando Lopez, Research Professor, Autonomous University of Nuevo Leon, Ave. Universidad S/N, Ciudad Universitaria, San Nicolas de Los Garza, NL, 66451, Mexico, fernando.lopezrr@uanl.edu.mx, Paulina A. Avila

An integrated decision aid methodology is presented for urban bus transit planning at a tactical level (minimal bus frequencies calculation and time tabling construction). At the core of the methodology is a multi-objective MILP model: objectives of involved social actors are taken into account, also multi period planning with smooth transition are represented, one exact method and one heuristic method are considered. Also some validation of the methodology is done with a real instance.

2 - A Empirical Research on the National Marketing

Li Min, Nanjing University of Aeronautics and Astronautics, Nanjing University, Nanjing, JS, 210016, China, windowsandlove@163.com

By empirical research, this paper demonstrated that the trans-industry operation of Cultural industry can promote reputation, improve human ecological image, modified the stereotyping effect of origin country or region from enterprise, product, brand, and regional levers.

3 - A Two-stage Queue with a Switching Server and N-policy

Tae-Sung Kim, Professor, Chungbuk National University, 12 Gaeshin-dong, Heungduk-gu, Cheongju, 361-763, Korea, Republic of, kimts@chungbuk.ac.kr, Hyun Min Park, Won Seok Yang

We consider a two-stage queue and N-policy for the switching mechanism of a server. A two-stage queue consists of an individual mode service in the first stage and a batch mode service in the second stage by a single server. We present the steady-state system distribution, the mean cycle lengths when the server stays at queue 1 and 2, respectively, and the average cost. We consider the holding cost, the switching cost, the individual and batch service cost.

****4 - Comparing Neural Network and Ordinal Logistic Regression to Analyze Attitude Responses**

Aisyah Larasati, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, aisyah.larasati@okstate.edu, Lisa Slevitch, Camille DeYong

This paper delivers comparative descriptions of the Artificial Neural Network (ANN) and the Ordinal Logistics Regression (OLR) models to analyze rank-order responses. The theoretical features and properties, which includes parameters, variable selection and model evaluation, followed by comparisons of the disadvantages and advantages of both models are analytically reviewed.

**Competition Submission

****5 - Heterogeneous vs. Homogeneous Vehicle Routing: Algorithms and Implications**
Fei Peng, Ph.D. Candidate, University of Michigan, 1205 Beal Ave, IOE Building, Ann Arbor, MI, 48109, United States of America, feipeng@umich.edu, Amy Cohn, Oleg Gusikhin

Classical VRP literature and many commercial software packages assume all vehicles are identical in their characteristics, while in real-world vehicles vary in size, fuel efficiency, and other performance-impacting factors even in a homogeneous fleet. Based on a strong formulation, our heuristic approach to VRP problems showed that considering differences within the fleet achieves lower cost for a variety of Pareto/non-Pareto cost structures. Real-world cases are examined and results presented.

****6 - Modeling for Equitable Allocation of Food Distribution in North Carolina under Capacity Constraints**
Irem Sengul, North Carolina State University, 3920 Jackson Street Apt. I-25, Raleigh, NC, 27607, United States of America, isengul@ncsu.edu, Reha Uzsoy, Julie Ivy

Our objective is to develop a model to determine the equitable distribution of donated food among people at risk for hunger. We work with the Food Bank of Eastern & Central North Carolina which serves as a hub and branch for distributing food to four branches on a 34-county service area. This poster presents deterministic, finite horizon, capacity-constrained network flow models with various non-cost based objective functions for this problem.

7 - Flow Isolation in Optical Networks
Hui Wang, PhD Candidate, North Carolina State University, 3607 Helix Ct. Apt. 302, Raleigh, NC, 27606, United States of America, hwang4@ncsu.edu

We improve the security of information communication in traffic grooming problems by using flow isolation technique.

****8 - Determining the Right Buffer Strategy during Red River Floods, ND, MN**
Luke Holt, Research Assistant, North Dakota State University, 7080 148th Ave Ne, Grafton, ND, 58237, United States of America, luke.holt@my.ndsu.edu, Joseph Szmerekovsky

The Red River of the North has created flooding problems to North Dakota and Minnesota for many years. Water levels are highly unpredictable from year to year. Planners face the challenge to determine what buffer strategy provides appropriate protection. OR analysis is done to determine the best buffer strategy.

9 - A New Approach to Sort Inventory Items and an Application
Gazi Bilal Yildiz, Research Assistant, Erciyes University, Department of Industrial Engineering, Kayseri, 38039, Turkey, bilal_yildiz_58@hotmail.com, Banu Soylu, Bahar Akyol

In this study, we developed a new approach to sort inventory items into ABC classes. At initial stage, the DM(s) are requested to classify some inventory items into appropriate classes. We determine the classes of other inventory items by using these references. We compared the results of our algorithm with the results of other methods by using the test data given in the literature, and we applied the proposed approach to the raw material inventory units of a mattress manufacturing factory.

10 - Dynamic Pricing of Digital Information Goods under the Presence of Positive Network Effects
Zhe Guo, Ph.D., Visiting Scholar, University of California, Berkeley, 4115 Etcheverry Hall, UC Berkeley, Berkeley, CA, 94720, United States of America, zheguo@ieor.berkeley.edu, Zuo-Jun (Max) Shen

The digital knowledge goods (DKG) present challenges to pricing due to their unusual cost structures, positive network effects and incomplete information. Different from the traditional models in the literature, we took these factors into consideration and made some interesting observations. We also studied the impact of pricing on customersí purchasing behavior.

****11 - CUTE: CUTting Edge Diamond Optimization**
Anthony Downward, Dr., University of Auckland, Level 3, 70 Symonds Street, Auckland, 1010, New Zealand, a.downward@auckland.ac.nz, Golbon Zakeri

The Centenary Diamond, weighing 55g, was estimated to be worth $100 million when it was unveiled in 1991. This diamond was cut from a rough-stone weighing 120g; thus when cutting such a stone, it is imperative to orient the stone such that waste is minimized. Our interactive software allows a user to maximize the value of a diamond from a given rough-stone. As the user alters the orientation of the diamond, it solves optimization problems to scale and position the diamond within the rough-stone.

12 - Dynamic Pricing in Electricity Networks
Mona Asudegi, University of Maryland, 1179 Glenn L. Martin Hall, University of Maryland, College Park, Un, 20742, United States of America, asudegi@umd.edu, Ali Haghani

Competition in electricity pricing market increases with the competition in energy market. Considering the competition and dynamic haracteristics of the electricity networks in optimal pricing is a complex problem. In this study dynamic pricing is applied to competitive electricity market using Nash equilibrium concept.

13 - An Analytical Framework of Supply Chain Complexity: A Graph Theoretic Approach
Myles Garvey, Independent Consultant, 98 Fencsak, Elmwood Park, NJ, 07407, United States of America, mylesgarvey@gmail.com, Steven Carnovale, Sengun Yeniyurt

This paper explores the graph theoretic implications that exist within supplier networks in the context of a firmís sourcing decision making. We begin with the formulation of an analytical problem and solve it under the guise of critical graph theoretic mechanisms. In order to understand supply chain complexity topics such as, sub-graphs, node criticality, node relations and other supply chain constructs and graph theoretic properties are explored.

14 - A Branch, Bound, and Remember Algorithm for the Simple Assembly Line Balancing Problem
Edward Sewell, Professor, Southern Illinois University Edwardsville, Department of Mathematics & Statistics, Edwardsville, IL, United States of America, esewell@siue.edu, Sheldon Jacobson

We present a new exact algorithm for the assembly line balancing problem. The algorithm finds and verifies the optimal solution for every problem in the benchmarks of Hoffmann, Talbot, and Scholl in less than one-half second per problem, on average, including one problem that has remained open for over ten years. The previous best algorithm is able to solve 257 of the 269 benchmarks. The new algorithm is based on a branch & bound method that uses memory to eliminate redundant subproblems.

15 - A Heuristic Method to Build Multiple Test Forms Based on a Seed Test
Peihua Chen, National Chiao Tung University, 1001 Ta Hsieh Rd, Department of Management Science, Hsinchu, 300, Taiwan - ROC, peihuamail@gmail.com, Kai-Min Chen, Jason Vong

Optimization approaches have been widely applied in educational measurement area to assemble test forms. This article presents an heuristic method to build multiple test forms from a given item bank based on a seed test. A comparison with another widely used heuristic, Weighted Deviation Method (Stocking & Swanson, 1993), is also conducted. The results will be evaluated by item information functions, test characteristic curves and content coverage.

16 - A Model to Predict Mortality in Critically Ill Patients
Desiree Tejada-Calvo, Tec de Monterrey, Carretera a Tapanatepec, Tuxtla Gutierrez, 29020, Mexico, desiree.tejada@itesm.mx, Iris Tejada-Calvo

The endocrinology behavior is of vital importance in the critically ill patient. The growth hormone (GH) axis includes several elements such as the GH, the insulin-like growth factor (IGF) and its biding proteins. The serum levels of the components of the axis, specially the IGF ñ I is a measure that can help us predict mortality. A Mathematical Model that predicts the mortality of critically ill patients is presented. Results show that the serum levels of this factor are higher in survivors.

17 - A Nonatomic-game Approach to Dynamic Pricing under Competition
Yusen Xia, Georgia State University, 35 Broad St., Atlanta, GA, 30303, United States of America, ysxia@gsu.edu, Jian Yang

We study a revenue management problem involving competing firms. We assume the presence of a continuum of infinitesimal firms where no individual firm has any discernable influence over the evolution of the overall market condition. For both deterministic- and stochastic-demand cases, we show the existence of equilibrium pricing policies that exhibit well-behaving monotone trends.

18 - Approximation Algorithms with Indefinite Matrices
Timothy Lee, Rensselaer Polytechnic Institute, 33 Utica Ave, Latham, NY, United States of America, leet3@rpi.edu

Semidefinite programming is widely used to relax combinatorial optimization problems. SDP relaxations of MAX-CUT, MAX2SAT and MAX3SAT can be solved approximately using indefinite matrices. We obtain performance guarantees for these approximate solutions that depend on the accuracy of the solution to the relaxation and on the strength of the relaxation.

**Competition Submission

****19 - Coordinated Production and Delivery for an Exporter**
Renato de Matta, University of Iowa, 108 PBB, Iowa City, IA, United States of America, renato-dematta@uiowa.edu, Chung-Lun Li, Vernon Hsu

We consider an exporter that receives periodic shipments of goods produced by different suppliers. Each supplier either delivers directly to the exporter or indirectly through a third party logistics firm which consolidates and ships the goods to the exporter. We cast the suppliers' decisions as a cost minimization, deterministic production lot-sizing and distribution problem. We model the problem as a mixed integer program, and develop an efficient procedure to find near optimal solutions.

20 - Integrated Scheduling and Resource Allocation OR Model
Amir Ahrari, PhD. Candidate, US DOT - FHWA / UMD, 4329 Rowalt Dr. Apt. #202, College Park, MD 20740, United States of America, aahrari@umd.edu, Ali Haghani

Common practice in scheduling is to priorities scheduling activities over resource allocation. Since these phases are interrelated in nature, optimizing both of them in an integrated OR model improves the results and demonstrates inferiority of the solution provided by traditional approach. Proposing such model is the topic of this research.

21 - HEV or EV, That is the Question: A Game Theoretic Approach
Fuminori Tsuchiya, Master student, Keio University, 2-15-45 Mita, Minato-ku, Tokyo, Japan, ftsuchiya0308@gmail.com, Yutaka Hamaoka

We propose a model to analyze new product introduction strategy incorporating selection of technological level of the product. Analysis reveals that for higher price cars, the technology differentiation between leader and follower is large and leader should choose higher technology. For low priced market, follower should introduce higher technology. Our model well explains introduction of hybrid and electronic vehicles in Japanese auto market.

22 - How to Improve Electricity Market Prices?
Eugene Zak, Principal Engineer, Alstom Grid, 10865 Willows Road NE, Redmond, WA, 98052, United States of America, eugene.zak@alstom.com, Ricardo Rios-Zalapa, Kwok Cheung

Modern electricity markets solve an LP model to determine power generation dispatch from a primal solution and electricity prices from a dual solution. An arbitrary dual solution that results as a by-product of an optimization algorithm may not always lead to the most reasonable market prices. We suggest a procedure explicitly exploring a dual space and delivering the satisfactory market prices for both the market authority and participants.

****23 - International Judging System in Figure Skating: Optimization and Analysis**
Kellie Keeling, Assistant Professor, University of Denver, Business Information & Analytics, 2101 S. University Blvd, Denver, CO, 80208-8952, United States of America, kkeeling@du.edu, Sydney Raith

In 2002, the International Skating Union scoring system was updated to make the system more objective, transparent, and fair to the competitors. In this study we examine how the judging system has impacted the skaterís strategy and their rankings.

24 - Introducing Congestion to Conventional Production Planning Problems through Clearing Functions
Ali Kefeli, Kimberly-Clark Corporation, 731 Preston Woods Trl, Dunwoody, GA, 30338, United States of America, akefeli@ncsu.edu

We present an algorithm to include congestion in planning models through clearing functions. Studies have shown that an arbitrary piecewise linear approximation of clearing function models can cause loss of information at higher utilization levels. We propose an iterative cut addition algorithm where the outer linear segments are added as they are needed. This method allows the user to achieve a predetermined sensitivity level from the model while keeping the computational burden to a minimum.

25 - Lead-Time Quotation and Reputation in a Stochastic Setting
Susan Slotnick, Associate Professor, Cleveland State University, Operations and Supply Chain Mgmt., 2121 Euclid Ave, BU 542, Cleveland, OH, 44115-2214, United States of America, s.slotnick@csuohio.edu

A firm must decide on lead-time promises that are be realistic and acceptable to the customer. This profit-maximizing model has dynamic arrivals, stochastic processing times, and customers who may stay or leave, depending on the lead-time promise as well as the firmís past reputation for on-time delivery.

26 - Locating and Protecting Facilities That Are Subject to Failures
Hugh Medal, Ph.D. Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hugh.medal@uark.edu

We introduce a model that integrates facility location and protection decisions. Although location and protection problems with failures are usually formulated as two- or three-stage problems, we derive a result that allows this problem to be formulated as a single-stage problem. We then decompose the integrated problem into set-cover-type problems and solve using a binary search algorithm. We find that integrating the location and protection decisions results in significantly better solutions.

****27 - MUNICIPAL: A Decision Aid for Emergency Response**
Ryan Loggins, Research Assistant, Rensselaer Polytechnic Institute, 110 8th St., Troy, NY, 12180, United States of America, ryan.a.loggins@gmail.com

This poster will and demonstration will describe MUNICIPAL and its components: the GIS interface, vulnerability module, and optimization module. MUNICIPAL is designed to support the decision making required for the restoration of services provided by critical infrastructures. The overall objective is to help ensure the resiliency of a community to an extreme event.

28 - Two-stage Stochastic Model for Pumped-storage Operational Cost Estimation
Goran Vojvodic, George Washington University, 2401 H Street NW, Washington, DC, United States of America, goranv@gwu.edu

Due to the need for efficiency in terms of resource usage, an accurate estimation of the forward-looking cost is needed. We draw a parallel between the structure of the two-settlement energy markets and a two-stage stochastic optimization model in order to estimate the operational cost at a pumped-storage hydroelectric power station. We introduce integer variables and appropriate risk measures in the model and comment on the results.

29 - An Optimization Method for Future Flight Schedule Generation
Feng Cheng, FAA, 800 Independence Ave., S.W., Washington, DC, 20591, United States of America, feng.cheng@faa.gov

Future flight Schedules are generated based on air traffic forecast for the purpose of aviation planning and performance analysis studies. A sample day selection process needs to be designed and implemented by sampling historical operational data. We propose an optimization based solution method for the problem by minimizing the weighted difference between the true population and the sample to be selected in terms of the defined metrics subject to a set of constraints.

****30 - Stochastic Network Design for Disaster Preparedness**
Xing Hong, Mr., George Washington University, 1776 G St., N.W., Washington, DC, 20052, United States of America, xhong@gwmail.gwu.edu, Nilay Noyan, Miguel Lejeune

We propose a risk-averse stochastic optimization model for disaster preparedness. Our chance-constrained model determines the locations and inventory levels of pre-positioned commodities. An efficient solution method is developed to handle a large number of scenarios, by simplifying the chance constraint and reformulating them by a combinatorial method. Our model is applied to the risk of hurricanes in the Southeastern US region and the risk of earthquakes in the Seattle area.

****31 - Stochastic Sequential Assignment Problem with Dependency**
Golshid Baharian, PhD student, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, gbahari2@illinois.edu, Banafsheh Behzad, Sheldon Jacobson

A class of problems is presented in which distinct resources are optimally allocated to sequentially arriving tasks with stochastic parameters. An optimal policy is formulated for a variation of the sequential stochastic assignment problem, in which a task arrives with a certain probability in each time period and task values in a time period are assumed to be dependent. A generalization of this problem in which the number of arriving tasks is unknown until after the final arrival is studied.

****32 - Modeling Uncertainty in Clinical Laboratories**
Varun Ramamohan, Purdue University, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, vramamoh@purdue.edu, George Klee, Yuehwern Yih, Jim Abbott

A statement of uncertainty provides information about the quality of the clinical laboratory measurement result. The laboratory measurement process is conceptualized as a system with the patient sample representing the input and the measurement result being the system output. The proposed approach is illustrated by developing a mathematical model of the serum creatinine assay analysis procedure, and Monte Carlo simulation is used to characterize the uncertainty of the model.

****33 - Nonparametric Multivariate Convex Regression with Applications to Value Function Approximation**
Lauren Hannah, Postdoctoral Researcher, Duke University, Box 90251, Duke University, Durham, NC, 27708, United States of America, lh140@duke.edu, David Dunson

Convex regression is regression subject to convexity constraints. Although useful for operations research, convex regression has been computationally infeasible in the multivariate setting. We provide two fast new methods for multivariate convex regression. We give consistency results and apply the methods to value function approximation for sequential decision problems including response surface estimation, pricing American basket options and inventory management.

****Competition Submission**

****34 - A Multi-objective Evolutionary Game Theory Approach to Optimize Patrolling Strategies**

Oswaldo Aguirre, PhD candidate, University of Texas-El Paso, 500 W. University Ave., El Paso, TX, 79968, United States of America, faguirre@miners.utep.edu, Heidi Taboada

A new hybrid approach based on game theory and evolutionary algorithms to optimize patrolling strategies is presented. Multiple objectives are used to evaluate the performance of defender patrolling strategies. The proposed algorithm identifies multiple Pareto-optimal patrolling strategies for the defender, which can be presented to human analysts for decision making.

****35 - A Sequential Fund Allocation Approach to Minimize Envy**

Emmanuel Gurrola, Research Assistant, University of Texas-El Paso, 500 W. University Ave., El Paso, TX, 79968, United States of America, egurrola@miners.utep.edu, Heidi Taboada

In the present research, a new approach which combines fair division methods along with a local search optimization algorithm is proposed to determine an optimal sequential allocation of transportation funds with the main objective of minimizing envy, the Envy Finder Algorithm is also introduced as a method to evaluate envy.

****36 - An Approach to Solve the Hybrid Power Systems Design Problem Considering Multiple Objectives**

Nicolas Lopez, Research Assistant, University of Texas-El Paso, 500 West University Ave., El Paso, TX, 79968-0521, United States of America, nlopez3@miners.utep.edu, Jose Espiritu

In the present research, a simulation tool is used to solve the multiobjective hybrid power systems design problem considering different renewable energy technologies and energy storage systems; the main objectives considered are the minimization of the total lifecycle cost of the system, and the minimization of green gas house emissions.

37 - Approximation Algorithm for Single Machine Min-Sum Scheduling Problem

Maurice Cheung, Cornell University, 288 Rhodes Hall, Ithaca, NY, United States of America, myc26@cornell.edu

We consider the single-machine scheduling problem where each job j has processing time p(j), and an arbitrary non-decreasing, non-negative cost function F(j,t) specifying the cost of finishing j at time t; the objective is to minimize the total cost. We give a simple primal-dual algorithm that yields, for any $c > 2$, a c-approximation algorithm for this problem. We also generalize this result for the setting where the machine's speed varies over time arbitrarily.

****38 - Implementation of Effects of Load on Movement-Related Operational Tasks in Agent-Based Simulation**

Cortney Kasuba, Senior Operations Research Analyst, TSE, Inc., 209 W. Central St., Suite 300, Natick, MA, United States of America, cortney.kasuba@tseboston.com, Dan Rice, Mitha Andra, Alex Kennedy, Adam Peloquin

Equipment load can have dramatic effects on task performance; TSE quantified these effects using data including physiological and terrain characteristics, and implemented a model into the Infantry Warrior Simulation (IWARS). The implementation allows analysts to study benefits/deficits of new or existing equipment, while supporting effective decision making.

39 - A Multi-stage Stochastic Programming Model for Dynamic Surgery Scheduling

Serhat Gul, Postdoctoral Fellow, Georgia Institute of Technology, School of Industrial and Systems, Engineering, Atlanta, GA, United States of America, serhatgul.az@gmail.com, Brian Denton, John Fowler

A multi-stage stochastic mixed integer programming formulation is used to schedule surgeries into future. The demand for surgeries and surgery durations are random variables. Expected surgery cancellations and OR overtime are the competing criteria. The properties of the model are discussed. A progressive hedging algorithm is implemented to find near optimal surgery plans.

****40 - An Artifitial Neural Network Application In Generating Vector Time Series for Simulation Input Autoregressive-to-Anything (ARTA)**

Shirin Akbarinasaji, Graduate Student, West Virginia University, 1428-B Center Hill Avenue, Star City, WV, 1428 B, United States of America, shirin.akbari@gmail.com

The Autoregressive -To-Anything (ARTA) algorithm is one of the most efficient methods. This paper suggests the use of artificial neural networks, called Elman, to solve the corresponding problem. Using two simulation experiments, the applicability of the proposed methodology is described and the results obtained from the proposed method to the ones from solving the equations numerically are compared. The results of the simulation experiments show that the proposed method works well.

41 - Hypothesis Test of Equality of Means with Non-equal Variances

Ehsan Shirazi, Graduate Student, West Virginia University, 616 Madigan Ave, Morgantown, WV, 26501, United States of America, ejafaris@mix.wvu.edu

Engineering statistics course books have often investigated the hypothesis test of equality of means of two independent normal distributions where the variances of the populations are unknown and equal however, there are some situations in which the variances are not equal. In this paper, three different methods to perform the hypotheses test when the variances are not equal are proposed.

****42 - GPU Computing in Bioinformatics, Linear Algebra and Monte Carlo Simulations**

Panagiotis Vouzis, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, pvouzis@cmu.edu, Nikolaos Sahinidis

We present the GPU parallelization of the Basic Local Alignment Search Tool (BLAST), linear algebra iterative solvers for PDEs, and Monte Carlo simulations for CO2 sequestration modeling. The speedups achieved vary from 2 to 4 for BLAST, 1 to 16 for linear algebra, and 15 to 60 for Monte Carlo Simulations depending on the GPU, CPU, and Linux cluster used. This work demonstrates the opportunities and challenges of GPU computing.

****43 - Multiobjective Robust Optimization in Finance and Risk Management**

Oleksandr Romanko, Mitacs Industrial Postdoctoral Fellow, McMaster University, ITB-220, 1280 Main St. West, Hamilton, ON, L8S4K1, Canada, romanko@mcmaster.ca

The common feature of financial and risk management optimization problems is presence of multiple performance indicators and risk measures as well as tackling uncertainty. We present parametric optimization based methodology that allows computing Pareto efficient surfaces for such multiobjective problems. Robustness can be either incorporated in the optimization problem structure or can be considered as an additional objective. We illustrate both approaches on practical examples.

****44 - SparOptLib - A Testing Library for Sparse Solution Recovery Algorithms**

Katya Scheinberg, Lehigh University, Harold S Mohler Lab, Industrial and Sys, 200 West Packer Avenue, Bethlehem, PA, 18015-1582, katyas@lehigh.edu

SparOptLib is a collection of problems for testing sparse solution recovery algorithms. The problems are drawn from a variety of applications, including compressed sensing and signal processing, and cover a wide range of size, difficulty, and sparsity. The current version of the library contains over 300 instances provided in a standard format, which includes the suggested target accuracy for optimization. It is our hope that SparOptLib will provide a universal testing framework and will enable researchers to develop improved algorithms for this class of problems.

45 - Coordination in a Single-supplier, Multi-retailer System with Supplier-facilitated Transshipments

Rong Li, Assistant Professor of Operations Management, Singapore Management University, 50 Stamford Road, Singapore, 178899, Singapore, rongli@smu.edu.sg, Jennifer Ryan, Zhi Zeng

While past literature focuses on single-period coordination via retailer-negotiated transshipments, we examine two-period coordination via supplier-facilitated transshipments (SFT). We study a system with 1 supplier and N symmetric retailers. The supplier produces in each period; transshipments among the retailers occur in 2nd period. SFT is implemented through a bi-directional adjustment contract. We show that a properly designed adjustment contract can be used to achieve coordination.

46 - Healthcare Operations Research in NU's Healthcare Systems Engineering Centers

Aysun Taseli, Post-doc Research Associate, Northeastern University, 363 Snell Engineering Center, 360, Huntington ave, Boston, MA, 02115, United States of America, a.taseli@neu.edu, Mehmet Erkan Ceyhan, James Benneyan

Health care has been identified as one of the "Grand Challenges" facing the U.S. in the upcoming century and as a critical focus for operations research and systems engineering. We describe a large scale effort to develop a comprehensive healthcare systems engineering program that includes two federally-awarded centers, undergraduate through graduate curricula, applied internships, faculty-in-training programs, and partnerships with dozens of hospitals and other healthcare organizations.

47 - Optimal Task Allocation in Wireless Distributed Computing

Andrew Heier, Virginia Tech ISE, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, aheier@vt.edu

Utilizing wireless distributed computing, ad-hoc cognitive radio networks can perform complex tasks in a distributed manner that reduces the burden of resources on individual nodes and provides increased robustness. The research employs mixed integer programming to optimally allocate tasks to ideal cognitive radios in a manner that minimizes network power consumption.

****Competition Submission**

****48 - A Markov Decision Model for Alzheimer's Disease Progression**

Muge Capan, North Carolina State University, 2931 Ligon Street, Raleigh, NC, 27607, United States of America, mcapan@ncsu.edu, Julie Ivy

We develop a Markov Decision Process model to examine the impact of treatment on post diagnosis Alzheimerís disease progression. Our research aim is to develop a dynamic model to evaluate potential economic impact of a new treatment. This model presents a valuable framework which captures both the uncertainty related to disease progression and treatment outcomes. We utilize probabilistic sensitivity analysis of model penalties and transition probabilities to control the dynamic process

****49 - Improving Patient Flow in an Obstetric Unit**

Jacqueline Griffin, Georgia Institute of Technology, Atlanta, GA, United States of America, jackie.griffin@gatech.edu, Shuangjun Xia, Siyang Peng, Pinar Keskinocak

To study the tradeoffs in blocking and system efficiency, we develop a simulation model of an obstetric unit with a focus on patient flow, considering patient classification, blocking effects, time dependent arrival and departure patterns, and statistically supported distributions for length of stay (LOS). The model is applied to DeKalb Medicalís Womenís Center, an obstetrics hospital in Atlanta, GA, to analyze the hospitalís readiness for potential changes to patient mix and patient volume.

****50 - Optimal Booking Strategies for Outpatient Procedure Centers**

Bjorn Berg, North Carolina State University, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, bpberg@ncsu.edu, Thomas Rohleder, S. Ayca Erdogan, Brian Denton, Todd Huschka

Patient appointment booking, sequencing, and scheduling decisions are challenging for outpatient procedure centers due to uncertainty in procedure times and patient attendance. We formulate a model based on a two-stage stochastic mixed-integer program for optimizing booking and appointment times in the presence of uncertainty. A case study based on an endoscopy suite at a large medical center is used to draw a number of useful managerial insights for procedure center managers.

****51- Parameter Comparison and Model Selection in Drug Development**

Clayton Barker, Research Statistician, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, clay.barker@sas.com, Rajneesh Rajneesh

We extend the Analysis of Means chart idea to compare parameter estimates across independent groups. This is useful in drug development, where modeling involves comparing parameter estimates from nonlinear regression. We discuss an information based criterion for model selection and a self-starting library of nonlinear models.

****52 - Positioning Emergency Medical Services for Trauma Response for Rural Traffic Crashes**

Poyraz Kayabas, Graduate Research Assistant, North Dakota State University, Room 212, CJPP Building,, P.O. Box 6050, NDSU, Fargo, ND, 58105, United States of America, poyraz.kayabas@ndsu.edu, Eunsu Lee

Given the episodic nature of crash injuries along rural areas, it is difficult to optimize service based on a needs-assessment in emergency medical service (EMS) response history. The emphasis of efficiency of limited resources creates a difficult decision making environment in balancing service accessibility based solely in geography and exposure factors such as population level and travel activity. This study provides an logistical analysis of EMS response to rural trauma victims.

****53 - Predicting Emergency Department Volume to Create a "Surge Response" for Non-Crisis Events**

Valerie Chase, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States of America, valjeanc@umich.edu, Amy Cohn, Mariel Lavieri, Tim Peterson

Our goal is to identify surges in emergency department volume based on the level of utilization of physician capacity. The models have been created and validated using data from a large urban teaching hospital. Our models improve current practice by identifying surges in patient volumes sooner on non-crisis days.

****54 - Simulation Optimization of PSA-Threshold Based Prostate Cancer Screening Policies**

Daniel Underwood, North Carolina State University, 150 Renwick Ct., Raleigh, NC, 27615, United States of America, daniel.underwood@ncsu.edu

We discuss a simulation optimization model to estimate near optimal PSA screening policies based on the mean expected quality adjusted life years (QALYs) of a large population. We describe the optimization method, based on a genetic algorithm. Numerical experiments are presented to compare the optimal policy to existing guidelines. Our results provide evidence that patients should be screened more aggressively but for a shorter period of time than current guidelines recommend.

****Competition Submission**

****55 - Medical Resident Scheduling Using Multi-Criteria Optimization Models**

Marcial Lapp, University of Michigan, Ann Arbor, MI, United States of America, mlapp@umich.edu, Brian Jordan, Kathy Lu, Daniel O'Connell, Amy Cohn, Jinshuai Guo, Yiwen Jiang, Siyuan Sun, Xun Xu

Work schedules for medical residents are subject to complex rules and restrictions. We provide a modular framework which can be used to (1) evaluate the feasibility of a given schedule; (2) compare multiple different schedules across several different metrics; and (3) generate high-quality feasible solutions for evaluation, modification, and implementation.

****56 - A Study in Usability: Handheld Apps for NJ's Department Health & Senior Services Hippocrates Software**

Christie Nelson, Rutgers University, 23A Norwood Ct, Princeton, NJ, 08540, United States of America, cgrewe@eden.rutgers.edu, Yves Sukhu, William M. Pottenger

A study was performed on handheld applications for New Jerseyís Department of Health and Senior Services Hippocrates software. Hippocrates is used for monitoring and responding to health-related emergencies by New Jersey. Research was conducted on two apps (iPad and Android) developed by other team members to identify potential areas for improvement. Research was based on similar software, current technologies, user interviews, a human factors evaluation of functionality, and usability testing.

****57 - An Ambulance Location Model with Constraints on Failure and Survival Probabilities**

Boray Huang, National University of Singapore, 1 Engineering Drive 2, E1A 06-25, Singapore, Singapore, isehb@nus.edu.sg, Yuan Zhou, Hui-Chih Hung

We study the ambulance location problem in an Emergency Medical Service system. The goal of the research is to locate the ambulance stations and decide the fleet size at each station. We build a set covering model with constraints on failure probability and survival probability. As the constraints are non-linear, we first derive the analytical solutions for a simple case. Then a heuristic is proposed for the general cases.

****58 - Analyzing and Designing Outpatient Appointment Schedules with Operational Policy Targets**

Emre Veral, Professor, Baruch College, 17 Lexington Ave., Box B9-240, New York, NY, 10010, United States of America, emre.veral@baruch.cuny.edu, Benedetto Valenti, Will Millhiser

We propose a new paradigm in appointment scheduling. Using a stochastic model to assess the distributions of patient waiting time and MD overtime, we focus on probabilistic targets to design scheduling templates. Analysis of existing rules demonstrates their inherent shortcomings, and model capabilities enable new schedule designs that meet operational performance targets such as the percentage of patients waiting more than X minutes, or the probability that session overtime exceeds Y minutes.

****59 - Multi-facility Surgical Case Scheduling**

Jihan Wang, Ph.D. Student, Wayne State University, 4815 Fourth St., Rm. 2033, Detroit, MI, 48202, United States of America, aw0984@wayne.edu, Alper Murat, Kai Yang

In a healthcare network, several facilities are located close to each other. The overall network can benefit in terms of increased utilization and reduced wait time by coordinating surgical scheduling decisions across the member hospitals. In our study, we expand the scope of OR scheduling to multi-facility setting by considering the transferring of surgical cases among multiple facilities of the network. A goal programming approach is adopted for the multi-criteria decision making process.

****60 - Patient and Nurse Considerations in Home Health Routing**

Jessica Spicer, Graduate research assistant, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, jbentz@uark.edu, Ashlea Bennett Milburn

In home health care, as in many applications, cost is an important factor used to measure the quality of a route. However home health agencies may also be interested in creating routes that achieve a variety of other patient and nurse satisfaction goals. We use an integer programming model to study the relationship among these multiple objectives, as well as the impact of new technologies such as remote monitoring devices on these various goals.

****61- Blood Platelet Optimization for Blood Banks**

Nico M. van Dijk, University of Amsterdam , Department of Operations Research, University of Amsterdam, The Netherlands, Netherlands, n.m.vandijk@uva.nl, Cees Smit Sibinga, René Haijema, Wim de Kort, Nikky Kortbeek, Michiel Jansen, Jan van der Wal

Donated Blood Platelets have a limited shelftime. Outdating , shortages, age and costs are to be minimized. Three phases are shown over 6 years: I The development of combined dynamic programming and simulation. II Its application and implementation to Dutch Bloodbanks. III Its extension to transportation and hospitals.

Monday, 1:30pm - 3:00pm

■ MC01

C - Room 201A

Retail Operations and Supply Chain Design

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: H. Sebastian Heese, Indiana University, 1309 E 10th St, Kelley School of Business, Bloomington, IN, 47405, United States of America, hheese@indiana.edu

1 - Horizontal Mergers in Multi-tier Decentralized Supply Chains

Soo-Haeng Cho, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15217, United States of America, soohaeng@andrew.cmu.edu

This paper examines the competition and synergy effects of a horizontal merger in multi-tier decentralized supply chains where different numbers of firms compete at each tier. My analysis shows that a consumer price is less likely to fall after a merger: (1) when a merger occurs in a downstream tier rather than in an upstream tier, and (2) when a merger occurs in a vertically disintegrated market rather than in a vertically integrated market.

2 - Managing Dual Distribution Channels under Uncertainty

Gokce Esenduran, The Ohio State University, 2100 Neil Avenue, Columbus, OH, United States of America, esenduran_1@fisher.osu.edu, Lauren Xiaoyuan Lu, Jayashankar Swaminathan

We consider a manufacturer selling products through both dealers and rental agencies. If rental agencies sell used rental items to consumers, competition between new and used rental products leads to channel conflicts. In response, manufacturers buy used rental items back and sell them through dealer. Prior research shows that this buyback program alleviates channel conflicts. We study how the demand uncertainty and the timing policy on when to set the buyback price affect channel conflicts.

3 - Category Captainship: When Should the Retailers Outsource Category Management?

Mumin Kurtulus, Assistant Professor, Vanderbilt University, Owen School of Management, 401 21st Avenue South, Nashville, TN, 37221, United States of America, mumin.kurtulus@owen.vanderbilt.edu, Alper Nakkas, Sezer Ulku

Category captainship is a practice where a retailer relies on one manufacturer in the category for recommendations regarding strategic category management decisions. This research investigates the conditions under which captainship practices are more likely to emerge and deliver value to the retailers in a context where the scope of category management is (1) deciding on the variety of the assortment and (2) undertaking demand enhancing activities such as better shelf-space management.

4 - Optimal Pricing and Bundling of Vertically Differentiated Products

Dorothee Honhon, Assistant Professor, University of Texas at Austin, McCombs School of Business, 1 University Station, Austin, TX, United States of America, dorothee.honhon@mccombs.utexas.edu, Xiajun Amy Pan

We study how to choose the optimal bundling and pricing strategy for a retailer offering vertically differentiated products. We characterize the conditions under which pure bundling and mixed bundling strategies are optimal respectively. We provide efficient methods to identify which individual components to offer, whether or not to offer a bundle and how to price the offered individual components and the bundle in order to maximize the decision maker's profit.

■ MC02

C - Room 201B

Optimization in Finance III

Cluster: Optimization in Finance

Invited Session

Chair: Michael Best, Professor Emeritus, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, mjbest@uwaterloo.ca

1 - Portfolio Selection with Constriant on VaR

Siming Huang, Professor, Institute of Policy and Management, Chinese Academy of Science, Beijing, 100190, China, simhua@casipm.ac.cn

This paper discuss the portfolio selection models with constriants on value at risk. We show that they can be transformed into quadratically constrianed quadratic programming problems. We will propose some interor point algorithms for solving them.

2 - When More Is Less: Using Multiple Constraints to Reduce Tail Risk

Alexandre Baptista, Associate Professor of Finance, The George Washington University, 2201 G Street, NW, Funger Hall, Suite 501, Washington, DC, 20008, United States of America, alexbapt@gwu.edu, Shu Yan, Gordon Alexander

We examine the effectiveness of multiple VaR constraints in controlling CVaR. Under certain conditions, we theoretically show that they are more effective than a single VaR constraint. Also, we numerically find that the maximum CVaR permitted by the constraints is notably smaller than with a single constraint. These results suggest that regulations and risk management systems based on multiple VaR constraints are more effective in reducing tail risk than those based on a single VaR constraint.

3 - A Similarity-based Indexing Model with Sector and Trading Restrictions

Roy Kwon, Associate Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, rkwon@mie.utoronto.ca, Dexter Wu

We present an indexing model that tracks a benchmark porfolio using similarity measures between assets and imposes a cardinality restriction on the number of assets held. Estimates for returns are not required. However, optimal tracking protfolios may over concentrate in just a few sectors. So we impose sector constraints as well as buy-in thresholds and lot sizing restrictions. We track the S&P 500 and find optimal tracking portfolios that are more efficient.

4 - The Explicit Derivation of the Efficient Frontier for Single-index Portfolio Models

Michael Best, Professor Emeritus, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, mjbest@uwaterloo.ca, Xili Zhang

This paper discusses the structure of the efficient frontier for single-index portfolio optimization models. We develop a closed form solution of the single-index portfolio model with lower or upper bound constraints. We show there are only n corner portfolios out of the potential 2^n corner portfolios. For each case, the order in which the assets are driven to their bounds corresponds to the ordering of their expected returns.

■ MC03

C - Room 202A

Tutorial/Panel: Bringing O.R. into the 21st Century with Social Networking and Web 2.0 Tools

Sponsor: Computing Society/ Open Source Software (Joint Cluster Optimization)

Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Introduction Social Networking for O.R.

Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

With the ever-increasing popularity of new online tools for social networking, how we interact and communicate as O.R. professionals is destined to change. We need to adapt to this new world and embrace it, so we can reap its many benefits. We will start with a series of quick tutorials, introducing the social networking tools most actively used today for O.R. collaboration. This will be followed by a panel discussion, including the reasons for O.R. professionals to adopt these tools.

2 - Social Networking Sites for O.R. – Active Collaboration through Online Networks

Bo Jensen, Sulum Optimization, Denmark, jensen.bo@gmail.com

LinkedIn and Facebook are social networking sites used by many O.R. professionals to connect together, post updates on their various projects, and form discussion groups. AnalyticBridge is a popular social network with over 10000 members, designed for analytic professionals, where they can ask questions, participate in discussion groups, find jobs, post photos and videos, and write blogs. Skype allows free conference calls, online group chatting, and live tutorials.

3 - Twitter for O.R. - Microblogging to a Wide Audience
Paul Rubin, Professor, Michigan State University, Department of Management, Eli Broad College of Business, East Lansing, MI, 48824-1122, United States of America, rubin@msu.edu

Often associated with oversharing of trivial information, Twitter provides easy access to several capabilities that are useful to O.R. professionals. We demonstrate its value for instant communication with online contacts, wide sharing of small bits of information (such as links to web resources or news), and reaching, through hashtags (#) and retweets (RT), interested parties outside your network of contacts (in the process growing that network).

4 - OR-Exchange - Q&A Site for O.R.
Michael Trick, Carnegie Mellon University, Pittsburgh, PA, United States of America, trick@cmu.edu

www.OR-Exchange.com is a site where people can ask questions about O.R. and analytics and get answers from professionals. The site was started by Michael Trick a couple of years ago. The idea was to mimic the popular MathOverflow.net site, but to specialize in O.R. issues. Moderated by a group of dedicated O.R. experts, the site has grown in popularity and now has more than 400 official users, hundreds of questions and over 1000 answers.

5 - Blogging for O.R. - Publish Your O.R. Work and Insights Online
Laura McLay, Assistant Professor, Virginia Commonwealth University, Richmond, VA, 23284, United States of America, lamclay@vcu.edu

The word blog is one of the most popular words on the Internet today. A blog is a web log, or an online public diary or journal that is written for others to read. Blogging about O.R. has also become quite popular. A number of the top O.R. experts from either academia or industry blog on their view on O.R. INFORMS even has a monthly O.R. blog challenge on different topics, with more than a dozen participating authors.

6 - Videos for O.R. - Courses, Presentations, and Tutorials
Tim Hopper, North Carolina State University, 129 Old Savannah Drive, Morrisville, NC, 27560, United States of America, tdhopper@ncsu.edu

Services such as YouTube allow O.R. professionals to share audio, video, and screencasts with the public. Relevant content can include academic courses, conference presentations, tutorials, O.R. success stories, and software demonstrations. Free and affordable software makes creating online video easy and accessible. For students and those looking for further their knowledge, video websites contain hundreds of hours of material on topics in operations research, mathematics, and more.

7 - Panel Discussion on Utilizing Social Networking for Professional O.R. Work
Moderator: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com, Panelists: Laura McLay, Tim Hopper, Michael Trick, Paul Rubin

After the quick series of tutorials, we will have a panel discussion where the speakers will discuss various aspects of using Web 2.0 and Social Networks as collaboration tools for professional O.R. work, and take questions from the audience, prompting a lively discussion. This session will all be video-taped and later published online, where we anticipate it will be tweeted, blogged, and discussed even further.

■ MC04

C - Room 202B

Joint Session ICS/Optimization: Multi-Start Methods for Global Optimization

Sponsor: Computing Society/Optimization/Global Optimization
Sponsored Session

Chair: John Chinneck, Professor, Carleton University, 1125 Colonel By Drive, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca

1 - Applications and Extensions of the OQNLP Multi-start Procedure
Leon Lasdon, Professor, University of Texas, IROM Department, McCombs Business School, Austin, TX, 78731, United States of America, Leon.Lasdon@mccombs.utexas.edu, Fred Glover, John Plummer, Michael Bussieck

OQNLP is a multistart procedure for nonconvex NLP. As a GAMS and TOMLAB Solver, it multi-starts any of the available NLP Solvers in those systems, using starting points generated by the OptTek systems search method OptQuest, after they are filtered by a set of rules. We discuss some uses of OQNLP in investigating the local-global issue in some constrained nonlinear regression problems arising from modeling secondary recovery in oil fields. We also discuss some extensions using pseudo-cuts.

2 - Speeding up the Cross-entropy Method for Global Optimization
Yuting Wang, University of Virginia, 151 Engineer's Way, Charlottesville, VA, 22903, United States of America, yw6h@virginia.edu, Alfredo Garcia

The performance quality of methods of cross-entropy minimization varies significantly on the interplay between the problem structure and the class of sampling distributions. We propose a parallel implementation in which threads interact. Some threads select sampling distributions so as to eliminate "less useful" information on locally optimal solutions. We derive sufficient conditions to ensure the interactive implementation provides a faster convergence rate than independent parallel threads.

3 - On Maximum Speedup Ratio of Restart Algorithms' Portfolios
Oleksii Mostovyi, Carnegie Mellon University, Department of Mathematical Sciences, Pittsburgh, PA, United States of America, omostovy@andrew.cmu.edu, Oleg A. Prokopyev, Oleg Shylo

We discuss two possible parallel strategies for randomized restart algorithms. Given a set of available algorithms, one can either choose the best performing algorithm and run multiple copies of it in parallel (single algorithm portfolio), or choose some subset of algorithms to run in parallel (mixed algorithm portfolio). It has been previously shown in the literature that the latter approach may provide better results. In this talk we investigate the extent of such improvement.

4 - Better Placement of Local Solver Launch Points for Global Optimization
John Chinneck, Professor, Carleton University, 1125 Colonel By Drive, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca, Laurence Smith, Victor Aitken

NLP solutions are very sensitive to the launch point provided to the local solver, hence multi-start methods are needed if the global optimum is to be found. We use Constraint Consensus as a fast way to improve random starting points. This allows us to identify clusters of points that generally correspond to disjoint feasible regions. Efficiency is improved by launching the local solver just once from each such cluster. Extensive empirical results are given.

■ MC05

C - Room 203A

Simple Heuristics for Optimal Inventory Policies in Supply Chains

Cluster: Tutorials
Invited Session

Chair: Kevin Shang, Duke University, Fuqua School of Business, Durham, NC, United States of America, khshang@duke.edu

1 - Simple Heuristics for Optimal Inventory Policies in Supply Chains
Kevin Shang, Duke University, Fuqua School of Business, Durham, NC, United States of America, khshang@duke.edu

This tutorial summarizes recent development on simple heuristics for optimal inventory policies in supply chains. The considered policies are (r,Q) policies and (s,T) policies. The former (latter) policies are often implemented in a continuous-review (periodic-review) inventory system. The proposed heuristics share a common approach that solves a set of independent, single-stage problems, whose parameters are obtained from the original system data.

■ MC06

C - Room 203B

Applying Production and Inventory Management Theory to Sustainable Energy Systems

Cluster: Tutorials
Invited Session

Chair: Owen Wu, Assistant Professor, University of Michigan, Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, owenwu@umich.edu

1 - Applying Production and Inventory Management Theory to Sustainable Energy Systems
Owen Wu, Assistant Professor, University of Michigan, Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, owenwu@umich.edu

In this tutorial, we discuss sustainable energy systems, focusing on the management challenges brought by intermittent energy generation resources. We apply the production and inventory management theory developed over the past decades to address these new challenges. We study the similarities and the differences between classical systems and energy systems in the new era, and extend the impact of the operations management theory to the field of sustainable energy system management.

■ MC07

C - Room 204

Large Scale Dynamic Stochastic Games

Sponsor: Applied Probability

Sponsored Session

Chair: Gabriel Weintraub, Columbia University, Columbia Business School, New York, NY, United States of America, gyw2105@columbia.edu

1 - Equilibria of Dynamic Games with Many Players: Existence, Approximation, and Market Structure

Sachin Adlakha, California Institute of Technology, Pasadena, CA, United States of America, adlakha@caltech.edu, Ramesh Johari, Gabriel Weintraub

We study stochastic games with many interacting players. In contrast to studying Markov perfect equilibrium (MPE), we consider stationary equilibrium (SE), where players' strategies depend only on the long run average state of their competitors. We study the conditions under which SE exists and show that the same conditions ensure that SE is a good approximation to MPE in large games. The conditions we propose amount to a dichotomy between decreasing and increasing return to larger states.

2 - Mean Field Equilibria of Dynamic Auctions with Learning

Ramesh Johari, Stanford University, Mgmt. Sci. and Eng., Stanford, CA, 94305, United States of America, ramesh.johari@stanford.edu, Krishnamurthy Iyer, Mukund Sundararajan

We use the methodology of mean field equilibrium to analyze a dynamic auction model where short-lived agents compete to obtain identical copies of a good while learning an unknown private valuation that determines the distribution of the reward they obtain from the good. We show an MFE exists and completely characterize agent behavior in equilibrium. Further, we show that an MFE is a good approximation to rational agent behavior as the number of agents in the market increases.

3 - A Framework for Dynamic Oligopoly in Concentrated Industries

Bar Ifrach, Columbia University, New York, NY, United States of America, bifrach14@gsb.columbia.edu, Vivek Farias, Gabriel Weintraub

We introduce a new model and equilibrium concept that alleviates the curse of dimensionality in computing equilibria in dynamic oligopoly models. We focus on industries in which there are a few large dominant firms and many small firms. Firms keep track of the state of dominant firms and of few aggregate statistics of the fringe firms' state distribution. Through theoretical and computational results we show that our approach greatly increases the applicability of dynamic oligopoly models.

4 - Tractable Notions of Equilibrium in Revenue Management

Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, vivekf@mit.edu, Matthieu Monsch, Georgia Perakis

We present a formalization of the notion that competing retailers practicing dynamic capacity management for some perishable product compete "implicitly". We show that this implicit competition provides a good approximation to the far more demanding notion of Markov Perfect Equilibrium while simultaneously requiring pricing policies similar to the monopolist case.

■ MC08

C - Room 205

Hybrid Methods I: Graph-based Propagation

Sponsor: Computing Society/ Constraint Programming and Integrated Methods

Sponsored Session

Chair: Tallys Yunes, Assistant Professor, University of Miami, Department of Management Science, Coral Gables, FL, 33124-8237, United States of America, tallys@miami.edu

1 - Manipulating MDD Relaxations for Combinatorial Optimization

David Bergman, Carnegie Mellon University, Tepper School of Buisness, Pittsburgh, PA, United States of America, dbergman@andrew.cmu.edu, John Hooker, Willem-Jan van Hoeve

We study the application of limited-width MDDs (multivalued decision diagrams) as discrete relaxations for combinatorial optimization problems. We introduce a new compilation method for constructing such MDDs, as well as algorithms that manipulate the MDDs to obtain stronger relaxations. We apply our methodology to set covering problems and show that for structured problems, the MDD relaxations outperform state-of-the-art integer programming technology by several orders of magnitude.

2 - MDD Propagation for Sequence Constraints

Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, vanhoeve@andrew.cmu.edu

We study propagation for the 'sequence' constraint in the context of constraint programming based on limited-width MDDs. We first show that establishing MDD-consistency for sequence is NP-hard. We further propose a partial filtering algorithm that relies on a specific decomposition of the constraint. We experimentally show that our filtering algorithm can obtain large savings in terms of search tree size and computation time.

3 - Multivalued Decision Diagrams Relaxation for the Maximum Independent Set Problem

Andre Cire, Carnegie Mellon University, Pittsburgh, PA, United States of America, andrecire@cmu.edu, David Bergman, Willem-Jan van Hoeve, John Hooker

Limited-Width Multivalued Decision Diagrams (MDDs) have recently been identified as a potential tool for generating relaxations to combinatorial optimization problems. We continue this line of research by applying MDDs to the Maximum Independent Set problem. We show bounds on the width of the exact MDD representation of the solution space for particular graph classes. Also, we provide computational experiments and evaluate our methodology against relaxations based on linear programming.

4 - Grammar-based Column Generation for Personalized Multi-activity Shift Scheduling

Bernard Gendron, Université de Montréal, C.P. 6128, Succ. Centre-ville, Montréal, Canada, gendron@iro.umontreal.ca, Marie-Claude Côté, Louis-Martin Rousseau

We present a branch-and-price algorithm to solve personalized multi-activity shift scheduling problems. The subproblems in the column generation method are formulated using grammars and solved with dynamic programming. The expressiveness of context-free grammars is exploited to easily model restrictions over shifts, allowing the branch-and-price algorithm to solve large-scale problem instances.

■ MC09

C - Room 206A

Revenue and Demand Management

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Georgia Perakis, Massachusetts Institute of Technology, Cambridge, MA, United States of America, georgiap@mit.edu

1 - Revenue Management of Reusable Resources with Advanced Reservations

Cong Shi, PhD Candidate, Massachusetts Institute of Technology, 602A, 70 Pacific St, Cambridge, MA, 02139, United States of America, shicong@mit.edu, Retsef Levi

This paper studies a class of revenue management problems in systems with reusable resources and advanced reservations. A simple control policy called the class selection policy (CSP) is proposed based on solving a knapsack linear program (LP). The CSP is guaranteed to generate near-optimal long-run average revenue in the critically loaded regime and the Halfin-Whitt regime. The analysis is based on new approaches that model the problem as loss network systems with advanced reservations.

2 - Supply Chain Planning with Online Demand Selection

Adam Elmachtoub, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, ane@mit.edu, Retsef Levi

We consider new online versions of supply chain models where one has to make instantaneous decisions regarding which demands to serve. Specifically, demands arrive sequentially, and one has to decide upon arrival whether to accept or reject the arriving demand, without knowledge about the future demands. The goal is to minimize the lost sales costs of the rejected demands plus the production costs of the accepted demands.

3 - Menu Pricing Competition when Suppliers' Capacities are Private Information

Hamid Nazerzadeh, Marshall School of Business, University of Southern California, Los Angeles, CA, United States of America, hamidnz@microsoft.com, Georgia Perakis

We study the role of information asymmetry in a common agency setting where two capacity-constrained suppliers compete to sell their product to a retailer, by simultaneously offering menus of quantity-price contracts.

4 - Differentiated Pricing Strategy for Fresh Products under Uncertain Demand

Zhengliang Xue, IBM, 1101 Kitchawan Rd, Yorktown, NY, 10598, United States of America, zxue@us.ibm.com, David D. Yao, Markus Ettl

We study a differentiated pricing strategy contingent on product freshness. A retailer sells both fresh and aged products where the fresher product provides a higher quality. Customers are segmented as high-end and low-end, and high-end customers are more sensitive to freshness. Customers might upgrade or downgrade their preferred product choice if a stock-out takes place. We analyze the joint pricing and inventory decisions to maximize the retailer's expected profit under uncertain demand.

■ MC10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - FICO - Building Optimization Applications in FICO Xpress

Oliver Bastert, Product Management, FICO, 901 Marquette Avenue, Ste. 3200, Minneapolis, MN, 55402, United States of America, OliverBastert@fico.com

This tutorial will focus on developing and deploying complete optimization applications using FICO's array of mathematical modeling and optimization tools. These tools can be used for modeling, solving, analyzing and visualizing optimization problems, and integrating them seamlessly in business applications. Bastert will explain how Xpress-Mosel, Xpress-IVE and Xpress-Application Developer can decrease development time for new optimization applications and enable you and your customers to make smarter decisions. The proven technologies offered by FICO can be used in range of applications such as supply chain management, transportation, finance, energy, manufacturing, retail, insurance and manufacturing industries, to name a few.

2 - AIMMS (Paragon Decision Technology) – Constraint Programming in AIMMS

Peter Nieuwesteeg, AIMMS (Paragon Decision Technology), 500 108th Avenue NE, Suite 1085, Bellevue, WA, 98004, United States of America, p.nieuwesteeg@aimms.com, Deanne Zhang

Constraint Programming, a recent addition to the AIMMS modeling platform, is a paradigm useful in formulating and solving highly combinatorial problems where MIP solvers fail. In this session, we will demonstrate AIMMS and the new Constraint Programming functionalities, through a real-life example with various formulations, and analyze the results using the tools in AIMMS.

■ MC11

C - Room 207A

Queueing and Stochastic Inventory

Sponsor: Applied Probability

Sponsored Session

Chair: Hossein Abouee-Mehrizi, University of Waterloo, Department of Management Sciences, Waterloo, ON, Canada, haboueem@uwaterloo.ca

1 - Optimal Return Policy under Resale

Valery Pavlov, University of Auckland, 12 Grafton Road, Auckland, New Zealand, v.pavlov@auckland.ac.nz, Kate Li

We consider different product return policies in a dynamic setting where immediate resale is possible. We show that the retailer chooses higher refund at the beginning of the selling horizon and examine the impact of consumer valuation, salvage value, product composition, and channel structure on the retailer's profit.

2 - On the Accuracy of Fluid Models for Capacity Planning in Queueing Systems with Impatient Customers

Achal Bassamboo, Northwestern University, Evanston, IL, United States of America, a-bassamboo@kellogg.northwestern.edu, Ramandeep Randhawa

We study the optimal capacity sizing problem for an M/M/N+G system. We use fluid models to characterize near-optimal prescriptions. These prescriptions depend intricately on the entire abandonment distribution and can lead to an operating regime with traffic intensity greater than 1. We demonstrate that in this case, the prescription is optimal up to O(1). That is, as the customer arrival rate increases, the optimality gap does not grow.

3 - Hybrid Policies and Inventory Rationing in a Multi-class Spare Parts System

Pedram Sahba, University of Toronto, Toronto, ON, Canada, pedram@mie.utoronto.ca, Baris Balcioglu

We consider a system consisiting of multiple repair shops and spare parts inventories. We examine the benefit of resource pooling while we use different policies to dispatch the spare parts. A queueing based approach is used to model the system. In our model, we assume that the system can store a hybrid of shared and reserved inventories. We compare the performance of each policy and based on the result, an appropriate policy is recommended.

4 - Strategies for a Single Product Multi-Class M/G/1 Make-to-Stock Queue Serving Different Markets

Hossein Abouee-Mehrizi, University of Waterloo, Department of Management Sciences, Waterloo, ON, Canada, haboueem@uwaterloo.ca, Opher Baron, Baris Balcioglu

For a single product multi-class M/G/1 make-to-stock queue, we analyze the strict priority and multilevel rationing policies when the inventory is centralized. Dynamic programming, the tool commonly used to investigate the MR policy, is less practical when service time is general. We focus on customer composition (the proportion of customers of each class to the total number of customers in the queue) and derive the optimal cost and control for the policies.

■ MC12

C - Room 207BC

Approximate Dynamic Programming in Health

Sponsor: Computing Society/ Computational Stochastic Optimization

Sponsored Session

Chair: Antoine Sauré, PhD Student, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, antoine.saure@sauder.ubc.ca

1 - A Sampling Based POMDP Approximation Method for Optimization of Prostate Cancer Screening Decisions

Jingyu Zhang, Philips Research North America, 345 Scarborough Rd, Briarcliff Manor, NY, 10510, United States of America, jingyu.zhang@philips.com, Brant Inman, Nilay Shah, Brian Denton

A multi-stage POMDP is proposed for the coordination of prostate cancer screening and treatment decisions. Multiple treatment options are considered in the model. A new sampling-based approximation method is developed to solve the model. A method to take advantage of the underlying structure is incorporated into the approximation method. Comparison between the new approximation method and other previously proposed methods and the optimal screening and treatment policy are presented.

2 - Approximate Dynamic Programming for Optimal Search in Minimally Invasive Surgery

Yasin Gocgun, Postdoctoral Fellow, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, yasin.gocgun@sauder.ubc.ca, Steven Shechter

We study a class of optimal search problems where the search region includes a target and an obstacle, each of which has some shape. We formulate these problems as Markov Decision Processes (MDPs), but because of the intractability of the state space, we use Approximate Dynamic Programming (ADP) techniques and compare their performances against heuristic decision rules. We motivate the problem with decision making that takes place during the course of minimally invasive surgery.

3 - ADP Methods for Optimal Control of Cardiovascular Risk in Patients with Type 2 Diabetes

Jennifer Mason, PhD Student, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, jemason2@ncsu.edu, Brian Denton, Nilay Shah, Steven Smith

We describe approximate dynamic programming (ADP) methods to approximate the solution to a finite horizon non-stationary Markov decision process (MDP) with a continuous state space. We compare the performance of two types of ADP methods. The first uses basis functions and the second uses an adaptive state aggregation approach to approximate the optimal policy. We present computational results for the optimal control of treatment of cardiovascular risk in patients with type 2 diabetes.

4 - Approximate Dynamic Programming Methods for Advance Patient Scheduling

Antoine Sauré, PhD Student, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, antoine.saure@sauder.ubc.ca, Martin Puterman, Jonathan Patrick

We describe a discounted infinite-horizon Markov decision process to dynamically schedule patients with different priorities to a healthcare facility in advance of the service day, when future demand is still unknown. The main purpose of this model is to reduce patients' wait times in a cost-effective manner. We then describe two approximate dynamic programming (ADP) techniques for solving this model. A comparison of the techniques in terms of their performances and challenges is presented.

■ MC13

C - Room 207D

Interface Between Inventory Management and Finance

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Jim Shi, Assistant Professor, Department of Managerial Sciences, 35 Broad Street, Atlanta, GA, 30303, United States of America, jmshi@gsu.edu

1 - Newsvendor Problem with Pricing under Stochastic Yield: CVaR Approach

Saman Eskandarzadeh, Visiting Graduate Student, University of California-Davis, Department of Mathematics, Davis, CA, 95616, United States of America, saman@math.ucdavis.edu

In this research, we consider the classic newsvendor problem with pricing and stochastic yield for a risk averse decision maker. We use CVaR criterion as the risk measure. We model the risk considerations of a risk averse decision maker by adding risk constraints. When the ex-post corrective actions (recourse actions) are not possible, optimization of a solely scalar function of random return is not sufficient to control the risk in the short run. In that case, tuning the mean of different parts of return distribution to our specification is one way to mitigate the bad consequences of exposure to risk.

2 - Cash-flow Based Multiple-period Inventory Management

Jim Shi, Assistant Professor, Department of Managerial Sciences, 35 Broad Street, Atlanta, GA, 30303, United States of America, jmshi@gsu.edu

This work studies single product multiple-period news-vendor problem with external fund availability. We treat the corresponding optimization problem as a capital-asset portfolio problem, and obtain the optimal ordering strategy.

■ MC14

C - Room 208A

Transmission Systems and Network Configurations for Supporting Renewable Integration

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Enzo Sauma, P. Universidad Catolica de Chile, Ave Vicuna Mackenna 4860, Santiago, Chile, esauma@ing.puc.cl

1 - Long-term Transmission Expansion Using Benders Decomposition

Francisco Munoz, Johns Hopkins University, 3400 North Charles, Baltimore, MD, 21218, United States of America, fmunoz2@jhu.edu, Benjamin Hobbs

There is a need to link realistic operating models (OPF) with long run planning under gross uncertainty. Decisions on transmission expansion today will affect investments on generation tomorrow. A multi-stage stochastic model is solved using the Benders decomposition for a meshed network with loop-flows. Assuming a linearized DC power flow, we compare our solution with a deterministic case and calculate the value of information as well the cost of disregarding uncertainty.

2 - Benefits of Co-locating Wind and Concentrating Solar Power

Ramteen Sioshansi, Assistant Professor, The Ohio State University, Integrated Systems Engineering, 240 Baker Systems, Columbus, OH, 443215, United States of America, sioshansi.1@osu.edu, Paul Denholm

We examine the benefits of co-locating wind and concentrating solar power when costly radial transmission lines must be used to interconnect these resources with the system.

3 - Special Protection Schemes with Robust Corrective Switching

Kory Hedman, Assistant Professor, Arizona State University, P.O. Box 875706, School of ECEE, GWC 206, Tempe, AZ, 85287, United States of America, kory.hedman@asu.edu, Muhong Zhang, Akshay Korad

Today, PJM has Special Protection Schemes that reconfigure the network topology after a contingency; this is known as corrective switching. These SPSs are few, however, as they are based on ad-hoc methods. Past research has proposed switching models that are solved immediately following a contingency. While it is ideal to solve these models in real-time, they are currently too slow. This research develops a robust corrective switching model that is solved offline and can identify potential SPSs.

4 - A Power Transmission Expansion Model Compatible with the Growth of Non-conventional Renewable Energy

Enzo Sauma, P. Universidad Catolica de Chile, Ave Vicuna Mackenna 4860, Santiago, Chile, esauma@ing.puc.cl, Cristobal MuÒoz, Javier Contreras, José Aguado, Sebastiàn De la Torre

We propose a transmission expansion model that is compatible with the integration of renewable energy. Specifically, we model the effect of incorporating wind power plants into the network planning problem. We show that ignoring this effect could induce to overestimate wind-power penetration.

■ MC15

C - Room 208B

Multiattribute Bids, Uncertainty Effect, Regime Detection and Risk Perception Over Time

Sponsor: Decision Analysis

Sponsored Session

Chair: L. Robin Keller, Professor, University of California-Irvine, Merage School of Business, Irvine, CA, 92697-3125, United States of America, lrkeller@uci.edu

Co-Chair: Tianjun Feng, Assistant Professor, Fudan University, Room 503, 670 Guoshun Road, Shanghai, 200433, China, tfeng@fudan.edu.cn

1 - Multiattribute Sealed-bid Procurement Auctions with Multiple Budgets

Jay Simon, Assistant Professor, Naval Postgraduate School, Defense Resources Management Institute, 699 Dyer Rd, Monterey, CA, 93933, United States of America, JRSimon@nps.edu, Francois Melese

A key challenge for government purchasing agents is selecting vendors that deliver the best combination of desired non-price attributes at realistic funding levels. The mechanism proposed is a multiattribute first price, sealed bid procurement auction in which a set of possible budget levels is specified. An extension of the model explicitly examines the buyer's decision problem under budget uncertainty by applying a utility function assessed over the value measure.

2 - Regime Change Prediction: Task Factors as Drivers of Judgmental Effectiveness and Learning

Florian Federspiel, PhD Student, IE Business School, Calle Maria de Molina 12, Bbajo, Madrid, 28006, Spain, ffederspiel.phd2014@student.ie.edu, Matthias Seifert, Lee Newman

We examine fundamental characteristics of the decision maker's external environment as predictors of judgmental effectiveness and learning. The main task employed is one of regime-change detection over time (Massey & Wu, 2005). We report results from an experimental study requiring subjects to generate probability judgments. Introducing a previously disregarded measure of signal strength, we shed further light on the drivers of learning when predicting regime shifts in uncertain environments.

3 - Time Inconsistency of Risk Perception
Yitong Wang, University of California-Irvine, Merage School of Business, Irvine, CA, United States of America, wangyt84124@gmail.com, Tianjun Feng, L. Robin Keller

Time inconsistency of preference has been studied by numerous researchers. However, little attention has been paid on time inconsistency of risk perception. In this talk we try to test people's intertemporal changes in their risk perception on abstract gambles. And we found that at different time points, probabilities of losses and potential losses had different roles.

4 - Counteracting the Uncertainty Effect Bias
Tianjun Feng, Assistant Professor, Fudan University, Room 503, 670 Guoshun Road, Shanghai, 200433, China, tfeng@fudan.edu.cn, Yitong Wang, L. Robin Keller

When exhibiting the uncertainty effect, individuals value a binary lottery less than the lottery's worst outcome. Our paper explores how to counteract the uncertainty effect bias by investigating a plausible underlying anchoring-and-adjustment process. Two experiments were conducted to examine if providing an anchor prior to judgments, or introducing additional cognitive load is able to counteract the uncertainty effect bias.

■ MC16

C - Room 209A

Forestry: Forest Fire Applications

Sponsor: Energy, Natural Resources and the Environment/ Forestry
Sponsored Session

Chair: Marc McDill, Associate Professor, Pennsylvania State University, 310 Forest Resources Bldg, University Park, PA, 16802, United States of America, mem14@psu.edu

1 - Incorporating Subjective Assessments of Detection System Performance in Fire Detection Planning
David Martell, University of Toronto, 33 Willcocks Street, Toronto, ON, M5S 1A1, Canada, david.martell@utoronto.ca, Colin McFayden, Douglas Woolford

Forest fire managers seek to find fires while they are small to increase the likelihood that they will be contained by the initial attack system while they remain small. We describe how subjective assessments of the likelihood of the public detecting and reporting fires were combined with daily people and lightning-caused fire occurrence predictions to help determine when and where to route forest fire detection patrol aircraft.

2 - Suppression or Prevention: Modeling Forest Fire Management Using System Dynamics
Ross Collins, Massachusetts Institute of Technology, Cambridge, MA, United States of America, ross.collins8j@gmail.com

The System Dynamics model provides an aggregate depiction of the physical and political dynamics of forest fire management. It evaluates suppression and prevention mixes of management resources in terms of total burned area. Assuming a finite budget, preliminary results indicate that under some mixes the system falls into a trap of short-term corrective action via increased fire suppression that diminishes fuel management. The result is more frequent and severe fire seasons.

3 - A Stochastic Programming Extended Attack Response Model for Large-scale Wildfires
Michelle McGaha, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, michelle.mcgaha@neo.tamu.edu, Lewis Ntaimo

We consider a multi-period stochastic integer programming model to optimize the location and timing of the dynamic deployment and redeployment of firefighting resources for an escaped large-scale wildfire. The model minimizes expected fire damage in terms of level of concern and ease of accessibility based on several scenarios of real time weather and how the fire front will grow, and utilizes production rates and travel delays for various firefighting resources.

4 - A Probabilistic Constrained Programming Standard Response Model for Wildfire Initial Attack Planning
Julian Gallego, PhD Student, Texas A&M University, 3017 Emerging Technologies Building, 3131 TAMU, College Station, TX, 77843, United States of America, kamizama77@tamu.edu, Lewis Ntaimo

We formulate a probabilistic constrained programming standard response model for initial attack planning. Risk is incorporated in the model in terms of "level of concern" at each representative fire location as defined by Texas Forest Service. Likewise, a probabilistic constraint allows for deployment plans based on a given acceptable level of reliability. We report preliminary results based on one of the Texas Forest Service fire planning units in East Texas.

5 - A Stochastic Programming Approach to Fire Suppression
Alex Masarie, Colorado State University, Forest and Rangeland Stewardship, Fort Collins, CO, 80523, United States of America, masariat@lamar.colostate.edu, Michael Bevers, Douglas Rideout

This paper presents a multistage, linear stochastic program with variable recourse to study a single-fire version of the fire management problem. Simulated fire behavior is based on representative weather scenarios derived from historical weather data. Simulation is performed on a landscape file in the Fire Area Simulator (FARSITE) that integrates terrain, fuels, and weather to estimate fire growth. A case study of the Black Hills National Forest is presented as proof of concept for the model.

■ MC17

C - Room 209B

Values and Trade-offs, When Deciding Gets Hard

Sponsor: Decision Analysis
Sponsored Session

Chair: Larry Neal, Chevron, San Ramon, CA, United States of America, LarryNeal@chevron.com

1 - Moving An Organization Towards understanding Values and Tradeoffs
Margery Connor, Chevron, 6001 Bollinger Canyon Road, Room G-2016, San Ramon, CA, 94583, United States of America, MHCO@chevron.com

This talk presents our progress to date moving our IT organization from 'rate and weight' calculations to having a dialog around the values and trade-offs of the alternatives.

2 - Minimizing the Need for Difficult Multiple Objective Value Trade-offs
Gregory Parnell, Distinguished Visiting Professor, United States Air Force Academy, Department of Management, 2354 Fairchild Drive, Suite 6H130, USAF Academy, CO, 80840, United States of America, greg.parnell@gmail.com

This presentation summarizes the author's value trade-off experience using multiple objective deicison analysis, Value-Focused Thinking (VFT), and Decision-Focused Transformation (DFT). The key ideas include separating cost and value, generating better alternatives to minimizing difficult value trade-offs, and explaining the value trade-offs with as much clarity as possible.

3 - Facilitating the Use of the Even Swaps Methodology
Larry Neal, Chevron, San Ramon, CA, United States of America, LarryNeal@chevron.com

This presentation will illustrate some novel adaptations of the Even Swaps methodology by Hammond, Keeney, and Raiffa, to enhance the facilitation of the decison making process. The use of color and decomposition of value metrics are key to improving clarity with the decision makers.

■ MC18

C - Room 210A

Current Issues in Project Management

Cluster: Scheduling and Project Management
Invited Session

Chair: Ted Klastorin, Professor, Foster School of Business, University of Washington, Box 353226, Seattle, WA, 98195-3226, United States of America, tedk@u.washington.edu

1 - Managing a Secret Project
Vera Tilson, Assistant Professor, University of Rochester, Simon School, Rochester, NY, United States of America, vera.tilson@simon.rochester.edu, Edieal Pinker, Joseph Szmerekovsky

We take the perspective of a project manager (PM) with an adversary. The PM seeks to limit the adversary's opportunity to interdict, and, therefore, tries to keep the adversary "in the dark" as long as possible while completing the project on time. In the context of a leader-follower game, we formulate and analyze a new form of project management problem for secret projects.

2 - Managing underperformance Risk in Project Portfolio Selection
Zhuoyu Long, National University of Singapore, Singapore, Singapore, longzhuoyu@nus.edu.sg, Jin Qi, Melvyn Sim, Nicholas G. Hall

We consider a project selection problem where projects have uncertain returns with partially characterized probability distributions. The decision maker selects projects to minimize the risk of the portfolio return not meeting a specified target. Our model captures correlation and interaction effects such as synergies. We solve the model using binary search and Benders decomposition. The project portfolios generated outperform those found by all classical benchmark approaches.

3 - Planning Uncertain R&D Projects under the Threat of a Disruptive Event
Issariya Sirichakwal, PhD Student, Foster School of Business, University of Washington, Box 353226, Seattle, WA, 98195-3226, United States of America, issars@u.washington.edu, Gary Mitchell, Ted Klastorin

We study an R&D project that is defined by a series of stages where the duration of each stage is described by a known distribution. There also exists the threat of a disruption that will stop the project for some random time. The payoff is determined by whether or not the project is completed before its announced due date. We define a model to analyze various policies, including if and when a manager should take proactive steps or wait until the disruption occurs to take contingent actions.

■ MC19

C - Room 210B

Methods and Applications in Financial Engineering

Sponsor: Financial Services Section

Sponsored Session

Chair: James Primbs, Assistant Professor, Stanford University, Huang Engr. Ctr. 358, 475 Via Ortega, Stanford, CA, 94305, United States of America, japrimbs@stanford.edu

1 - Bounding Contingent Claim Prices via Hedging Strategy with Coherent Risk Measures
Jun-ya Gotoh, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo, 112-8551, Japan, jgoto@indsys.chuo-u.ac.jp, Weifeng Yao, Yoshitsugu Yamamoto

We investigate an optimization approach for tightening the lower and upper bounds of the price of contingent claims in incomplete markets. Due to the dual representation of coherent risk measures, the lower and upper bounds are located by solving a pair of semi-infinite linear optimization problems. Tuning the parameter of the risk measure, we demonstrate by numerical examples that the two bounds approach to a price that is fair in the sense that seller and buyer face the same amount of risk.

2 - Real Options Valuation of Abandoned Farmland
Michi Nishihara, Osaka University, 1-7, Machikaneyama, Toyonaka, Osaka, 5600043, Japan, nishihara@econ.osaka-u.ac.jp

This paper investigates the decision-making process of an owner of abandoned farmland that is currently restricted to agricultural use but will be available for non-agricultural use in the future. I find that a slight probability of land conversion greatly increases the land value and discourages the owner from cultivating the land. I also observe that a small gap in the anticipation of land conversion prevents the owner from selling or leasing the land to a more efficient farmer.

3 - A Nonlinear Control Policy Using Kernel Method for Dynamic Asset Allocation
Yuichi Takano, Tokyo Institute of Technology, 2-12-1-W9-77 Ookayama, Meguro-ku, Tokyo, 152-8552, Japan, takano.y.ad@m.titech.ac.jp, Jun-ya Gotoh

We build a computational framework for determining an optimal dynamic asset allocation over multiple periods. To do this, a nonlinear control policy, which is a function of past returns of investable assets, is adopted. By employing a kernel method, the problem of selecting the best control policy from among nonlinear functions can be formulated as a convex quadratic optimization problem or a linear optimization problem.

4 - Robust Project Selection with Percentile Optimization
Ruken Duzgun, PhD Candidate, Lehigh University, 200 West Packer Avenue, Bethlehem, 18015, United States of America, rud207@lehigh.edu, Aurelie Thiele

We consider the problem of selecting projects to maximize total Net Present Value, for uncertain cash flows with a budget constraint. Our approach relies on a tractable approximation to the problem of maximizing a percentile of the objective, which leads to a robust optimization problem with only one new parameter and closed-form expressions of the objective coefficients. Numerical results are encouraging. We also discuss how to avoid over-conservatism when we implement the approximation.

5 - Dynamic Portfolio Choice with Bayesian Regret
Shea Chen, University of California-Berkeley, 4177 Etcheverry Hall, University of California, Berkeley, CA, 94720, United States of America, sheachen@berkeley.edu, Andrew Lim

We formulate a multi-period portfolio choice problem in which the investor is uncertain about parameters of the model, and the objective function is a Bayesian version of relative regret. The optimal portfolio is characterized and shown to involve a "tilted" posterior, where the tilting is defined in terms of a family of stochastic benchmarks.

■ MC20

C - Room 211A

Heuristics for Global Optimization, and Applications

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Michael Hirsch, Raytheon, 3323 Pelham Road, Orlando, FL, 32803, United States of America, mjh8787@ufl.edu

1 - Heuristic Algorithms for the Cardinality Constrained Efficient Frontier
Maria Woodside Oriakhi, Assistant Professor, College of the Bahamas, 137 Pink Coral Drive, Nassau, GT 2602, Bahamas, mw_oriakhi@yahoo.com, J E Beasley, Cormac Lucas

This paper examines the application of genetic algorithm, tabu search and simulated annealing metaheuristic approaches to finding the cardinality constrained efficient frontier that arises in financial portfolio optimisation. We consider the mean-variance model of Markowitz as extended to include the discrete restrictions. Computational results are reported for publicly available data sets drawn from seven major market indices.

2 - On Characterization of Maximal Independent Sets via Quadratic Optimization
Foad Mahdavi Pajouh, Oklahoma State University, Industrial Engineering & Management, Stillwater, OK, 74078, United States of America, mahdavi@okstate.edu, Balabhaskar Balasundaram, Oleg A. Prokopyev

This article investigates the local maxima properties of a box-constrained quadratic optimization formulation of the maximum independent set problem. Theoretical results characterizing binary local maxima of this formulation are developed. We also consider relations between continuous local maxima of the quadratic formulation and binary local maxima in the Hamming distance-1 and distance-2 neighborhoods. These results are then used to develop an efficient local search algorithm.

3 - A C-GRASP Python/C Library for Bound-constrained Global Optimization
Mauricio Resende, AT&T Labs Research, 180 Park Avenue, Bldg. 103, Room C241, Florham Park, NJ, 07932, United States of America, mgcr@research.att.com, Panos Pardalos, Ricardo Silva

We describe libcgrpp, a GNU-style dynamic shared Python/C library of the continuous greedy randomized adaptive search procedure (C-GRASP) for bound constrained global optimization. After a brief review of C-GRASP, we show how to download, install, configure, and use the library. An ilustrative example is described.

4 - On the Optimization of Information Workflows
Michael Hirsch, Raytheon, 3323 Pelham Road, Orlando, FL, 32803, United States of America, mjh8787@ufl.edu, Rakesh Nagi, Hector Ortiz-Pena, Moises Sudit, Adam Stotz

In this briefing, we focus on information workflows, and their relevance to military missions. A rigorous mathematical formulation is derived, and heuristics are developed to solve this NP-hard problem. Numerical results are presented, and future research directions are discussed.

■ MC21

C - Room 211B

Robust Optimization and Its Applications

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Muhong Zhang, Assistant Professor, Arizona State University, P.O. Box 878809, Tempe, AZ, 85287, United States of America, Muhong.Zhang@asu.edu

1 - The Recoverable Robust Bandwidth Packing Problem
Manuel Kutschka, RWTH Aachen University, Wuellnerstrasse 5b, Aachen, 52056, Germany, kutschka@math2.rwth-aachen.de, Christina Büsing, Arie Koster

Recoverable robustness has been recently introduced to deal with uncertainties in optimization problems. This two-stage approach allows a limited change of a first-stage decision after the realization of all uncertain parameters is known. In the bandwidth packing problem, commodities have to be routed before actual bandwidth requirements are known. In this talk, we study the Recoverable Robust Bandwidth Packing Problem. Preliminary computational results for an IP network are presented.

2 - Outpatient Sequencing and Scheduling under Uncertainty
Melvyn Sim, National University of Singapore, Mochtar Riady Building, BIZ 1, 8-76 15 Kent Ridge Drive, Singapore, melvynsim@nus.edu.sg, Jin Qi, James Ang

We study the outpatient sequencing and scheduling problem where the service times of the patients are potentially uncertain. We propose a new service compliance measure that ensures that patients' waiting times are within tolerable limits and show that the corresponding optimization problem can be solved exactly via a series of deterministic mixed-integer programming problems.

3 - Robust Optimization and Project Prioritization
Aurelie Thiele, Associate Professor, Lehigh University, 200 W Packer Avenue, Bethlehem, PA, 18015, United States of America, aurelie.thiele@lehigh.edu, Ruken Duzgun

We consider a multi-range optimization approach for project prioritization under cost and net present value uncertainty. We provide a tractable formulation of this problem, benchmark the approach against a two-stage stochastic programming problem and study numerical tractability as well as theoretical insights. We then extend the approach to a dynamic setting where information is revealed over time.

4 - Multi-stage Robust Network Problems
Muhong Zhang, Assistant Professor, Arizona State University, P.O. Box 878809, Tempe, AZ, 85287, United States of America, Muhong.Zhang@asu.edu

In this talk, we consider the multi-stage robust network flow and design problems under a polyhedral uncertainty set. The multi-stage problems are reduced to a two-stage problem to avoid the "curse of dimensionality". A special case of Lot-sizing problem is discussed as an example.

■ MC22

C - Room 212A

Paths, Path Curvature and Interior-point Methods

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Murat Mut, Department of Industrial and Systems Engineering Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, mhm309@lehigh.edu

1 - Polytopes and Arrangements: Diameter and Curvature
Yuriy Zinchenko, University of Calgary, Calgary, BC, Canada, yzinchen@math.ucalgary.ca

We introduce a continuous analogue of the Hirsch conjecture and a discrete analogue of the result of Dedieu, Malajovich and Shub. We prove a continuous analogue of the result of Holt and Klee, namely, we construct a family of polytopes which attain the conjectured order of the largest total curvature. Further developments are discussed.

2 - On Fundamental Properties of the Volumetric Path
Tamàs Terlaky, Lehigh University, Industrial & Systems Engineering Department, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, terlaky@lehigh.edu, Murat Mut

Logarithmic and volumetric barrier functions (LBF/VBF) are used in IPMs. For the LBF, the analytic center of a level set is on the central path (CP). We prove that this also holds for the volumetric path (VP). For the CP, the analytic center of the optimal set is the limit point of the CP. Lack of strict complementarity allows this property to fail for the LBF for semidefinite optimization. We show that for the VP this property fails to hold for a linear optimization problem in canonical form.

3 - Study of Iteration-complexity for the Central Trajectory via Curvature of Information Geometry
Atsumi Ohara, University of Fukui, Japan, ohara@fuee.u-fukui.ac.jp, Takashi Tsuchiya, Satoshi Kakihara

In this talk, we geometrically explain that iteration-complexity of an interior-point algorithm for conic linear programs is characterized by the embedding curvature of information geometry. As a result, the complexity is shown to asymptotically coincide with the curvature integrated along the central trajectory.

4 - Different Curvature Measures Arising in IPM's
Murat Mut, Department of Industrial and Systems Engineering Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, mhm309@lehigh.edu, Tamás Terlaky

We investigate the relationships between different measures of curvature in IPM's: the classical curvature from differential geometry and the curvature introduced by Sonnevend, Stoer and Zhao(1991). We develop a predictor-corrector type algorithm with a complexity upper bound given by a quantity similar to the classical curvature. Finally, the possibility of obtaining "average case" upper bounds is discussed.

■ MC23

C - Room 212B

Joint Session IAC/QSR: Asian Journal of Industrial Engineering (AJIE)

Cluster: INFORMS International Activities Committee (IAC)-Invited International Journal Sessions/Quality, Statistics and Reliability

Invited Session

Chair: Fugee Tsung, Department Head, Professor, Honk Kong University of Science and Technology, IELM Department, Hong Kong, China, season@ust.hk

Co-Chair: Ch Chu, National Tsing Hua University, Tsinghua, Taiwan - ROC, chchu@ie.nthu.edu.tw

1 - Statistical Quality Techniques to Service Science and Engineering
Fugee Tsung, Department Head, Professor, Honk Kong University of Science and Technology, IELM Department, Hong Kong, China, season@ust.hk

With the shift in economic focus from manufacturing to service, industrial and academic research facilities may need to apply more scientific rigor to the practices of service. This talk will focus on the development of statistical quality techniques and recent extensions to the service engineering research area.

2 - Reengineering and Evaluation of TFT-LCD Product Design Verification Process
Jack Su, Assistant Professor, National Tsing Hua University, 101 Sec. 2, Kuang-Fu Rd., Hsinchu, 30013, Taiwan - ROC, su@ie.nthu.edu.tw, Shou-Chuan Chang, Li-Ping Wu

Short product development lead time is one of the most important competitive advantages in TFT-LCD industry. Design Verification Testing (DVT) accounts for much of this lead time. In this research, we propose a new DVT process by overlapping some of the activities. Mathematical models are developed to evaluate the distribution of DVT completion times and the probability of inventory lost. Three real cases are used to demonstrate the application of these models.

3 - Determining Advanced Recycling Fees and Subsidies in Taiwan 'E-scrap' Reverse Supply Chains
I-Hsuan Hong, Assistant Professor, National Taiwan University, Industrial Engineering, 1, Sec. 4, Roosevelt Road, Taipei, 106, Taiwan - ROC, ihong@ntu.edu.tw, Yi-Ting Lee

We present a Stackelberg-type model to determine socially optimal advanced recycling fees (ARFs) and subsidy fees in decentralized "e-scrap" reverse supply chains where each entity independently acts according to its own interests. For comparative purposes, we also develop a conceptual model describing the current practice where ARFs and the subsidy fees are determined on the basis of fund balance between revenues and costs along with recycling operations.

■ MC24

C - Room 213A

Exact Solvers for Mixed Integer Nonlinear Optimization

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Pietro Belotti, Assistant Professor, Clemson University, Clemson, United States of America, pbelott@clemson.edu

1 - Generating the Convex Hull of Disjunctions in Mixed Integer Second Order Cone Optimization (MISOCO)

Julio C. Goez, Ph.D. Candidate, Lehigh University, Mohler Laboratory, 200 West Packer Avenu, Bethlehem, PA, 18015, United States of America, jcg207@lehigh.edu, Pietro Belotti, Ted Ralphs, Tamás Terlaky, Imre Polik

We consider the intersection of the continuous relaxation of the MISOCO feasible set, assumed to be an ellipsoid, and a disjunction. Under mild assumptions, we show that the convex hull of that intersection can be enclosed in a second order cone. Additionally, we present a procedure to obtain that unique second order cone. This cone provides a novel conic cut for MISOCO and thus can be an essential tool in branch-and-cut algorithms for MISOCO problems.

2 - Solving MINLPs with MINOTAUR

Ashutosh Mahajan, Argonne National Laboratory, 9700 S Cass Avenue, Argonne, IL, United States of America, mahajan@mcs.anl.gov, Sven Leyffer, Todd Munson

MINOTAUR is an open-source toolkit for MINLP. It includes implementation of standard algorithms for solving MINLPs: Branch-and-bound, Branch-and-Reduce, Quesada-Grossmann. It is also at the same time a flexible framework for exploiting problem structure to reformulate instances and to write customized solvers for specific problems. We will give an overview of the design and capabilities of MINOTAUR, describe recent enhancements and show its performance on standard test instances.

3 - Don't Break My Orbits

Leo Liberti, Professor, École Polytechnique, Palaiseau, France, leoliberti@gmail.com, Matteo Fischetti

Nature and art love symmetry. Mathematicians and computer scientists also love symmetry, with the only exception of MIP people who always want to break it. Why? As a matter of fact, symmetry is of great help in a convex setting, but in the MIP case it can trick enumeration because symmetric solutions are visited again and again. We will outline an approach called orbital shrinking where additional variables expressing variable sums within each orbit are used to "encapsulate" model symmetry.

4 - Optimizing the Design and Dispatch of Distributed Generation Systems

Kristopher Pruitt, PhD Candidate, Colorado School of Mines, 10545 Black Elk Way, Colorado Springs, CO, 80908, United States of America, kpruitt@mymail.mines.edu, Alexandra Newman, Robert Braun

We present a mixed-integer nonlinear program (MINLP) to optimally design and dispatch a distributed generation system for commercial buildings. Our MINLP determines the mix, capacity, and operational schedule of technologies (e.g. photovoltaic cells, fuel cells, batteries) that minimize economic and environmental costs subject to heat and power demands of the building and operational complexities of the integrated system. We apply reformulation and decomposition techniques to solve the MINLP.

■ MC25

C - Room 213BC

Incentives and Games

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Serguei Netessine, Professor, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, serguei.netessine@insead.edu

1 - Open Operations: Using Customer Voting for Development Decisions

Simone Marinesi, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, simone.marinesi@insead.edu, Karan Girotra

This study examines a novel business practice where firms ask customers to vote on potential product designs, and use the voting outcome to decide whether to invest resources to develop them, and even what price to sell them for. Typically, these Internet-based systems reward voters by giving a discount on the product design they vote for, in case it is developed. We study the firm-customer incentive game and compare the performance of alternate voting systems.

2 - Collaborative Cost Reduction and Component Procurement under Information Asymmetry

Serguei Netessine, Professor, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, serguei.netessine@insead.edu, Sang-Hyun Kim

We investigate how information asymmetry and procurement contracting strategies interact to influence the supply chain parties' incentives to collaborate on cost reduction efforts. We consider a number of procurement contracting strategies, and identify conditions under which one contract performs better than others in terms of promoting collaboration. We also find that ex-post efforts to enhance supply chain efficiency may hinder ex-ante collaboration that precedes production.

3 - The Relational Advantages of Intermediation

Elena Belavina, INSEAD, Boulevard De Constance, Fontainebleau, 77305, France, elena.belavina@insead.edu, Karan Girotra

This paper provides a novel explanation for the use of supply chain intermediaries such as Li & Fung Ltd. We find that even in the absence of the well-known transactional and informational advantages of mediation, intermediaries improve supply chain performance. In particular, intermediaries facilitate responsive adaptation of the buyers' supplier base to their changing needs while simultaneously ensuring that suppliers behave as if they had long-term sourcing commitments from buying firms.

4 - Static Pricing in the Presence of Demand Shocks and Strategic Customers

Senthil Veeraraghavan, The Wharton School, 3730 Walnut Street, Suite 500, Jon M Huntsman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Necati Tereyagoglu

Exogenous Demand shocks cause sudden increase in the cost of supply, and may also cause a sudden decrease in the aggregate demand of customers. Yet, many firms have been observed not to adjust their prices during such shocks. While this may seem suboptimal, using data from an organization, we find that a firm may benefit from static pricing when there is a sufficient number of strategic customers with consistent but misled beliefs.

■ MC26

C - Room 213D

Empirical Healthcare Operations

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Diwas KC, Emory University, 1300 Clifton Road NE, Atlanta, GA, United States of America, Diwas_KC@bus.emory.edu

1 - Adoption of Service Process Innovation in Cardiac Surgery

Diwas KC, Emory University, 1300 Clifton Road NE, Atlanta, GA, United States of America, Diwas_KC@bus.emory.edu

Although diffusion of innovation has received considerable research interest, the adoption of service process innovation remains relatively unexplored. In this paper, we study the drivers of adoption of a new service process innovation in cardiac surgery. Specifically, we examine whether hospital and physician variables including teaching status, volume of cardiology practice, severity of the patient population and overall skill level of the physician impact the physician's choice of adoption.

2 - Managing Hospital Recovery Units: An Empirical Study of Capacity Allocation and Patient Outcomes

Carri Chan, Columbia Business School, 3022 Broadway, Uris Hall 410, New York, NY, United States of America, cwchan@columbia.edu, Hailey Kim, Marcelo Olivares

We look at the impact of occupancy levels on routing from ED or after surgery in a capacity constrained setting to three types of recovery units with increasing levels of treatment and monitoring. Ideally, the routing should depend only on the patients' medical necessity. However, this work uses empirical data from over 60,000 actual patient flows to show the occupancy levels of recovery rooms also influence them. How these routing patterns further affect patient outcomes is also discussed.

3 - Drivers of Ambulance Diversion: Unpredictable vs. Predictable Variability
Sarang Deo, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, 500032, India, sarang_deo@isb.edu, Wuqin Lin, Gad Allon

We develop a two-stage queuing model to study the impact of structural factors such as the size and utilization of the hospital and the size of the emergency department (ED) on the extent of ambulance diversion status in the ED. We analyze two different approximations (heavy traffic and fluid) of this model and test the key insights from these using cross-sectional data from California. Using statistical tests, we find that heavy traffic approximations provide better explanation of our data.

4 - Hospital Specialization and its Impact on Process Quality
Dimitrios Andritsos, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, dandrits@anderson.ucla.edu, Christopher S. Tang

Using patient- and hospital-level data, we examine linkages between hospital specialization and the quality of care-delivery processes.

■ MC27

C - Room 214

Emissions, Operations, and Cap-and-Trade Regulation

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Saif Benjaafar, Professor, University of Minnesota, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, saif@umn.edu

1 - Economic Effects of Alternative Carbon Emission Reduction Technology under Cap-and-trade
Shijie Deng, Georgia Institute of Technology, School of ISYE, Atlanta, GA, United States of America, deng@isye.gatech.edu, Hui Xia

We analyze the economic effects of adopting alternative carbon emission reduction technology through a duopoly competition model under cap-and-trade. We derive the Nash equilibrium of the optimal quantities of the CO2 emission allowances with these two types of emission reduction technology, and illustrate their respective effects on the total allocation of emission allowances, the total production outputs, and the social welfare.

2 - Analyzing a Cap-and-trade Market with a Safety Valve
Andrew Liu, Assistant Professor, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, andrewliu@purdue.edu, Lanshan Han

One policy to prevent soaring CO2 prices in a cap-and-trade (CAT) market is to assign a safety valve, a cap on CO2 prices (or acting as a valve to switch between CAT and carbon tax). In this work we study such a market via equilibrium modeling with kinked price curves. Existence and uniqueness of market equilibria will be discussed via theories in complementarity problems. We further extend the model with capacity expansion and study the impacts of a safety valve on clean energy investment.

3 - Managing Product Procurement and Inventory under Carbon Cap-and-trade
Saif Benjaafar, Professor, University of Minnesota, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, saif@umn.edu, David Chen

We consider decisions regarding product procurement, inventory control, and carbon trading that a firm makes when it is subject to a carbon cap-and-trade system. The firm faces both stochastic demand and stochastic carbon prices. We characterize the structure of the optimal policy over a finite planning horizon and study the impact of carbon price volatility.

4 - Production Models under Carbon Emission Constraints
Emre Berk, Faculty of Business Administration, Bilkent University, Ankara, Turkey, eberk@bilkent.edu.tr, Ulku Gurler, Sibel Sozuer

We consider a production model with random demands under a carbon emission constraint. The aim is to investigate the impact of emission caps on the optimal production decisions and resource allocations. A variety of models are constructed to represent different operational environments. Operating characteristics of the models are derived and numerical examples are provided.

5 - Taxing Policies to Achieve Sustainable Supply Chain Design
Zachery Gillerlain, University of Cincinnati, College of Business, Cincinnati, OH, 45221, United States of America, gillercz@email.uc.edu, Michael Fry, Michael Magazine

We build a model to determine the optimal number of stores for maximizing profit as well as minimizing emissions in a single product, single firm environment. We then consider how four taxing policies – carbon tax, cap, cap and trade, and offset – can be employed by a governing body to compel the firm to act differently. A numerical study is utilized to investigate the conditions under which these taxing policies can drive the firm closer to the emissions minimizing optimal number of stores.

■ MC28

C - Room 215

Dynamic Pricing/Inventory Control

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Jian Yang, Associate Professor, New Jersey Institute of Technology, 323 Martin Luther King Jr. Boulevard, Newark, NJ, 07102, United States of America, yang@njit.edu

1 - Optimal Control Policy for Capacitated Inventory Systems with Remanufacturing
Xiting Gong, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, xitingg@umich.edu, Xiuli Chao

We study the optimal operational strategy for capacitated manufacturing systems with product returns. The system may have finite capacities on manufacturing, remanufacturing, and/or total in each period. Using L-natural convexity and lattice analysis, we show that the firm's optimal policies in each period can be nicely characterized by a modified remanufacture-down-to policy and a modified total-up-to policy. Extension to joint optimization of pricing and production decisions is also discussed.

2 - Preservation of Supermodularity in Parametric Optimization Problems and its Applications
Xin Chen, Associate Professor, University of Illinois at Urbana Champaign, Urbana, IL, United States of America, xinchen@uiuc.edu, Peng Hu, Simai He

We present a new preservation property of supermodularity in a class of two dimensional parametric optimization problems, where the constraint set may not be a lattice. This property and its extensions include several existing results in the literature as special cases, and provide powerful tools as we illustrate their applications to several operations models, including integrated inventory and pricing models among others.

3 - Optimality of (s; S)-policies in a Dynamic Pricing Model with Restocking Opportunities
Jian Li, Assistant Professor, Northeastern Illinois University, 5500 N. St. Louis Avenue, Chicago, IL, 60625, United States of America, jli@neiu.edu, Xiaowei Xu

This paper studies a joint dynamic pricing and inventory control problem. Demand follow a non-homogeneous Poisson process, depending on the product price and the distribution of customers' reservation value. The retailer incurs a linear purchase cost and a fixed cost when restocking her inventory. The retailer dynamically adjusts the product price and makes inventory replenishment decisions. We prove that the optimal inventory control policy in the presence of dynamic pricing is (s, S)-polices.

4 - Dynamic Pricing for Nonstationary Demands
Yifeng Liu, New Jersey Institute of Technology, 323 Martin Luther King Jr. Boulevard, Newark, NJ, 07102, United States of America, yl222@njit.edu, Jian Yang

We treat dynamic pricing models in which the Poisson demand arrival rate is a product of price-dependent and time-varying terms. In total we consider three possibilities: markup, markdown, and reversible-pricing. We establish the optimality of threshold policies for all cases. In addition, we clarify the asymmetry between the markup and markdown cases, and develop efficient algorithms for computing threshold points that are also numerically stable.

■ MC29

C - Room 216A

Analysis of High Frequency Trading

Cluster: Quantitative Finance

Invited Session

Chair: Xin Guo, Associate Professor, University of California, Berkeley, Berkeley, CA, United States of America, xinguo@ieor.berkeley.edu

1 - Optimal Order Placement in a Limit Order Book

Xin Guo, Associate Professor, University of California, Berkeley, Berkeley, CA, United States of America, xinguo@ieor.berkeley.edu

We discuss how to optimally place an order, with the incorporation of key statistics from the limit order book and with simple models of price impact.

2 - A Generalized Birth-death Stochastic Model for High-frequency Order Book Dynamics

He Huang, Graduate Student, Florida State University, 1017 Academic Way, rm 208, Tallahassee, FL, 32306-4510, United States of America, hhuang@math.fsu.edu, Alec Kercheval

We use a generalized birth-death stochastic process to model the high-frequency dynamics of the limit order book, where limit orders are allowed to arrive in multiple sizes. We compute various quantities of interest without resorting to simulation, such as the conditional probability that the next move of the mid-price will be upward. This generalizes a successful model of Cont et al. (2010) by means of a new approach to computing the distribution of first passage times.

■ MC30

C - Room 216B

Risk Management in Sourcing Models

Sponsor: Manufacturing & Service Oper Mgmt/ iFORM SIG

Sponsored Session

Chair: Victor Martìnez-de-Albéniz, Associate Professor, IESE Business School, Av. Pearson 21, Barcelona, 08034, Spain, valbeniz@iese.edu

Co-Chair: Aadhaar Chaturvedi, Post-doctoral Fellow, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, aadhaar@umich.edu

1 - Safety Stock, Excess Capacity or Diversification: Trade-offs under Supply Risk

Aadhaar Chaturvedi, Post-doctoral Fellow, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, aadhaar@umich.edu, Victor Martìnez-de-Albéniz

Firms can mitigate uncertainty in demand and supply by carrying safety stock, by planning for excess capacity or by diversifying supply sources. In this paper, we study how a firm can jointly optimize these three levers in an infinite horizon setting. We characterize the optimal levels of each: inventory, capacity and diversification and investigate the impact of supply/demand variability on these levels.

2 - Improving Supplier Yield with Spillover

Yixuan Xiao, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, xiaoy@wustl.edu, Yimin Wang, Nan Yang

We study the effect of potential knowledge spillover on manufcturers' supplier improvement efforts. We consider the scenario where two manufacturers compete in the same market place and share a common component supplier, which has a production process that is subject to random production yield. We model the competition between manufacturers as a two-stage game, and characterize its equilibrium.

3 - Managing Sub-tier Supply Risk

Mohammadjavad Samieenia, McGill University, 1001 Sherbrooke St West, Montreal, QC, H3A 1G5, Canada, mohammadjavad.samieenia@gmail.com, Saibal Ray, Tamer Boyaci

We study the problem of sub-tier supply risk management. Specifically, how an OEM can optimally design a contract with a first-tier supplier in order to influence the corresponding contract between the first-tier and a second tier supplier, when she has less information about the supply risk of the second tier than the first tier has.

4 - Subsidising Supplier Capacity Investment: Theory and Experiment

Zhixi Wan, Assistant Professor, HEC Paris, 1 Rue de la Liberation, Jouy en Josas, 78351, France, wan@hec.fr, Shanshan Hu, Qing Ye

We studied how upstream capacity investment could be facilitated by downstream firms through financial subsidy. We developed a two-stage game model, and showed that properly designed subsidy schemes could induce high capacity investment and significantly improve the buyer's profitability. The theoretic results were supported by the results of lab experiments, which, however, also indicated that subjects tended to invest higher capacity and bid lower prices compared to the theory predictions.

■ MC31

C - Room 217A

Joint Session HAS/DM: Data Mining and Decision Analysis in Health Care

Sponsor: Health Applications/Data Mining

Sponsored Session

Chair: Shengfan Zhang, Assistant Professor, University of Arkansas, Fayetteville, AR, 72701, United States of America, shengfan@uark.edu

1 - Strategy For Predicting Immunity Of Vaccines

Eva Lee, Professor & Director, Georgia Insitute of Technology, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

This work is joint with Emory Vaccine Center. The talk will describe methodologies that are used to predict the immunity of a vaccine without exposing individuals to infection, which addresses a long-standing challenge in the development of vaccines that of only being able to determine immunity or effectiveness long after vaccination and, often, only after being exposed to infection. Successful results in yellow-fever vaccines and flu vaccines will be presented. The work is sponsored by the National Institutes of Health and published in Nature Immunology.

2 - Data Mining and Ontology Approaches to Identify Risk Factors in Bone Marrow Transplantation

Pouya Raeiszadeh, University of Toronto, 5 King's College Road, Department of MIE, Toronto, ON, Canada, praeis@mie.utoronto.ca, Dionne Aleman, Ardeshir Ghavamzadeh

Bone marrow transplantation (BMT) is commonly used to treat patients with leukemia. Several criteria other than human leukocyte antigen should be considered when selecting a BMT donor. We present a feasibility study using ontology and decision tree approaches to understand the relationship between donor and recipient attributes in BMT and to assess the effect of these attributes on patient survival.

3 - Reliable Biomarkers: A Two-layer Network Model and the Algorithm

Bo Zeng, Assistant Professor, University of South Florida, Tampa, FL, 33647, United States of America, bzeng@usf.edu, Xiaoning Qiang, Seyed Javad Sajjadi

In order to find the most discriminating subset of biomarkers for a given disease, we consider a two-layer node and edge weighted graph to represent the set of biomarkers and their interactions (synergistic effects). To solve the resulting problem, we constructed a new type of maximum clique problem and solved it using column generation method for the large-scale integer programming formulation. Computational results will be presented.

4 - The Equity of Pediatric Healthcare Accessibility: Measurement and Inference

Mallory Nobles, Georgia Institute of Technology, School of ISyE, 1722 Wildwood Rd NE, Atlanta, GA, 30306, United States of America, mallory.nobles@gmail.com, Nicoleta Serban, Julie Swann

In this study we identify systematic disparities in geographic access to pediatric health care between different groups of children, identified by location or underlying socioeconomic variables. We develop a measure of access that considers both the centralized service provider's objective of minimizing total travel distance and individuals' decentralized choices about which health care facility they will visit based on congestion at the sites and their mobility and insurance status.

■ MC32

C - Room 217BC

Modeling Opportunities in Improving Pickup/Delivery Freight Operation

Sponsor: Railway Applications

Sponsored Session

Chair: Dharma Acharya, AVP - Operations Research, CSX Transportation, 500 Water St. J250, Jacksonville, FL, 32082, United States of America, dharma_acharya@csx.com

1 - Review of Delivery/Pickup Service Modeling Practices

Dharma Acharya, AVP - Operations Research, CSX Transportation, 500 Water St. J250, Jacksonville, FL, 32082, United States of America, dharma_acharya@csx.com

In this paper, we will present modeling practices used in delivery and pick up service used across various industries. We will then discuss possible modeling approaches useful for improving freight rail delivery and pick up services.

2 - Journey to a Customer Focused Culture

Jan Hobbs, Director TSI Carload, CSX, 500 Water St. J300, Jacksonville, FL, 32202, United States of America, Jan_Hobbs@csx.com, Chantel Campbell, Dharma Acharya

Total Service Integration Carload is a key strategic intiative for CSX. We are focusing on our local network & the alignment of CSX & Customer capabilities and commitments. Three key steps to improving our local service product: Improve internal processes, digitize our Customer capabilities, industrial engineer our Local Assignments. Successful implementation of our local initiatives will drive price, volume and productivity gains.

3 - Improving Local Service at BNSF Railway

John Orrison, AVP - Service Planning, BNSF Railway, 2600 Lou Menk Drive, Fort Worth, TX, 76131, United States of America, John.Orrison@bnsf.com

We will first describe the current practice of designing/planning the local service at BNSF. BNSF is currently conducting various studies geared towards improving local services in picking up and delivering carload traffic from/to the customer. Study findings and modeling opportunities identified in improving the local service will be discussed.

4 - Small Yards: Increased Network Flexibility at Low Incremental Cost

David Lehlbach, Oliver Wyman, One University Square Drive Suite 100, Princeton, NJ, 08540, United States of America, David.Lehlbach@oliverwyman.com, Rod Case, Carl Van Dyke

Today's railways focus significant effort on the throughput of large yards, while most small-sized yards are focused to consistently meet local operating needs. The usefulness of these small yards should be reconsidered as "hidden" sunk-cost assets, where they can be actively utilized for alternative operations that support broader rail network goals. This presentation will discuss an example of this thinking from a leading European railway, with key learnings for railways across all continents.

■ MC33

C - Room 217D

Nanomanufacturing and Nanoinformatics III: Modeling, Monitoring, and Control

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Satish Bukkapatnam, Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, satish.t.bukkapatnam@okstate.edu

1 - Simultaneous Adjustment and Calibration of Nanocomposite Computer Models

Arda Vanli, Assistant Professor, Florida State University - High Performance Materials Institute, 2005 Levy Avenue, Tallahassee, FL, 32310, United States of America, oavanli@eng.fsu.edu, Ben Wang, Kan (Kevin) Wang, Chuck Zhang

For a cost effective production of nanocomposites it is of interest to accurately predict material properties. Model and parameter assumptions may introduce significant prediction bias in computational models. This talk presents a statistical adjustment and parameter calibration approach for buckypaper micromechanics models. A maximum likelihood approach is proposed to simultaneously estimate a bias correction model and model parameters (CNT diameter and length) from data and model predictions.

2 - Computational Modeling of Nanodroplet Impingement on Substrate

Ravindra Kaware, Ph.D. Student, North Carolina A&T State University, 1601 East Market Street, Greensboro, 27411, United States of America, sharvil_kaware@yahoo.co.in, Salil Desai

This paper focuses on the computational modeling of droplet based nano manufacturing process. Water nanodroplet deposition on a silicon dioxide substrate is modeled using a molecular dynamics approach. CHARMM force field parameters are employed to capture the droplet and substrate interaction. The nanodroplet spread and wetting characteristics are validated using dynamic contact angle values. This research provides understanding of droplet spreading and wetting behavior at the nanoscale.

3 - Designed Experiments for Characterizing Nanostructured Surfaces Created by Machining Processes

Marcus Perry, University of Alabama, Box 870226, Tuscaloosa, AL, United States of America, mperry@cba.ua.edu

We consider the identification of critical factors that lead to superior nano-structured properties in machined surfaces via a design-of-experiments approach. We propose a method for analysis and consider the inherent nested error structure induced by the nature of the experiments. We emphasize the increased likelihood of misrepresenting the influential factors by using the standard approach to analysis with experiments of this kind.

4 - LGP Accelerated Monte Carlo Simulation of Carbon Nanotube (CNT) Synthesis in Catalytic CVD Process

Changqing Cheng, Oklahoma State University, Stillwater, OK, United States of America, changqing.cheng@okstate.edu, Satish Bukkapatnam

A coarse-grained Monte Carlo simulation model is used to simulate CNT growth in catalytic CVD process. To reduce the computational overhead associated with MC simulation, local Gaussian process (LGP) model is employed to predict the evolution of the CNT height profile. The prediction-based MC model has been applied to different synthesis conditions, and it reduces up to 70% of the computational cost.

■ MC34

C - Room 218A

Scheduling, Access and Throughput in Large Academic Hospitals

Sponsor: Health Applications

Sponsored Session

Chair: Retsef Levi, Massachusetts Institute of Technology, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, retsef@mit.edu

1 - An Optimization Framework for Smoothing Surgical Bed Census via Strategic Block Scheduling

Tim Carnes, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, tcarnes@mit.edu, Retsef Levi, Peter Dunn, Bethany Daily, Devon Price, Sue Moss

Massachusetts General Hospital (MGH) is a large academic hospital that makes use of over fifty operating rooms. Currently the inpatient beds have peak usage in the middle of the week, and are under-utilized on other days. Using an integer programming model to find a feasible adjustment to the surgical block schedule, we are able to find a solution such that the predicted use of inpatient beds is level-loaded, providing an effective increase in capacity.

2 - On the Access-throughput Spiral Affects in Large Academic Centers

Retsef Levi, Massachusetts Institute of Technology, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, retsef@mit.edu, Tim Carnes, Benjamin Christensen, Devon Price, Peter Dunn, Bethany Daily, Sue Moss, Ulrich Schmidt

Patient flow is a critical issue in most if not all large academic hospitals. We show empirically and statistically that in several settings lack of timely access to resources leads to reduced throughput and in turn to even more severe access problems. We call this the Access-Throughput Spiral Affect.

3 - Analytical and Empirical Analysis of Telemedicine Treatment for Neurological Disorder Patients

Abraham Seiddmann, Simon school of Business, University of Rochester, Carol Simon, Rochester, United States of America, avi.seidmann@simon.rochester.edu, Balaraman Rajan

We are currently performing a novel clinical and analytical study addressing the economic impact of telemedicine practice for the care of patients with neurological disorder. While telemedicine has the potential to increase access to some remote patients, specialists are generally hesitant in adopting telemedicine as the returns are not only immediate but also uncertain. We analyze the effect of telemedicine on specialists' volume mix, reimbursement rates and other such economic factors.

■ MC35

C - Room 218B

Computer Experiments at National Labs

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Peter Qian, Associate Professor, University of Wisconsin-Madison, Department of Statistics, 1300 University Avenue, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

1 - Calibration and Prediction Using Multiple Computer Models

Curtis Storlie, Scientist, Los Alamos National Laboratory, P.O. Box 1663, MS F600, Los Alamos, NM, 87545, United States of America, storlie@lanl.gov, Brian Reich

The analysis of many physical systems involves running complex computer models. Some of these problems (e.g., nuclear reactor performance) have multiple competing models, and the goal is to use all of these multiple models to obtain better prediction. We propose a new approach to calibration and prediction using multiple computer models, which allows for emulation of computationally demanding models, and for the contributions of the models to the prediction to change over the input space.

2 - Parallel Computational Algorithms for the Assessment of Mathematical Models under Uncertainty

Ernesto Prudencio, Research Associate, The University of Texas at Austin, 1 University Station C0200, Austin, TX, 78712-0027, United States of America, prudenci@ices.utexas.edu

I will give an overview of the research being conducted at the PECOS Center, UT Austin, on the assessment of mathematical models under uncertainty using parallel statistical algorithms. The presentation will cover Bayesian model analysis, model calibration, model ranking according to model evidence, and parallel sampling algorithms for multimodal and high-dimensional parameter spaces, as well as stochastic collocation. I will also cite different mathematical models under analysis.

■ MC36

C - Room 219A

Network Reliability and Survivability

Sponsor: Telecommunications

Sponsored Session

Chair: Esra Sisikoglu, Assistant Professor, University of Missouri, Lafferre Hall, Columbia, MO, 65211, United States of America, sisikoglue@missouri.edu

1 - Algebraic Connectivity and Network Design

John Klincewicz, Principal Member of Technical Staff, AT&T Labs, Room D5-3C06, 200 S. Laurel Avenue, Middletown, NJ, 07748, United States of America, klincewicz@att.com, Herbert Shulman

The "algebraic connectivity" of a network is the second smallest eigenvalue of the Laplacian matrix. It provides bounds on edge and vertex connectivity, and is used as a measure of network survivability. We explore whether this (and other eigenvalues) might also be useful in designing telecommunications networks that are restorable under single failures.

2 - Optimal Location of Network Traffic Sensors for Cyber Security

Soumyo Moitra, Software Engineering Institute, 4500 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, sdmoitra@hotmail.com

In this paper, we present a model to assess the benefit of deploying a sensor as a function of its location in the network. The goal is to find the optimal sites for multiple sensors. However, the benefit from a given sensor depends on the location of other sensors on the network because of possible overlaps in the coverage. The combinatorial optimization scenario is modeled and potential solution strategies are discussed with examples.

3 - An Exact Algorithm for Multi-perspective Event Coverage in Wireless Multimedia Sensor Networks

Esra Sisikoglu, Assistant Professor, University of Missouri, Lafferre Hall, Columbia, MO, 65211, United States of America, sisikoglue@missouri.edu, Mustafa Sir, Enes Yildiz, Kemal Akkaya

We consider the camera deployment problem with multi-perspective coverage (MPC) in which multiple disparate views of events are obtained in a region. We propose using a bi-level algorithm to achieve MPC. In the first level we determine camera locations to cover a given set of points and in the second level we identify additional points that are not covered. With this approach, we define the camera locations that achieve MPC in a continuous region, while minimizing the total number of cameras.

4 - Performance In Stochastic Communication Networks: Monitoring and Prediction

Yupo Chan, University of Arkansas at Little Rock, 2801 South University Avenue, Little Rock, AR 72204-1099, United States of America, yxchan@ualr.edu, Ayman Abbosh, John C. Van Hove, Raied Caromi

With the complexity, scale, and speed of communication networks, compromise in network performance is a concern. Stochastic models have been developed to account for the random nature of network performance. It was found that robust performance measures have means and bounds that are a direct function of traffic volume. The resulting non-stationary series could be analyzed by available techniques, including control charts.

■ MC37

C - Room 219B

Multiple Component System Reliability Modeling and Optimization

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: David Coit, Professor, Rutgers University, Department of Industrial & Systems Eng, Piscataway, NJ, 08844, United States of America, coit@rutgers.edu

1 - System Reliability Analysis and Preventive Maintenance for Dependent Component Failure Processes

Sanling Song, Rutgers University, Core Building 201, Busch Campus, Rutgers University, Piscataway, NJ, 08854, United States of America, sanling@eden.rutgers.edu, David Coit, Qianmei Feng, Hao Peng

This paper presents reliability models for systems subject to Multiple Dependent Competing Failure Process. Two dependent failure processes are considered: soft failures and hard failures. These two failure processes are correlated or dependent in two respects. A preventive maintenance policy is developed based on the reliability analysis. A numerical example is given in which the optimal inspection intervals, lower degradation threshold are given to minimize the maintenance cost rate.

2 - A Method for Condition Based Maintenance of Multi-component Systems

Zhigang Tian, Assistant Professor, Concordia University, Institute for Information Systems Engine, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca, Bairong Wu, Jialin Cheng

A CBM optimization method is proposed for multi-component systems, where economic dependency exists among the components. Deterioration of a multi-component system is represented by a conditional failure probability value, which is calculated based on the predicted failure time distributions of components. The proposed CBM policy is defined by a two-level failure probability threshold. A method is developed to obtain the optimal threshold values to minimize the long-term maintenance cost.

3 - Reliability Modeling in the Design of a New Energy Concept
Sarah Riddell Powers, Lawrence Livermore Natl Labs, 7000 East Avenue, L-153, Livermore, CA, United States of America, powers22@llnl.gov

A Laser Inertial Fusion Energy (LIFE) power plant is an advanced energy technology under development at LLNL. We developed a system-wide Monte Carlo simulation model to study the impact of system designs, component reliability and design modularity on system availability as this is a key project goal for the economic competitiveness of LIFE. Results indicate that a lower baseline for component reliability can be used while still obtaining high system availability thus expediting time to market.

4 - Reliability Importance Measures for Continuum System Structure with Correlated Degrading Components
Jingrui Li, Rutgers University, 96 Frelinghuysen Road, Department of Industrial & System Engine, Piscataway, NJ, 08844, United States of America, lijingrui1205@gmail.com, Khalifa Al-Khalifa, Elsayed Elsayed, Xiao Liu, David Coit, A.M.S. Hammuda

For an operating system, the degradation path of the components can be correlated or dependent due to the shared environment or operating stresses. A continuum system structure function is a non-decreasing mapping from the unit hypercube to the unit interval. In such a system, the reliability importance measures of continuum structure function is developed for each component.

■ MC38

H- Johnson Room - 4th Floor

Location Models II

Sponsor: Location Analysis

Sponsored Session

Chair: Oded Berman, Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Berman@Rotman.Utoronto.Ca

1 - Assessing the Quality of Simpson's (Condorcet's) Solutions through a Max-sum Objective
Mozart Menezes, Professor, MIT-Zaragoza International Logistics Program, Calle de Bari 55, Portal 5, PLAZA, Zaragoza, 50197, Spain, mmenezes@zlc.edu.es, Yoshitsugu Yamamoto, Rongbing Huang

We focus on the quality of Simpson's solution versus a centralized decision maker that maximizes the total sum of voters' utility. The central decision maker aims maximizing the total utility whereas voters attempt to maximize their own individual utilities leading to under-optimal solutions measured by the maxi-sum objective. Our results suggest that the democratic process may provide good solutions and, as the set increases in size, the gap between the two solutions converges.

2 - Return-on-investment (ROI) Criteria for the Network Design of Retail Chains
Rongbing Huang, Associate Professor, York University, Room 282, Atkinson Building, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, rhuang@yorku.ca, Seokjin Kim, Mozart Menezes

When designing a retail store network, one of the widely used objectives is to maximize profit. In general, this approach leads to locate more stores to increase captured demand. Starbucks' failure in 2008 invokes the motivation of considering return-on-investment (ROI) in addition to profit. In this paper we consider structural differences among several formulations and their solutions to highlight the strategic implications of the ROI criterion. Numerical examples are presented.

3 - Value-at-risk and Facility Location
Jiamin Wang, Long Island University, Roth Hall 202, 720 Northern Blvd, Brookville, NY, 11548, United States of America, Jiamin.Wang@liu.edu

We consider a network where the number of potential customers at each node is a random variable. Traditional facility location models are extended to minimize the value-at-risk, a widely applied measure of risk, at a pre-selected confidence level. For instance, the objective of the maximal covering model is to minimize the number of potential customers out of the coverage radius with a probability beyond a given level. General solution procedures are developed to solve the problems.

4 - Prepositioning of Supplies for Hurricanes under Spatial Relations and Demand Uncertainty
Rajan Batta, Professor, Industrial and Systems Engineering, and Associate Dean for Graduate Studies, University at Buffalo (SUNY), School of Engineering and Applied Scienc, 412 Bell Hall, Buffalo, NY, 14260, United States of America, batta@buffalo.edu, Gina Galindo

In this research we develop a model for prepositioning supplies in preparation for hurricanes. The model establishes the location of supply points, and their level of storage, while minimizing distribution costs. Possible destruction of the supply points, stochasticity of demand, and spatial relations among locations are considered. Solution methodologies are discussed based on computational experience. Our progress in an improved version of the model is also provided.

■ MC39

H - Morehead Boardroom -3rd Floor

Spreadsheets in Analytical Work

Sponsor: Spreadsheet Productivity Research Interest Group

Sponsored Session

Chair: Tom Groleau, Associate Professor, Carthage College, 2001 Alford Park Drive, Kenosha, WI, 53140, United States of America, tgroleau@carthage.edu

1 - Error Propagation and Significant Digits in Spreadsheets – A Primer
Ric Blacksten, Principal Analyst, Innovative Decisions, Inc., 1945 Old Gallows Road, Suite 207, Vienna, VA, 22182, United States of America, hblacksten@innovativedecisions.com

Many of us management scientists and operations research analysts neglect to perform any sort of uncertainty analysis in our models, or we simply use presented significant digits as a surrogate for confidence, without justifying that number. This primer presents basic principles of error propagation and shows how to apply them in spreadsheet models to properly compute confidence intervals and determine appropriate number of significant digits for different variables.

2 - Teaching BI with MS-Excel: Good, Bad and Ugly
Kala Seal, Professor, Loyola Marymount University, One LMU Drive, Hilton Building, Los Angeles, CA, 90045, United States of America, Kala.Seal@lmu.edu

Excel has been accepted as a viable media for learning MS/OR since Bodily (1986). It, therefore, makes sense to extend its role in teaching Business Intelligence courses to provide hands-on experiences to students and avoid the cost and learning curve of a commercial BI system. Excel, along with some readily available add-ins, can actually cover the multitude of capabilities needed in a BI system but raises some issues. They are addressed here from the experience of teaching an MBA BI course.

3 - Excel Application for Improving Exam Reliability
Chris Keller, Assistant Professor, East Carolina University, 3136 Bate Building, College of Business, Greenville, NC, 27858, United States of America, KELLERC@ecu.edu, John Kros

This talk extends a previously developed non-macro Excel application for improving exam reliability, including discussion and Excel implementation of additional dimensions: partial credit, differential question scoring, distractor analysis, and/or student profiling, (see "An Innovative Excel Application to Improve Exam Reliability in Marketing Courses", Marketing Education Review, 21, 1, 21-27 (2011)).

4 - Teaching Spreadsheet Analytics with Excel VBA
Mehmet Begen, Assistant Professor, Ivey School of Business - University of Western Ontario, 1151 Richmond St., London, ON, N6A3K7, Canada, mbegen@ivey.uwo.ca

We introduce an elective undergraduate business course in which we teach spreadsheet analytics with Excel VBA (Visual Basic for Applications). We discuss the practices used and lessons learned in teaching the course.

5 - Company Movement and Assessment Tool in Excel
John Wray, Major, US Marine Corps, Quantico, VA, 22134, United States of America, john.wray@afg.usmc.mil, John Bancroft, Dan Zappa

The Company Movement and Assessment Tool (CMAT) is an open source Excel based application developed by the Marine Corps to maintain vital patrol records. User forms are used to ensure quality data input and VBA is used to provide automated real-time analysis in PowerPoint providing feedback and enabling decision makers.

■ MC40

H - Walker Room - 4th Floor

Joint Session TMS/NPD: Meet the Editors

Sponsor: Technology Management/New Product Development

Sponsored Session

Chair: Cheryl Druehl, George Mason University, Fairfax, VA, United States of America, cdruehl@gmu.edu

Co-Chair: Raul Chao, University of Virginia, Darden School of Business, Charlottesville, VA, 22903, United States of America, ChaoR@darden.virginia.edu

1 - Panel Discussion: Meet the Editors and Ask Them Questions

Moderators: Cheryl Druehl, George Mason University, Fairfax, VA, United States of America, cdruehl@gmu.edu, Raul Chao,University of Virginia, Darden School of Business, Charlottesville VA 22903, United States of America, ChaoR@darden.virginia.edu

Panelists: Cheryl Gaimon, Georgia Tech, POM Journal, Management of Technology Department Editor; Dan Guide, Penn State, Journal of Operations Management, Co-Editor-in-Chief & POM Journal, Sustainable Operations Department Editor; Stylianos Kavadias, Georgia Tech, POM Journal, New Product Development, R&D & Project Mgmt Department Editor; Kamalini Ramdas, London School of Business, Management Science, Entrepreneurship & Innovation Department Editor; Asoo Vakharia, Univ. of Florida, Editor, Decision Sciences Journal.

■ MC41

H - Waring Room - 4th Floor

Coordinating Decentralized Innovation Processes

Cluster: New Product Development

Invited Session

Chair: Raul Chao, University of Virginia, Darden School of Business, Charlottesville, VA, 22903, United States of America, ChaoR@darden.virginia.edu

1 - Pricing for Innovation & Investment in Digital Supply Chains

Ayhan Aydin, PhD Candidate, University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Room # 307, Chicago, IL, 60637, United States of America, aaydin@chicagobooth.edu, Dan Adelman, Rodney Parker

Upstream providers in innovative industries, such as Internet, telecommunications and electronics, rely on their downstream customers' innovation and investment efforts. Motivated by digital supply chains and a major industrial partner, we ask the question: under competition is it possible for a firm to encourage its customers to invest in their products while still being able to recoup the benefits of doing so? We find the optimal pricing and investment strategies.

2 - Customer-supplier Innovation Collaboration Based on the Optimal Allocation of Intellectual Assets

Li Shen, Xi'an Jiaotong University, School of Management, P.O.Box 2341, Xi'an, 710049, China, ecoshen@gmail.com, Zizhen Geng, Xinmei Liu

Customer-supplier innovation collaboration in the service outsourcing project is usually invalid because of inefficient allocation of intellectual assets. We used the game theory to study the problem of customer-supplier innovation collaboration based on the optimal allocation of intellectual assets by introducing the reputation mechanism. We found when customers has long-term relationship with suppliers, the effect of the reputation mechanism enables the innovation cooperation occurs smoothly.

3 - Greener Pastures: Kick-starting Green Tech Innovation in the IP Commons

Daniel Greenia, Stanford University, Huang Engineering Center, 245A, Stanford, CA, 94305, United States of America, dgreenia@stanford.edu

IP commons (e.g. GreenXChange) are an emerging opportunity for firms to approach a diverse population of innovators to license technologies. Adoption of these technologies requires thoughtful contract designs that consider the market opportunity. To wit, we explore contract design when competitors and non-competitors alike are potential licensees and the future value of the green technology is uncertain.

■ MC42

H - Gwynn Room - 4th Floor

Information Systems and Economics

Sponsor: Information Systems Society

Sponsored Session

Chair: Mingfeng Lin, Assistant Professor, University of Arizona, 1130 E. Helen St, Tucson, AZ, 85721, United States of America, mingfeng@eller.arizona.edu

1 - Developing Electronic Markets in Low-tech Environments: India's Agriculture Markets

Chris Parker, PhD Candidate, London Business School, Regent's Park, London, NW14SA, United Kingdom, cparker.phd2007@london.edu, Bruce Weber

IT helps create fair and efficient markets where technology is prevalent among market participants. Less well known is how a price/market support system enables markets to operate better when participants use minimal IT in their own operations. We discuss an SMS information service for agricultural market participants in India which has made local 'mandis' more efficient, and empowered farmers to sell crops more profitably. Low-tech infrastructure can support a valuable price information system.

2 - Influencing Self-regarding to Other-regarding Behaviors through Social Network

Dobin Yim, PhD Student, University of Maryland, Robert H. Smith School of Business, 3300 Van Munching Hall, College Park, MD, United States of America, dyim@rhsmith.umd.edu, Siva Viswanathan

We investigate the role of online social networks in fostering prosocial behaviors towards achieving greater social good. Through visibility of individual action to others, we show how network characteristics influence one's decision to participate as well as effort level. We develop insights on the strategic use of information to enhance self-image or learning and thereby raise total level of contribution.

3 - An Empirical Analysis of the Effectiveness of Customer Retention Policy in Mobile Service Industry

Lin Hao, University of Washington Seattle, Foster School of Business, Seattle, WA, United States of America, linhao@uw.edu, Yong Tan, Jianping Peng

This study investigates the effectiveness of customer retention policy in mobile service industry. Based on the data, including voice, text messages and data service usage from a large number of mobile phone users, their choices on discount plans provided by the wireless carrier, and their consumption after selecting discount plans, we analyze how the design of discount plan affects consumer's choices and how effective the retention policy is on promoting future consumption.

4 - Mitigating the Matthew Effect in Online Reputation Systems

Mingfeng Lin, Assistant Professor, University of Arizona, 1130 E. Helen St, Tucson, AZ, 85721, United States of America, mingfeng@eller.arizona.edu, Siva Viswanathan, Ritu Agarwal

Although online reputation systems may reduce information asymmetry in e-commerce, they also lead to an anti-competition, rich-get-richer "Matthew Effect". A mechanism to address this issue must (1) reduce the positive externality in online feedback systems; and (2) allow for easier first-hand dealings so that users do not have to rely on second-hand reputation information. We empirically tested and found support for this hypothesis by exploiting a natural experiment in an online labor market.

■ MC43

H - Suite 402 - 4th Floor

Sustainable Energy Planning

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Emrah Cimren, The Ohio State University, Integrated Systems Engineering, 210 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43202, United States of America, cimren.1@osu.edu

1 - Unified Approach to the Energy Efficiency Problem in Data Centers

Ronny Polansky, Texas A&M University, College Station, TX, United States of America, ronnyp@tamu.edu, Julian Gallego, Young Myoung Ko, Eduardo Perez, Lewis Ntaimo, Natarajan Gautam

otivated by the energy consumption problem in data centers, we formulate and solve a large-scale mixed integer program so that total energy cost can be minimized. Previous work has considered the key decisions of allocating applications to servers, routing applications to servers, and choosing server frequencies in an independent fashion; however, by making decisions under a unified framework, we show that previous approaches are suboptimal.

2 - Designing Green Supply Chains for Remote Sites

Yue Geng, Northwestern University, Tech Building 2145 Sheridan Road, Evanston, IL, United States of America, yuegeng2008@u.northwestern.edu, Marius Solomon, Diego Klabjan

Remote sites in pristine locations have two main logistical challenges: limited options to deliver goods, and environmental scrutiny. We propose models and solution methodologies that explicitly take into account environmental impacts. A real world case study is presented.

3 - A System Dynamics Approach to Policy Assessment for Sustainable Development

Emrah Cimren, The Ohio State University, Integrated Systems Engineering, 210 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43202, United States of America, cimren.1@osu.edu, Andrea Bassi, Joseph Fiksel

We develop a system dynamics simulation model to analyze the broader social, economic and environmental impacts of waste to profit activities such as recycling, electricity generation from waste, and bio-fuel production. Three alternative scenarios are simulated to evaluate the impacts of biomass co-firing, government stimulus for solid waste recycling, and by-product synergy activities for the State of Ohio.

4 - Optimal Balancing of Wind Resources with Responsive Demand on a Network

Lindsay Anderson, Assistant Professor, Cornell University, 320 Riley Robb Hall, Ithaca, NY, 14853, United States of America, landerson@cornell.edu, Judith Cardell

Demand response resource quality is classified by response time, reliability, location and procurement cost. This project considers the cost minimizing allocation of responsive demand as a wind energy-balancing resource on the electricity network, with updated wind forecasts as the system approaches real time dispatch.

■ MC44

H - Suite 406 - 4th Floor

Undergraduate III

Cluster: Undergraduate Operations Research Prize

Invited Session

Chair: Susan Martonosi, Assistant Professor, Harvey Mudd College, Claremont, CA, 91711, United States of America, martonosi@hmc.edu

1 - Bayesian Applications in a Probability Programming Language

Matthew Robinson, United States of America, mthw.wm.robinson@gmail.com

Over the past decade, interest in Bayesian statistics has increased rapidly. In consequence of this growth, a variety of software packages have been developed in order to facilitate applied statistical analysis. These software packages, however, use numerical techniques implemented inlanguages such as SAS and SPSS to produce discrete approximations of posterior distributions. Currently, no program automates the derivation of exact closed form posterior distribtions. These derivations must either be accomplished by hand, which is often intractable, or approximated through simulation. We present software capable of automating the derivation of exact posterior distributions.

2 - LP Performance Bounds for Queueing Networks

Maya Bam, Gordon College, Wenham, MA, United States of America, maya.bam@gordon.edu, Michael Veatch

Many queueing network control problems can be formulated as (large) Markov decision processes. We use function approximation and the linear programming form of the optimality equations to construct bounds on optimal performance. The form of the approximation is refined using simulation.

3 - An Integer Programming Model for Equitable Nurse Rostering

Rodrigo de la Cadena, Pontificia Universidad Javeriana, Cali, Colombia, jarsarasty@javerianacali.edu.co, Cristian Hurtado, Juan Valencia

In health care institutions staff rostering influences the employee motivation and the patient service level. Based on the nurse rostering problem in one major private hospital in southwest Colombia, we developed an integer programming model to obtain a realistic and equitable schedule.

4 - Skeletonization for Isocentre Selection in Leksell Gamma Knife Perfexion

Evgueniia Doudareva, University of Toronto, Toronto, ON, Canada, jenya.doudareva@utoronto.ca

Leksell Gamma Knife Perfexion (PFX) is used to deliver radiosurgery to treat lesions and tumours in the brain by means of selectively ionizing the tissue with high-energy beams of radiation. An important component of designing PFX treatments is the selection of points at which to focus the radiation, called isocentres. This study applies skeletonization methods to select isocentres. Skeletonization identifies a structure's skeleton, or its most basic shape; we use this skeleton to inform isocentre locations. The resulting isocentres are used as input to a sector duration optimization model that determines the optimal shot shapes of the radiation deposited at each isocentre. The results for four clinical cases are presented. For each case, target structure dose meets clinical radiosurgery guidelines, and brainstem dose is kept to acceptable levels.

■ MC45

H - Suite 407 - 4th Floor

Algorithmic Game Theory

Cluster: Auctions

Invited Session

Chair: Kevin Leyton-Brown, University of British Columbia, 201-2366 Main Mall, Vancouver, BC, Canada, kevinlb@cs.ubc.ca

1 - Computational Analysis of Incomplete-information Position-auction Games

Dave Thompson, University of British Columbia, 201-2366 Main Mall, Vancouver, BC, Canada, daveth@cs.ubc.ca, Kevin Leyton-Brown

Position auctions (used to sell online advertising space) are commonly modeled as full-information games. However, there has been recent interest in the role of uncertainty in online advertising markets. Using Bayesian action-graph games, a recently developed compact representation, we investigate Bayes-Nash equilibria of position-auction games under several models.

2 - Optimal Auctions with Positive Network Externalities

Nima Haghpanah, PhD Student, Northwestern University, 6161 N Winthrop Avenue, Chicago, IL, 60660, United States of America, nima.haghpanah@gmail.com, Nicole Immorlica, Kamesh Munagala, Vahab Mirrokni

We consider auctions in social networks for goods that exhibit single-parameter submodular network externalities in which a bidder's value for an outcome is a submodular function of the allocation of his friends. We operate in a Bayesian environment and prove that the optimal auction is APX-hard. Our main positive result considers step-function externalities for which we provide a e/(e+1)-approximation. We give a 0.25-approximation auction for general single-parameter submodular externalities.

3 - Increasing Revenue in Sponsored Search via Envy-reducing Strategies

Tuomas Sandholm, Professor, Carnegie Mellon University, Pittsburgh, PA, United States of America, sandholm@cs.cmu.edu, Abe Othman

We conduct experiments comparing envy-reducing strategies in the GSP mechanism to two others: the "balanced bidding" strategy from the literature, and agents who adjust their bids only to increase their own utility. We find that envy-reducing behaviors yield higher revenue than the other behavioral schemes, and are the only one that on average yields higher revenue than the truthful VCG mechanism. Our results suggest that encouraging envy should be a key focus in order to increase revenue.

4 - Option Trading with Agents that Combine Insights from Prediction Markets and Finance

Abe Othman, Carnegie Mellon University, Computer Science Department, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, aothman@cs.cmu.edu, Tuomas Sandholm

Options are a basic, widely-traded form of financial derivative that offer payouts based on the future price of an underlying asset. We simulate the performance of five trading agents inspired by the prediction market and finance literature on a database of recent option prices. We find that a combination of the approaches produced the best results in our experiments: a trading agent that keeps track of previously-made trades combined with a good prior distribution on how prices move over time.

■ MC46

H - Suite 403 - 4th Floor

In Memoriam: Paul Jensen's Influence on OR Pedagogy

Sponsor: INFORM-ED

Sponsored Session

Chair: James Cochran, Bank of Ruston Barnes, Thompson, & Thurmon Endowed Research Professor, Louisiana Tech University, College of Business, Ruston, LA, 71272, United States of America, jcochran@cab.latech.edu

1 - Memories of a Colleague

Jonathan Bard, Professor, The University of Texas, Operations Research Group, Austin, TX, 78712, United States of America, jbard@mail.utexas.edu

Paul was one of the first persons I met when I arrived at the University of Texas more than 26 years ago. Over that time, we shared many professional and personal experiences. I will reminisce about some of those during this talk.

2 - Paul Jensen's Impact on OR Practice

Jeffrey Camm, University of Cincinnati, College of Business, Cincinnati, OH, United States of America, cammjd@ucmail.uc.edu

Paul Jensen was the recipient of the 2007 INFORMS Prize for the Teaching of OR/MS Practice. In this talk, I will discuss how the work of Paul Jensen has impacted not only the teaching of OR/MS practice but the practice of OR itself.

3 - Tribute to a Mentor

Glenn Bailey, Sr. Director of Operations Research, Manheim Auctions, 6205 Peachtree Dunwoody Road, Atlanta, GA, 30328, United States of America, glenn.bailey@manheim.com

Paul Jensen's influence on the OR/MS profession continues through the contributions of today's practitioners whose careers were shaped by his guidance and insight. This talk will recall the inspiration and enthusiasm he gave to his many students over the years.

4 - On Paul Jensen's Contributions to OR/MS

David Morton, Professor, University of Texas at Austin, Graduate Program in ORIE, Austin, TX, 78712, United States of America, morton@mail.utexas.edu

Paul Jensen's contributions to operations research and the management sciences through his research, teaching, mentoring, and service are far-reaching. We will recount some of these contributions along with a few personal anecdotes.

■ MC47

H - Dunn Room - 3rd Floor

Anticipatory Optimization for Dynamic Vehicle Routing

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Stephan Meisel, University of Braunschweig, Muehlenpfordtstr. 23, Braunschweig, 38106, Germany, stephan.meisel@tu-bs.de

1 - Inventory Routing for Dynamic Waste Collection from underground Containers

Martijn Mes, Assistant Professor, University of Twente, P.O. Box 217, Enschede, 7500 AE, Netherlands, m.r.k.mes@utwente.nl, Marco Schutten

We study the use of dynamic policies for the collection of waste from underground containers. The problem is a reverse inventory routing problem which involves decisions regarding routing and container selection. We show that in more dense networks more emphasis should be put on the latter. Given the huge variation in deposits, we need an anticipatory policy that balances the workload. We propose such a policy and tune the parameters of this policy using simulation optimization.

2 - Adaptive Waiting Strategies for Dynamic Vehicle Routing with Service Agreements

Uli Suppa, University of Braunschweig, Mühlenpfordtstr. 23, Braunschweig, Germany, u.suppa@tu-bs.de, Dirk C. Mattfeld, Stephan Meisel

We consider a dynamic vehicle routing problem with a fleet of vehicles, stochastic customer requests and two types of service agreements. The problem typically occurs in businesses providing after sales services. In order to minimize the total distance traveled for serving every request, future requests are anticipated by means of an adaptive waiting strategy. The strategy adapts to the current states of the vehicles as well as to possible future scenarios.

3 - Rollout Policies for Dynamic Vehicle Routing with Stochastic Demand, Duration Limits, and Waiting

Justin Goodson, Saint Louis University, 3674 Lindell Blvd., St. Louis, MO, 63108, United States of America, goodson@slu.edu, Jeff Ohlmann, Barrett Thomas

We consider a dynamic vehicle routing problem where demand is known only in distribution prior to arrival at customers, vehicle routes are limited in duration, and the objective is to maximize expected demand served. We formulate the problem as a Markov decision process and develop rollout policies based on fixed routes that dynamically adjust an initial routing plan as demand is observed. We study the benefit of allowing vehicles to wait, rather than requiring them to continue on their routes.

4 - Anticipatory Routing of a Vehicle with Stochastic Customer Requests

Stephan Meisel, University of Braunschweig, Muehlenpfordtstr. 23, Braunschweig, 38106, Germany, stephan.meisel@tu-bs.de

We consider different policies for anticipatory routing of a vehicle with stochastic customer requests. The number of requests served within the time horizon must be maximized. To this end we apply both purely heuristic policies and policies derived by approximate dynamic programming. The solution quality of the latter critically depends on the used type of value function approximation. We derive policies from different approximations and compare them with the purely heuristic approaches.

■ MC48

H - Graham Room - 3rd Floor

Modeling Issues in Vehicular Ad Hoc Networks

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Yong Hoon Kim, Purdue University, 3000 Kent Avenue, West Lafayette, IN, United States of America, kim523@purdue.edu

1 - Numerical Analysis of Dynamic Traffic Information under Vehicle to Vehicle Communications

Yong Hoon Kim, Purdue University, 3000 Kent Avenue, West Lafayette, IN, United States of America, kim523@purdue.edu, Srinivas Peeta

We analyze the characteristics of dynamic traffic information in V2V Communications with different physical network, demand, and market penetrations. An efficient searching algorithm in V2V Communication Information Map to identify the dynamic traffic information is discussed first followed by numerical experiments to test the data quality and spatio-temporal coverage. Insights will be illustrated by comparing the data obtained through the V2V Communications and the field data.

2 - Modeling Individual Activity Patterns Using Online Social Media Data

Samiul Hasan, PhD Student, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, hasan1@purdue.edu, Satish Ukkusuri

Individual mobility is a fundamental need of all societies to participate in a wide variety of activities including work and leisure. Geo-locations shared by the users of social media offer us access to patterns of human activity choices and locations at a level unimaginable before. In this work we seek to develop models inferring individual activity patterns from geo-location data shared by the users of online social media.

3 - Graph Theoretical Modeling for the Dynamic Traffic Information Update Problem under Vehicle-to-Vehicle Communications

Yong Hoon Kim, Purdue University, 3000 Kent Avenue, West Lafayette, IN, United States of America, kim523@purdue.edu, Srinivas Peeta

This study proposes a graph theoretical approach to identify the dynamic traffic information update under V2V Communications. We represent comprehensive descriptions of the structural and functional organization of V2V Communication Information Map, which provides important implications of relationships with traffic network. Illustrative numerical examples are presented to demonstrate the proposed approach, as well as the data structures of V2V Communication Information Map.

■ MC49

H - Graves Room - 3rd Floor

Simulation Optimization with Constraints

Sponsor: Simulation

Sponsored Session

Chair: Douglas Morrice, The University of Texas, Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, morrice@mail.utexas.edu

1 - Common Random Numbers in Constrained Ranking and Selection

Christopher Healey, APC by Schneider Electric, 85 Rangeway Rd, Building 2, North Billerica, MA, 01862, United States of America, chris.healey@schneider-electric.com, Seong-Hee Kim, Sigrun Andradóttir

Common random numbers (CRN) are often used to improve the efficiency of comparison in ranking and selection procedures. We show how to incorporate CRN into fully sequential procedures for constrained ranking and selection due to Healey et al.(2011). The resulting procedures are statistically valid, require little correlation to improve performance in most cases, and can yield substantial savings. We also propose modifications for procedures that cannot use CRN in a statistically valid manner.

2 - Penalty Function with Memory for Discrete Optimization via Simulation with Stochastic Constraints

Chuljin Park, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States of America, cpark41@gatech.edu, Seong-Hee Kim

We consider a discrete optimization via simulation (DOvS) problem with stochastic constraints on secondary performance measures. To solve the problem, we propose a method called penalty function with memory (PFM). The method is similar to a penalty function but determines a penalty value for a solution based on past information of the solution's estimates for secondary performance measures. Convergence properties of the method are proven and its performance is tested on numerical examples.

3 - Comparison with the Standard and Selection with Contraints

E. Jack Chen, Business Integration Analyst, BASF Corporation, 333 Mt. Hope Avenue, Rockaway, NJ, 07866, United States of America, e.jack.chen@basf.com

We investigates comparison with the standard and develops a procedure to perform selection with contraints. In selection with contraints, there are multiple critiera. The goal is to find the system with the best primary performance measure in the presenece of stochastic constraints on secondary performance measures. Our procedure incorporates the indifference-zone approach and does not distinguish system performances with difference equals to or less than the indifference amount.

4 - Using Utility Theory to Avoid Bad Outcomes by Focusing on the Best Alternatives

Douglas Morrice, The University of Texas, Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, morrice@mail.utexas.edu, John Butler, Jason Merrick

In this paper, we show how well known results in stochastic optimization apply to multiattribute ranking and selection procedures and how to avoid the shortcomings of some proposed approaches via the use of utility theory. In short, utility theory uses tradeoffs to identify the one, best alternative rather than focusing on identifying the poorest performing alternatives that fail to meet some level of performance.

■ MC50

H - Ardrey Room - 3rd Floor

Behavioral Operations Management

Sponsor: Behavioral Operations Management

Sponsored Session

Chair: Yaozhong Wu, Associate Professor, NUS Business School, 15 Kent Ridge Drive, Singapore, Singapore, bizwyz@nus.edu.sg

1 - Designing Contracts for Irrational but Predictable Newsvendors

Michael Becker-Peth, University of Cologne, Albertus-Magnus-Platz, Cologne, 50226, Germany, michael.becker-peth@uni-koeln.de, Elena Katok, Ulrich Thonemann

Faced with uncertain demand decision makers do not place expected profit maximizing decision. We add to this body of knowledge by demonstrating that ordering decisions also systematically depend on individual contract parameters, and develop a behavioral model that captures this systematic behavior. We test our approach in an additional out-of-sample experiment that confirms that, contracts designed using the behavioral model perform much better than contracts designed using the standard model.

2 - Ordering Behavior under Disruption Risk: An Experimental Investigation

Karthik Ramachandran, Assistant Professor, Southern Methodist University, Dallas, TX, United States of America, karthik@mail.cox.smu.edu, Haresh Gurnani, Yusen Xia, Saibal Ray

We study ordering behavior in a setting in which suppliers differ in reliability and cost. The experimental results suggest that subjects systematically deviate from analytical findings in the supply disruption literature. We further quantify the profit implications of these deviations, and discuss managerial insights under different scenarios.

3 - Forecast Information Sharing in China and the U.S.: The Impact of Culture on Trust

Yanchong Karen Zheng, Assistant Professor, Massachusetts Institute of Technology, Sloan School of Management, Cambridge, MA, 02139, United States of America, yanchong@mit.edu, Ozalp Ozer

We experimentally investigate how cultural distinctions between China and the U.S. affect the efficacy of forecast sharing in a supply chain. We verify the findings in an earlier paper that trust and trustworthiness foster cooperation in the supply chain and risk has a greater impact than uncertainty. More importantly, we demonstrate that trust and trustworthiness are lower and decline more evidently with increasing risks in China. We discuss the managerial implications for these results.

4 - Fairness and Reciprocity in Pricing Decisions in Supply Chains

Yaozhong Wu, Associate Professor, NUS Business School, 15 Kent Ridge Drive, Singapore, Singapore, bizwyz@nus.edu.sg, Teck-Hua Ho, Xuanming Su

We report an experimental study on how upstream and downstream parties make pricing decisions in supply chains. We find that behavioral regularities in social contexts, namely fairness and reciprocity, are important forces in determining supply chain transactions and the expressions of them are affected by the structures of supply chains.

■ MC51

H - Caldwell Room - 3rd Floor

Emergency Evacuation I

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Pamela Murray-Tuite, Assistant Professor, Virginia Tech, 7054 Haycock Rd, Falls Church, VA, 22043, United States of America, murraytu@vt.edu

1 - Transit Pick-up Locations for Evacuation Planning with Demand Uncertainty

Yafeng Yin, University of Florida, 365 Weil Hall, Gainesville, FL, 32611, United States of America, yafeng@ce.ufl.edu, Ashish Kulshrestha, Yingyan Lou

This paper determines optimal transit pick-up locations for evacuation planning under demand uncertainty, the uncertainty associated with the number of transit-dependent people during evacuation. The proposed model is formulated as a mixed integer program and is solved via a cutting-plane algorithm. Numerical example suggests that the optimal plan results in lower evacuation time while achieving nearly the same level of performance compared to the plan based on the worst-case demand scenario.

2 - An Integrated Pedestrian Guiding and Bus Routing Model for Emergency Evacuation Planning

Mojtaba Heydar, PhD Student, Department of Industrial and Manufacturing Engineering, University of Wisconsin-Milwaukee, 3200 N Cramer St, Milwaukee, WI, 53211, United States of America, mheydar@uwm.edu, Yue Liu, Matthew Petering

This paper presents a two-level optimization model for evacuating carless people during emergency. An integrated linear model is formulated to concurrently optimize the operations of pedestrian flows and the public transit. The first-level guides evacuees through urban streets and crosswalks (i.e. the pedestrian network) to designated pick-up points and the second-level properly dispatches and routes a fleet of buses to transport evacuees to a safe place through the vehicular network.

3 - Optimization of Household Activity Chain, Meeting Location, and Destination in No-Notice Evacuation

Pamela Murray-Tuite, Assistant Professor, Virginia Tech, 7054 Haycock Rd, Falls Church, VA, 22043, United States of America, murraytu@vt.edu, Lisa Schweitzer

A nonlinear integer program was developed that assigns activity chains, meeting locations, and final destinations to minimize household evacuation time in a multimodal transportation network. This program can be used to investigate the impacts of car availability and household gender-based roles as well as the degree to which households optimize their emergency logistics.

■ MC52

H - North Carolina - 3rd Floor

SpORts (Sports Analytics) II

Sponsor: SpORts (Sports Analytics)

Sponsored Session

Chair: Ben Alamar, PhD, Professor of Sports Management, Menlo College, Director of Basketball Analytics &, Research for NBA Oklahoma City Thunder, Atherton, CA, United States of America, quantsports@gmail.com

1 - The Blindside Project: Measuring the Impact of Individual Offensive Linemen Individual Offensive Linemen

Ben Alamar, PhD, Professor of Sports Management, Menlo College, Director of Basketball Analytics &, Research for NBA Oklahoma City Thunder, Atherton, CA, United States of America, quantsports@gmail.com

In football, the offensive line has a significant impact on an offense, but there is no performance metric that allows us to compare the linemen or understand their true value to a team. This paper analyzes play-by-play data such as the number of defensive players rushing the QB, time in the pocket, steps in the QB's dropback, formation to first establish a baseline probability of success for each position on the line using a Cox regression. Once the baseline is established, the regression is run separately for each lineman, allowing each player's performance to be compared to the average after controlling for time in the pocket. The difference between a player's performance and the baseline is an estimate of the value added-subtracted to the team's passing game.

2 - A Markov Model of Football - Using Stochastic Processes to Model a Football Drive

Keith A. Goldner, Chief Analyst, numberFire, Inc, 1500 Broadway Ste. 1802, New York, NY, 10003, United States of America, keithgoldner@gmail.com

A team is backed into a fourth-and-26 from their own 25, down three points. What are the odds that drive ends in a field goal? In the 2003 playoffs, Donovan McNabb and the Eagles scoffed at such a probability as they converted and ultimately kicked a field goal to send the game into overtime. This study creates a mathematical model of a football drive that can calculate such probabilities, labeling down, distance, and yard line into states in an absorbing Markov chain. The Markov model provides a basic framework for evaluating play in football. With all the details of the modeloabsorption probabilities, expected time until absorption, expected pointsowe gain a much greater situational understand-ing for in-game analysis.

3 - Accuracy of Projected Fantasy Football Player Rankings

Paul Kerl, PhD Student, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, paul.kerl@gatech.edu

NFL Fantasy Football has 27 million American participants and is an estimated $4 billion industry. Working with a start-up company that projects player performance rankings, we evaluate and compare the performance of the rankings of several experts by simulating one million fantasy football teams. Our results show that player performance and ranking accuracy can be highly varied from week-to-week. We propose suggestions for the use of OR in future seasons to aid in fantasy football decisions.

4 - The Methodology of Officially Recognized International Sports Rating Systems

Raymond T. Stefani, Professor Emeritus, California State University-Long Beach, Long Beach, CA, United States of America, Stefani@csulb.edu

Presented are the methodologies used by recognized international sports federations that publish rating systems for two combat sports having a subjective rating system, 82 sports having a point-accumulation system (which converts results to points, ages results more than one year old, and adjusts points for performance quality) and 13 sports having a self-adjustive system (favoured for technical sophistication). Predictability is tabulated for selected world cup and grand slam competitions.

■ MC53

H - South Carolina - 3rd Floor

Joint Session DM/QSR: Panel Discussion: Funding Opportunities

Sponsor: Data Mining/Quality, Statistics and Reliability

Sponsored Session

Chair: Jing Li, Assistant Professor, Arizona State University, University Drive and Mill Avenue, Tempe, AZ, United States of America, jing.li.8@asu.edu

1 - Panel Discussion: Funding Opportunities

Moderator: Jing Li, Assistant Professor, Arizona State University, University Drive and Mill Avenue, Tempe, AZ, United States of America, jing.li.8@asu.edu, Panelists: Russell Barton, Mou-Hsiung Chang, Donald Hearn, Karin Remington

In this panel, program officers from NSF, NIH, and DOD will talk about funding opportunities. The panelists are:Dr. Russell Barton from NSF/SES&MES; Dr. Karin Remington from NIH/NIGMS; Dr. Mou-Hsiung (Harry) Chang from Army Research Office/Mathematical Sciences Division; Dr. Donald Hearn from Air Force Office of Scientific Research/Mathematics, Information and Life Sciences.

■ MC54

H - Charlotte Hall - 3rd Floor

Daniel H. Wagner Prize for Excellence in Operations Research

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research

Invited Session

Chair: Allen Butler, Daniel H Wagner Associates, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States of America, Allen.Butler@va.wagner.com

1 - To Show or Not Show: Using User Profiling to Manage Internet Advertisement Campaigns

Vijay Mookerjee, Charles and Nancy Davidson Distinguished Professor, The University of Texas at Dallas, School of Management, 800 West Campbell Road, Richardson, TX, 75080, United States of America, vijaym@utdallas.edu, Radha Mookerjee, Subodha Kumar

We study the problem of an internet ad firm (www.chitika.com) that needs to maximize its ad revenue subject to a click-through-rate constraint imposed by a publisher. The solution combines real-time data and decision analytics, namely, predicting the likelihood of a visitor's click event for a given ad, followed by a filter to decide whether or not to show the ad to the visitor. The approach has significantly boosted ad revenue as well as provided a competitive advantage for the company to enter new markets.

2 - Fleet Renewal with Electric Vehicles at La Poste

Stefan Spinler, Kuehne Foundation Chair in Logistics Management, WHU - Otto Beisheim School of Management, Burgplatz 2, Vallendar, D-56179, Germany, Stefan.Spinler@whu.edu, Paul Kleindorfer, Andrei Neboian, Alain Roset

We provide a decision model for La Poste on adoption of electric vehicles (EVs) for mail and parcel distribution. Two competing technologies are available, internal combustion vehicles and EVs. Uncertainty about fuel price and EV battery cost is taken into account. We derive the optimal timing of EV adoption and evaluate the total cost of fleet renewal. An optimal strategy for EV adoption and to support negotiations with stakeholders such as energy companies and EV manufacturers is formulated.

■ MC55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS/LAW: Public Sector Analytics

Sponsor: Analytics/CPMS, The Practice Section of INFORMS/Law, Law Enforcement and Public Policy

Sponsored Session

Chair: Arnold Greenland, Distinguished Engineer, IBM, 6710 Rockledge Drive, Bethesda, MD, 20817, United States of America, agreenland@us.ibm.com

1 - A Pattern Recognition Approach to Medical Cost Data

Gigi Yuen, IBM, 3031 N Rocky Point Dr West, Tampa, FL, 33607, United States of America, gigi.yuen@us.ibm.com, Aleksandra Mojsilovic, Dmitriy Katz-Rogozhnikov

Medical costs are driven by numerous factors, ranging from patients characteristics, to providers, to conditions, to procedures. The effects are complex & interrelated. In this work, we developed a pattern recognition approach to identify and quantify key cost drivers considering the underlying hierarchical & multiplicative factor relationship. The approach greatly improves the efficiency and effectiveness of common cost attribution approach, and facilitates early detection of emerging patterns.

2 - Analytics and Optimization for Smarter Cities

Tarun Kumar, Senior Research Engineer, IBM Research, Room 32-238, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, ktarun@us.ibm.com, Edward Matto, Li Zhuang, Layne Morrison, Dave Mallya, Hongfei Li, Arun Hampapur, Shilpa Mahatma, Mehmet Candas, Xuan Liu, Zhiguo Li, Songhua Xing, Yada Zhu, Don Fenhagen, Surinder Puri

With more than 70% of the world's population expected to dwell in cities by 2050, city operators are challenged to provide better services under increasingly demanding conditions. IBM is working with three cities on developing solutions for supporting operations & maintenance, including field service optimization, predictive maintenance, usage & revenue optimization, coordinated capital planning & operations management. This talk with outline the challenges & analytics technologies developed.

3 - Treating Citizens like Customers: Applying Analytics in the Public Sector

Jodi Blomberg, Principal Technical Architect, SAS, 6400 S. Fiddlers Green Circle, Ste 600, Denver, CO, 80111, United States of America, Jodi.Blomberg@sas.com

We will present two examples of public sector agencies applying popular private sector applications to show the benefits of treating citizens like "customers". The first example, collections optimization, is used by government agencies from tax collections to child support enforcement to maximize economic outcomes by making the most of each individual communication. In the second example, we examine efforts at wildlife agencies to calculate the customer lifetime value of outdoorsmen.

4 - Targeted Risk Identification Model (TRIM)

Alex Cosmas, Lead Associate, Booz Allen Hamilton, 22 Batterymarch Street, 2nd Floor, Boston, MA, 02109, United States of America, cosmas_alex@bah.com, Robert Love, Cenk Tunasar

The FAA has set a goal to reduce fatalities by 50% by 2025 in the face of increasing volume. Our approach leverages Bayesian techniques to enable proactive risk targeting with partial information. Our method enables the provision of critical information to pilots, controllers, airlines, FAA, etc. to inform real-time risk mitigation. Our analysis integrates data sources such as operational, fleet, and safety data and employs risk distributions for fatigue, stress, weather, and aircraft anomalies.

■ MC56

H - Biltmore Boardroom - 2nd Floor

Appointment Scheduling

Contributed Session

Chair: Michele Samorani, Leeds School of Business, University of Colorado at Boulder, UCB 419, Boulder, CO, 80309, United States of America, michael.samorani@colorado.edu

1 - Appointment Scheduling with No Show: A Review

Mingang Fu, University of Washington, 4717 24th Avenue NE, Apt 325, Seattle, WA, 98105, United States of America, mf23@u.washington.edu, Richard Storch

This paper provides a survey of literature on the phenomenon of no show and Appointment Scheduling (AS) that considers the impact of no show. Although no show itself has been an active research area with productive results, throughout nearly 60 years of history of research in scheduling, few AS papers deal with no show. Our goal is to present general methodologies used in modeling and predicting no show, and solving scheduling problems with no show.

2 - An Integrated Prediction and Optimization Models for Appointment Scheduling with Disturbances

Sara Shirinakm, Wayne State University, 4815 Fourth St., Detroit, MI, United States of America, sshirinkam@gmail.com, Kai Yang, Chandan Reddy, Adel Alaeddini

we develop a hybrid probabilistic model based on logistic regression and Bayesian inference to predict the probability of no-shows in real time. We also develop an optimization model which can use no-show probabilities for scheduling patients. Our model can be used to enable a precise overbooking strategy to reduce the negative effect of no-shows while maintaining short wait times. The effectiveness of the proposed approach is demonstrated using healthcare data collected at a medical center.

3 - Walk-in Patient Admission in Outpatient Clinics with High No-Shows and Late Cancellations

Xiuli (Shelly) Qu, Assistant Professor, North Carolina A&T State University, 1601 E. Market Street, 424 McNair Hall, Greensboro, NC, 27411, United States of America, xqu@ncat.edu, Jing Shi, Yidong Peng, Ergin Erdem

Clinics with high patient no-shows and late cancellations usually adopt overbooking and/or accept walk-in patients to reduce the resultant negative impact on the efficiency of healthcare delivery and the accessibility to care. In this talk, we present a semi-MDP model to optimize the decisions of whether or not to accept a walk-in patient and when a walk-in patient should be seen. Using this model, we derive the optimal policies for walk-in patient admission under representative scenarios.

4 - Reducing Occurrences of Long Waiting Times by Making Early Patients Wait

Michele Samorani, Leeds School of Business, University of Colorado at Boulder, UCB 419, Boulder, CO, 80309, United States of America, michael.samorani@colorado.edu, Subhamoy Ganguly

When a provider is idle, clinics often face the dilemma of choosing between preemptively seeing a very early patient right away versus waiting for the next scheduled patient who has not shown up yet. Even though using preemption minimizes provider idle time, we show that under certain conditions, it is wiser to wait and periodically re-evaluate the prospect of preemption. Despite a small increase in provider overtime, our method dramatically reduces the occurrences of very long wait times.

■ MC57

W - Providence I- Lobby Level

Distributed Mechanisms for Allocating NAS Resources

Sponsor: Aviation Applications

Sponsored Session

Chair: Mark Hansen, University of California Berkeley, 114 McLaughlin Hall, Berkeley, CA, 94720, United States of America, mhansen@ce.berkeley.edu

1 - Performance Metrics and Trade-offs in Ground Delay Program

Yi Liu, University of California, Berkeley, 107D, Mclaughlin Hall, Berkeley, CA, 94720, United States of America, liuyi.feier@gmail.com, Mark Hansen

We construct performance metrics for capacity, efficiency, and predictability, and show how these metrics may be traded off in the design of Ground Delay Programs under capacity uncertainty. The results enable the FAA and flight operators make trade-offs among different performance criteria.

2 - Collaborative Resource Allocation Strategies for En Route Air Traffic Flow Management

Amy Kim, University of California Berkeley, Berkeley, CA, United States of America, amy_kim@berkeley.edu

This work investigates strategies that aim to minimize the user-cost impact of a future AFP that employs rerouting and ground delay. A modeling framework was developed to evaluate allocation strategies under differing assumptions regarding the airlines' private resource preferences. The strategies feature different assignment rules and preference inputs requested of flight operators. We study the gaming and truth-telling behavior of flight operators in competition for limited resources.

3 - Equitable Resource Allocation Mechanisms During Reduced Airspace Capacity

Kleoniki Vlachou, PhD Candidate, University of Maryland, 1173 Glen Martin Hall, College Park, MD, 20742, United States of America, kvlachou@umd.edu

In this talk I will present new fair allocation schemes that will take into account the preferences and cost information of airlines that will allow for more precise allocations decisions. These new resource allocations mechanisms will take into account three performance criteria: 1) System efficiency, meaning performance criteria such as throughput and flight delay, 2) Equity (flight operators are treated fairly), and 3) User cost.

4 - Service Expectations Setting in Air Traffic Flow Management: A Consensus-building Mechanism

Prem Swaroop, University of Maryland, College Park, MD, United States of America, pswaroop@rhsmith.umd.edu

The U.S. National Airspace System (NAS) is a complex system operated by a multitude of independent firms serving the aviation passengers. When faced with extreme weather conditions, its capacity decreases, necessitating deployment of systematic Traffic Management Initiatives (TMIs) like Ground Delay Programs (GDPs) and Airspace Flow Programs (AFPs). The TMIs involve multiple stakeholders: Federal Aviation Administration (FAA), airlines, and airports, requiring consensus-based, fair approaches to joint decision-making. We formalize a mechanism for this collaborative decision-making that could be incorporated by the FAA for collaboratively determining the TMI parameters at the NAS-level.

■ MC58

W - Providence II - Lobby Level

Modeling and Operations Research for Defense Analysis

Sponsor: Military Applications Society

Sponsored Session

Chair: Bill Fox, Professor, Naval Postgraduate School, 589 Dyer Rd, 103 F, Monterey, CA, 93943, United States of America, wpfox@nps.edu

1 - Modeling Counterinsurgency Strategies and Coalitions

Chris Arney, Professor, United States Military Academy, Department of Mathematics, West Point, NY, 10996, United States of America, David.Arney@usma.edu, Kristin Arney

In order to be more effective, the US military must improve its counterinsurgency capabilities and flexibility to match the adaptability of insurgent networks and terror cells. Our simulation model combines elements of traditional differential equation combat modeling with modern social science modeling of networks, psyop, and coalition cooperation to inform the tactics and strategies of counterinsurgency decision makers.

2 - Effects of Agent Attribute Distributions on Civil Violence Model Results

Michael Jaye, Associate Profesor, Naval Postgraduate School, 589 Dyer Road, Monterey, CA, 93953, United States of America, mjjaye@nps.edu, Robert Burks

Epstein's agent-based civil violence work serves as the conceptual model. Earlier, we followed Epstein by assigning some agent attributes from the uniform distribution while fixing others; we validated model results. Now we investigate effects by assigning agent parameters from other distributions; we will assign from various distributions other parameters fixed in the original work; we will incorporate rules to modify agent attributes based on interactions. We discuss modification effects.

3 - Detecting Suicide Bombers: Update and New Metrics

Bill Fox, Professor, Naval Postgraduate School, 589 Dyer Rd, 103 F, Monterey, CA, 93943, United States of America, wpfox@nps.edu

Terrorist use human-born Improvised Explosive Devices against public and military persons. These undetected suicide bombers enter crowded public areas in order to detonate the IED, inflicting lethal damage to the surrounding individuals. Currently, there are no detection systems that can identify suicide bombers at adequate standoff distances. We develop new models, metrics, and and a methodology to increase the probability of identifying a suicide bomber.

4 - Reliability Growth Model Types

Don Gaver, Naval Postgraduate School, Monterey, CA, United States of America, DGaver@nps.edu, Lyn Thomas, Patricia Jacobs

Two different basic model types have been proposed for Reliability Growth: 1) Empirical-Statistical (Duane), and 2)Stochastic Design-Fault Mode mitigation (DFMM). We describe new versions of 2) that recognize the effects of serial-dynamic DFM encounter during test ("masking"), caused by DFM creation while attempting mitigation, and DFM creation from Common Causes, e.g. enviromental shocks. Statistical parameter estimation is addressed.

■ MC59

W - Providence III - Lobby Level

Managing Service Quality

Sponsor: Service Science

Sponsored Session

Chair: Syamantak Saha, Affiliation: NYU Stern School of Business, East 3rd Street, New York, NY, 10003, United States of America, ssaha@zapaat.com

1 - PSM Analysis: A Perspective Approach to Service Management

Syamantak Saha, Affiliation: NYU Stern School of Business, East 3rd Street, New York, NY, 10003, United States of America, ssaha@zapaat.com

For effective service management, the service that is provided has to be deemed effective by both the organisation and the service provider. However, often there is a disagreement about the effectiveness of a provided service. This is mainly due to perspective mismatches between the organisation and its service provider. In this paper, a Perspective based Service Management (PSM) method is presented that provides a common and integrative framework for an agreed quality of provided service.

2 - Integrated Insights for Contact Center Delivery Optimization

Tao Qin, IBM, Diamond Building A, Zhongguancun Software Park, Beijing, 100193, China, qintao@cn.ibm.com, Miao He, Sai Zeng, Changrui Ren, Jin Dong

In the modern contact centers, quite a variety of software are available to record agents' behaviors, while there exists few tools to consolidate these channels for integrated insights. Our work bridges this gap by mapping monitoring records from several software and extracting critical features from agents and processes behaviors, to identify the space for contact center performance improvement.

3 - A Comprehensive Assessment Method for Distribution Grid Using Fuzzy Set and Self-Tuning Weighting

Tianzhi Zhao, Research Staff Member, IBM Research, Diamond Building 19A, ZGC Software Park, Haidian District, Bejing, 100193, China, zhaotzhi@cn.ibm.com, Feng Gao, Xinjie Lv, Jinyan Shao, Hairong Lv, Wenjun Yin

Abstract: The construction and renovation of distribution grid heavily rely on scientific and reasonable evaluation of grid status. In this paper, a systematic index system is developed from both technical and managerial perspectives, and then a comprehensive assessment method for distribution grid is presented based on fuzzy set for index evaluation and self-tuning weight approach for weighting factors. The method is driven by rule engine to combine power grid data with expert knowledge.

■ MC60

W - College Room - 2nd Floor

Combinatorial Optimization and Matroids

Sponsor: Optimization/Networks

Sponsored Session

Chair: Illya Hicks, Associate Professor, Rice University, Houston, TX, United States of America, ivhicks@rice.edu

1 - Circuits and Cocircuits of Matroids

John Arellano, Graduate Student, Rice University, 6100 Main Street, Houston, TX, 77005, United States of America, jda2@rice.edu, Illya Hicks

A new set covering problem formulation of the matroid cogirth problem, finding the cardinality of the smallest cocircuit of a matroid, is presented. The solution to the matroid cogirth problem provides the degree of redundancy of a sensor network. Existing methods developed to solve the matroid cogirth problem and the set covering problem are discussed. A branch-and-cut algorithm that solves the set covering problem to optimality is presented.

2 - The Cunningham-Geelen Method in Practice: Branch-decompositions and Integer Programming

Susan Margulies, Rice University, Houston, TX, United States of America, susan.margulies@rice.edu, Illya Hicks, Jing Ma

Cunningham and Geelen (2007) describe an algorithm for solving the integer program max{c^Tx : Ax = b, x >= 0}, which utilizes a branch-decomposition of the matrix A and techniques from dynamic programming. We report on the first implementation of the CG algorithm, and demonstrate that certain infeasible knapsacks instances with width <= 6 run in a matter of minutes with the CG algorithm, but in a matter of hours with the commercial integer programming software Gurobi.

3 - Integer Programming Techniques for the Branchwidth of Matroids

Illya Hicks, Associate Professor, Rice University, Houston, TX, United States of America, ivhicks@rice.edu, Elif Ulusal

This talk offers an integer programming formulation for computing branch decompositions and finding the branchwidth of matroids. The concept of branch decompositions and its related invariant branchwidth were first introduced by Robertson and Seymour in their proof of the Graph Minors Theorem and can easily be generalized for any symmetric submodular set function.

■ MC63

W - Tryon North - 2nd Floor

Evolutionary Multi-Objective Optimization 2

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Brian Piper, North Carolina State University, 7801-102 Mayfaire Crest Lane, Raleigh, NC, 27615, United States of America, bepiper@ncsu.edu

1 - Agent-based Modeling and Evolutionary Computation for Sustainable Urban Water Supply Management

Venu Kandiah, Texas A&M University, Civil Engineering Department, 2250 Dartmouth St, #1022, College Station, TX, 77840, United States of America, vkkandia@neo.tamu.edu, Emily Zechman

Decentralized technologies and water conservation practices can alleviate the stress that population growth and climate change place on urban water systems. These interactions are studied using a sociotechnical model that couples agent-based models of households with engineering models of water systems. The integrated model is coupled with a hypervolume-maximizing evolutionary algorithm to explore the trade-offs among energy utilization, water sustainability, and costs of water supply designs.

2 - Parallel Parameter Estimation for Subsurface Flow and Reactive Transport Problems

Jitendra Kumar, Oak Ridge National Laboratory, One Bethel Valley Road, P.O. Box 2008 MS 6301, Knoxville, TN, 37831, United States of America, jkumar@climatemodeling.org, Richard Mills

Aquifers are comprised of stratigraphic units with highly heterogeneous material properties. Inferring these properties from spatially and temporally sparse field observations is a complex non-linear and high dimensional problem. We have applied a massively parallel evolutionary algorithm to this task for simulations of sites on the Oak Ridge reservation using the PFLOTRAN parallel flow and reactive transport model.

3 - Many-objective Visual Analytics: Supporting Discovery and Negotiation in Complex Engineered Systems

Josh Kollat, Research Associate, Pennsylvania State University, 403 Sackett Building, University Park, PA, 16802, United States of America, juk124@psu.edu, Patrick Reed

Our recent decision aiding work combines many-objective search with highly interactive visual exploration of high dimensional tradeoffs. Our many-objective visual analytics framework is being used operationally in a wide variety of research and commercial applications. Our framework also provides tools to visualize search dynamics and convergence in both serial and parallel computing contexts. Our goal is to support the discovery of new design insights and improve negotiated decisions.

■ MC64

W - Queens Room - 2nd Floor

Humanitarian Logistics and Disaster Relief II

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Irina Dolinskaya, Assistant Professor, Northwestern University, 2145 Sheridan Road, IEMS, Evanston, IL, 60208, United States of America, dolira@northwestern.edu

1 - Pre-positioning Hurricane Supplies: A Commercial Supply Chain Perspective

Emmett Lodree, The University of Alabama, Operations Management, Tuscaloosa, AL, United States of America, ejlodree@cba.ua.edu, Kandace Ballard, Chang Song

Motivated by the effective response of retailers such as The Home Depot and Walmart following Hurricane Katrina in 2005, this paper investigates pre-positioning supplies at retailer locations in anticipation of a potential demand surge following the landfall of an observed hurricane. A two-stage stochastic programming model is proposed and illustrated via case study comprised of real-world hurricane scenarios.

2 - Locating Points of Distribution in Disasters with Social Costs Considerations

Miguel Jaller, Rensselaer, 110 8th St, Troy, United States of America, jallem@rpi.edu, Jose Holguin-Veras

This paper develops analytical formulations that serve as planning tools, and provides an indication of the optimal number of points of distribution (PODs) and their capacities, to be located in a region impacted by a major disaster. The PODs should serve all individuals while minimizing total costs; defined as the cost of locating the PODs and servers plus the social costs associated with the walking distance and the waiting time for service.

3 - Strategic Stockpiling of Power System Supplies for Disaster Recovery

Russell Bent, Los Alamos National Laboratories, P.O. Box 1663, MS C933, Los Alamos, NM, 87545, United States of America, rbent@lanl.gov, Carleton Coffrin, Pascal Van Hentenryck

This paper studies the Power System Stochastic Storage Problem (PSSSP), a novel application in power restoration which consists of deciding how to store power system components throughout a populated area to maximize the amount of power served after a disaster. The paper proposes an exact mixed-integer formulation for the linearized DC power flow model and a general column-generation approach. The results show that the column-generation algorithm produces near-optimal solutions quickly.

■ MC65

W - Kings Room - 2nd Floor

Service Science and Service Operations Management

Sponsor: Service Science

Sponsored Session

Chair: Gang Li, Associate Professor, Xi'an Jiaotong University, The Management School, No.28, Xianning West Road, Xi'an, China, glee@mail.xjtu.edu.cn

1 - Competition in a Dual-channel Supply Chain with Value-added Services

Linyan Sun, Xi'an Jiaotong University, No.28, Xianning West Road,Xi'an,Shaanxi, Xi'an, 710049, China, lysun@mail.xjtu.edu.cn, Gang Li, Meiling Luo, Valerie C.Y. Zhu

We study the manufacturer's introducing of a direct value-added service channel to compete with the traditional retailer which only offers products to customers. The effect of the competition on the pricing, market share and profit allocation of the supply chain is analyzed. We get the condition that the manufacturer is willing to introduce the value-added services channel. Under some conditions, a win-win situation for the manufacturer and the retailer can achieve.

2 - Robust Mixed-model Assembly Line Balancing with Uncertain Demand

Jie Gao, Associate Professor, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, Shaanx, Xi'an, 710049, China, gaoj@mail.xjtu.edu.cn, Linyan Sun, Jinlin Li

In a mixed-model assembly line (MMAL), a common task may need to be assigned to a single station while have different processing times depending on the model assembled. For a MMAL facing changing product mix, the line design problem firstly determines location of WIP buffer for each task. Then, when the product mix is observed, each task can be assigned and reassigned around its WIP buffer. In this paper, the robust MMAL balancing problem is modeled, and solution procedures are developed.

3 - A Coordination Contract Based on Real-option for Risk Management with Dual Sourcing

Meiling Luo, The Management School of Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, China, shareluo@gmail.com, Gang Li, Linyan Sun

The paper studies the supply chain coordination issue in a retailer-led supply chain with dual sourcing. The supply chain coordination mechanism based on real-option is proposed. We design the algorithms of the optimal real option price and exercise price, and analyze the effects of the supply capacity risk and the price risk of the spot market on the optimal decisions and performance of the supply chain.

■ MC66

W - Park Room - 2nd Floor

DEA Session 3

Cluster: Data Envelopment Analysis

Invited Session

Chair: Andy Johnson, Assistant Professor, Texas A&M University, Department of I&SE, College Station, TX, 77843-3131, United States of America, ajohnson@tamu.edu

1 - Efficiency Analysis of U.S. and Indian Banks: Theory and Evidence

Aleda Roth, Endowed Professor, Clemson University, 101 Sirrine Hall, Clemson, SC, 29634, United States of America, aroth@clemson.edu, Sriram Venkataraman, Paul Wilson

This paper integrates diffusion model from marketing and path dependency theory from economics into service operations management. We test our hypotheses using data from banks operating in the U.S. and India. Methodologically, we use a consistent bootstrapping technique from data envelopment analysis literature to test the two hypotheses and draw meaningful statistical inference.

2 - Empirically-constructed Wealth Variables in Public-sector DEA Applications

Walter A. Garrett, Jr., Instructor of Decision Sciences, John Cook School of Business, Saint Louis University, 3674 Lindell Blvd, DS417, Saint Louis, MO, 63108, United States of America, wgarrett@slu.edu, N.K. Kwak

Public-sector DEA researchers often require a wealth, poverty, or socio-economic deprivation measure as an input to their models, but lack a standard wealth variable. Wealth proxies are typically constructed from a variety of available variables. We illustrate selected constructed wealth variables, and compare them to a two-step DEA approach for constructing a wealth variable. The models are demonstrated using a sample of U.S. public schools data.

3 - A Non-parametric Clustering Analysis with Application in Digital Divide in Europe

Emilyn Cabanda, Regent University, 1333 Regent University Drive, Virginia Beach, VA, 23464, United States of America, ecabanda@regent.edu, Roya Gholami, Ali Emrouznejad

This paper proposes a clustering method based on a non-parametric multiplicative linear programming model, and attempts to compare the results with the general clustering approaches of digital divide produced by previous research, applied to the 15-member states of the European Union (EU). The findings of research suggest that EU witnessed a real digital divide between its developed and developing members within the Union.

■ MC69

W - Grand D - 2nd Floor

Sustainable and Responsible Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Jose Cruz, Assistant Professor, University of Connecticut, School of Business, Storrs, CT, United States of America, Jose.Cruz@business.uconn.edu

1 - Sustainable Fashion Supply Chain Management under Oligopolistic Competition & Brand Differentiation

Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts - Amherst, Eugene M. Isenberg School of Management, Amherst, MA, 01003, United States of America, nagurney@gbfin.umass.edu, Min Yu

We developed a model of oligopolistic competition for fashion supply chains in the case of brand differentiated products with the inclusion of environmental concerns. Each fashion firm seeks to maximize its profits as well as to minimize its emissions throughout its supply chain with the latter criterion being weighted in an individual manner by each firm. The competitive supply chain model is network-based and variational inequality theory is used for the formulation of the Nash equilibrium.

2 - Sustainable Production Strategies

Hsiao-Hui Lee, Assistant Professor, University of Hong Kong, Meng Wah Complex, Room 607, Pok Fu Lam, Hong Kong - ROC, hhlee@hku.hk, Jose Cruz, Manuel Nunez

Sustainability practices have emerged as potential factors for cost savings and winning orders from fans of green business operations. We develop a two-stage dynamic game to analyze different sustainability decisions such as starting a recycling program or developing alternative technologies to replace limited or polluting resources. In particular, we find optimal decisions, investigate the impact of the parameters, and finally discuss the role of competition in sustainability decisions.

3 - Supply Chains Competition through Corporate Social Responsibility (CSR)

Zugang (Leo) Liu, Assistant Professor, Pennsylvania State University, 76 University Dr., Hazleton, PA, United States of America, zxl23@psu.edu, Jose Cruz

We considered competition between two supply chains each of which consists of a supplier and a manufacturer. We analyze and provide insights to the following questions: (1) How does the CSR readiness level affect the competition between two supply chains? (2) How do the CSR readiness levels of supply chains firms affect the profitabilities of themselves and their supply chain partners, respectively? (3) Whether or not should the manufacturers disclose the CSR information of their suppliers?

4 - Green Information Systems for Product Recovery Management

Tina Wakolbinger, Professor, WU (Vienna University of Economics and Business), Vienna, Austria, Tina.Wakolbinger@wu.ac.at, Fuminori Toyasaki, William J. Kettinger

This paper sheds light on the role of "Green IS" in product recovery management. Guided by a theoretically grounded research framework and an eco-efficiency perspective, we develop analytical models to determine under what conditions investments in Information-intensive Product Lifecycle Management Systems are economically justifiable for manufacturers and when policy-makers need to consider facilitating their implementation.

Monday, 4:30pm - 6:00pm

■ MD01

C - Room 201A

Empirical Session on Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Suresh Muthulingam, Assistant Professor of Operations Management, Cornell University, The Johnson School, 401P Sage Hall, Ithaca, NY, 14853, United States of America, sm875@cornell.edu

Co-Chair: Anupam Agrawal, Assistant Professor of Business Administration, University of Illinois at Urbana-Champaign, 363 Wohlers Hall, 1206 South Sixth Street, Champaign, IL, 61820, United States of America, anupam@illinois.edu

1 - Causes and Consequences of understaffing in Retail Stores

Vidya Mani, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, vidya_mani@unc.edu, Saravanan Kesavan, Jayashankar Swaminathan

In this paper we study the causes and consequences of understaffing in retail stores by examining the longitudinal data on store managers' labor-planning decisions and the performance of 41 stores in a large retail chain. We show that store managers of this retail chain differ considerably in their imputed cost of labor, understaffing is predominantly present during peak hours, and forecast errors and scheduling inflexibilities contribute to understaffing.

2 - Designing Health Care Supply Chain for Heterogenous Populations: Towards an Integrative Framework

David Zepeda, University of Minnesota, 3-150 Carlson School of Management, 321 19th Avenue South, Minneapolis, MN, 55455, United States of America, zepe0003@umn.edu, Kingshuk Sinha

It is well established that disparities exist in the access to and delivery of quality health care. Health IT has the potential to reduce disparities in care delivery. Yet, the relationship between Health IT interventions and quality of care in under-resourced settings (where those that are uninsured and socially disadvantaged typically access care) has received little attention. We investigate the relationship between Health IT capability and quality of care in under-resourced settings.

3 - Organizational Structure, Quality Improvement and Learning
Anupam Agrawal, Assistant Professor of Business Administration, University of Illinois at Urbana-Champaign, 363 Wohlers Hall, 1206 South Sixth Street, Champaign, IL, 61820, United States of America, anupam@illinois.edu, Suresh Muthulingam

In this empirical work based on a four year long primary data of an automotive OEM, we explore how a streamlined supplier improvement structure, focused on sustained investment of resources in supplier quality, can affect the quality of incoming components. We open the black box of quality improvement and explore the contingencies affecting a buyer's investment in its suppliers.

■ MD02

C - Room 201B

Optimization in Finance IV

Cluster: Optimization in Finance

Invited Session

Chair: Kun Soo Park, Assistant Professor, KAIST Graduate School of Management, 85 Hoegi-ro, Dongdaemun-gu, Seoul, Korea, Republic of, kunsoo@business.kaist.ac.kr

1 - Robust Optimization in Interest and Exchange Rate Management
Elcin Cetinkaya, Doctoral Student, Lehigh University, 200 W Packer Avenue, Bethlehem, PA, 18015, United States of America, elc209@lehigh.edu, Aurelie Thiele

We investigate robust optimization models that address uncertainty for interest rate and exchange rate management problems. These rates obey different stochastic processes than oft-studied stock prices and therefore require the design of application-specific robust optimization techniques. We formulate static and dynamic models, discuss practical tractability and theoretical insights, and provide numerical results.

2 - Credit Risk with Selection of Effort and Volatility
Abel Cadenillas, Professor, University of Alberta, 632 Central Academic Building, Department of Mathematical Sciences, Edmonton, AB, T6G 2G1, Canada, acadenil@math.ualberta.ca, Jaeyoung Sung, Hyeng Keun Koo, Alain Bensoussan

We consider a bank which lends money to an investor. The investor selects effort and projects. Her/His objective is to maximize his expected utility of terminal wealth after paying the loan, and to minimize the cost of effort. We compute the choice of schedule. In other words, we compute the fair amount of money that the bank should charge the investor for lending her/him money.

3 - A Portfolio Optimization Model with Regime-switching Risk Factors for ETFs
Len MacLean, Herbert Lamb Chair, Dalhousie University, 6100 University Avenue, Halifax, NS, B3H 3J5, Canada, L.C.MacLean@DAL.CA, Yonggan Zhao

This paper develops a portfolio optimization model with a market neutral strategy under a Markov regime-switching framework. The investment objective is to dynamically maximize the portfolio alpha (excess return over the T-Bill) subject to neutralization of the portfolio sensitivities to the selected risk factors. We evaluate the in-sample and out-of-sample performance of the regime-dependent market neutral strategy against the equally weighted strategy.

4 - New Markov Chain Models to Estimate the Premium for Extended Hedge Fund Lockups
Kun Soo Park, Assistant Professor, KAIST Graduate School of Management, 85 Hoegi-ro, Dongdaemun-gu, Seoul, Korea, Republic of, kunsoo@business.kaist.ac.kr, Ward Whitt

To estimate the premium an investor should expect from extended hedge fund lockups, Derman et al. (2009) proposed a three-state discrete-time Markov Chain to model. To be more realistic, we propose an alternative three-state continuous-time Markov Chain model, which allows state changes continuously in time. We develop new techniques for parameter fitting, exploiting nonlinear programming.

■ MD03

C - Room 202A

Open-Source OR in the Real World

Sponsor: Computing Society/ Open Source Software (Joint Cluster Optimization)

Sponsored Session

Chair: Matthew Saltzman, Clemson University, Department of Mathematical Sciences, Martin Hall, Box 340975, Clemson, SC, 29631, United States of America, mjs@clemson.edu

1 - The Bearcats Transportation System: A New Vehicle Routing Formulation
Kipp Martin, University of Chicago, Booth School of Business, 5807 South Woodlawn, Chicago, IL, 60637, United States of America, kmartin@chicagobooth.edu, Jeffrey Camm, Michael Magazine, Saravanan Kuppusamy

We consider the problem of constructing optimal bus routes. The objective is to minimize the distance traveled weighted by the number of riders on the route. The resulting model is a non-convex integer program that is extremely difficult to optimize. We show how to reformulate this problem as a linear integer program in an extended variable space. The resulting formulation is very large and we describe a column generation algorithm based on COIN-OR software.

2 - Vehicle Routing for Paratransit with Heterogeneous Vehicle and Passenger Classes
John Carlsson, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, jgc@isye.umn.edu

Small-scale non-profit paratransit services currently rely on software packages such as Microsoft MapPoint or MileCharter to assign vehicles to customers. These packages do not support optimization for assignment and routing and therefore decisions are usually made manually. Here we describe an open source, customized implementation of an algorithm tailored to the needs of such agencies and report our success with two Minnesota-based paratransit organizations.

3 - Optimal Layout of Chlorine Booster Stations for Water Supply Network Security
Angelica Wong, Graduate Student, Texas A&M University, 3122 TAMU, College Station, TX, 77843, United States of America, ang_vanessa@tamu.edu, Gabriel Hackebeil, Katherine Klise, Carl Laird, William Hart

Water quality can be disrupted by the ingression of contaminants into the water distribution system. An early warning detection system has been proposed as the first method of protection. This must be followed by a cleanup and control strategy to return the distribution system to an operational state. We present large-scale mixed-integer linear program formulations for performing optimal emergency response techniques. The formulations are tested on a network with approximately 13,000 nodes.

4 - Decomposition Strategies in Pyomo for Estimation of a Spatio-temporal Infectious Disease Model
Daniel Word, Texas A&M University, MS 3122, College Station, TX, 77843, United States of America, dword@tamu.edu, Jean-Paul Watson, David Woodruff, Carl Laird

Many real-world parameter estimation problems can be intractably large for general estimation approaches, and to solve these problems alternative solution approaches must be used. Decomposition techniques are one way to formulate these problems in tractable ways. Here, we demonstrate decomposition strategies within the Pyomo modeling framework to estimate transmission parameters for a nonlinear, spatio-temporal infectious disease model.

■ MD04

C - Room 202B

Surrogate-assisted Evolutionary Optimization

Sponsor: Computing Society/Optimization: Surrogate and Derivative-free Optimization(Joint Clusters)

Sponsored Session

Chair: Heping Liu, University of Wisconsin at Madison, 3270 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, hliu235@wisc.edu

1 - Constrained Black-box Optimization Using Evolutionary Algorithms with Radial Basis Function Models
Rommel Regis, Saint Joseph's University, Philadelphia, PA, United States of America, rregis@sju.edu

This talk presents an evolutionary algorithm for constrained optimization problems whose objective and constraint functions are computationally expensive black-box functions. This algorithm builds radial basis function (RBF) surrogate models of the objective and constraint functions and uses these models to identify promising offspring for function evaluations. Numerical results on test problems, including a problem with 124 decision variables and 68 inequality constraints, will be presented.

2 - A Combination Correction Strategy in Surrogate-assisted Evolutionary Optimization

Heping Liu, University of Wisconsin at Madison, 3270 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, hliu235@wisc.edu

In the surrogate-assisted evolutionary optimization, the correction operation is normally needed. This paper develops a combination correction strategy and uses it to improve a surrogate-assisted evolutionary optimization algorithm which is based on Kriging and particle swarm optimization. The empirical analysis shows that the combination correction strategy has obvious advantages and can significantly reduce computational expenses while maintaining the optimization capability of the algorithm.

3 - Evolutionary Algorithms and Agent Modeling to Route Siren Vehicles for Water Infrastructure Security

M. Ehsan Shafiee, Research Assistant, Texas A&M University, 1001 Harvey Rd., Apt. 76, College Station, TX, 77843, United States of America, shafiee@tamu.edu, Emily Zechman

Water distribution infrastructure systems are vulnerable to intentional and accidental contamination events, which threaten public health. To reduce the consequences of contamination events, emergency vehicles are deployed to warn consumers to avoid contact with tap water. A sociotechnical agent-based model captures the dynamics of consumer exposure to contaminant and response to warnings. Evolutionary algorithms are coupled with the agent model to route vehicles for warning consumers.

4 - Sociotechnical Systems Analysis for Utilizing Consumer Complaints for Water Infrastructure Security

Kristen Drake, Research Assistant, North Carolina State University, Campus Box 7908, Raleigh, NC, 27695-7908, United States of America, kristenldrake@hotmail.com, Emily Zechman, M. Ehsan Shafiee

Detecting and identifying contaminants in water distribution systems is a critical step in protecting public health. Complaints about unusual odor and taste of tap water can be used to identify the location and timing characteristics of a contamination event. An agent-based model of consumer exposure and response is coupled with evolutionary algorithms to develop an approach for using consumer complaints to identify the loading signature of contaminant intrusion.

■ MD05

C - Room 203A

Mixed-Integer Optimization Approaches for Inventory Management

Cluster: Tutorials

Invited Session

Chair: Simge Kucukyavuz, Ohio State University, 1971 Neil Avenue, Columbus, OH, United States of America, kucukyavuz.2@osu.edu

1 - Mixed-integer Optimization Approaches for Deterministic and Stochastic Inventory Management

Simge Kucukyavuz, Ohio State University, 1971 Neil Avenue, Columbus, OH, United States of America, kucukyavuz.2@osu.edu

We survey recent mixed-integer programming (MIP) methods for various lot sizing and inventory control problems. We consider problems with dynamic demand, both deterministic and random, over a finite planning horizon. We use polyhedral combinatorics to develop cutting planes or extended formulations to tighten the original MIPs, which prove to be highly effective in solving difficult capacitated multi-echelon multi-item order lot-sizing problems.

■ MD06

C - Room 203B

Bayesian Methods for Global and Simulation Optimization

Cluster: Tutorials

Invited Session

Chair: Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

1 - Bayesian Methods for Global and Simulation Optimization

Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

This tutorial shows how Bayesian statistics can be used to solve large-scale global optimization and simulation optimization problems. The optimization problems considered are non-convex, with noisy and computationally-expensive function evaluations. We discuss well-established techniques for continuous problems, as well as emerging techniques for large discrete problems. We also discuss connections to sequential experimental design, ranking and selection, and optimal learning.

■ MD07

C - Room 204

Multi-class Queueing Models

Sponsor: Applied Probability

Sponsored Session

Chair: Ivo Adan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612 AZ, Netherlands, iadan@tue.nl

1 - An Analytical Approximation for a Closed Fork/Join Network with Multi-station Input Subnetworks

Erkut Sonmez, Assistant Professor, Boston College, 140 Commonwealth Avenue, Fulton Hall, 350D, Carroll School of Management, Chestnut Hill, MA, 02467, United States of America, erkut.sonmez@bc.edu, Alan Scheller-Wolf, Nicola Secomandi

Fork/join stations are used for modeling synchronization between entities, and fork/join queueing networks are natural models for a variety of communication and manufacturing systems. In this paper, we present a simple approximation method to estimate the throughput of a closed queueing network that features a single fork/join station receiving inputs from multi-station subnetworks.

2 - Optimal Control of a Deterministic Multiclass Queuing System Simultaneously Serving Several Queues

Erjen Lefeber, Eindhoven University of Technology, Den Dolech 2, P.O. Box 513, Eindhoven, 5650 MB, Netherlands, A.A.J.Lefeber@tue.nl, Stefan Laemmer

We consider optimally clearing a deterministic single server multiclass queuing system without arrivals. We assume the server can serve several queues simultaneously, each at its own rate, independent of the number of queues being served. We show that the optimal sequence of modes is ordered by rate of cost decrease. However, queues are not necessarily emptied. We propose a dynamic programming approach for solving the problem, which results in a series of problems that can be solved readily.

3 - Strategic Customers in Polling Systems

Vidyadhar Kulkarni, University of North Carolina, Department of Stat. and OR., Chapel Hill, NC, 27599, United States of America, vkulkarn@email.unc.edu, Ivo Adan, Onno Boxma

We consider a polling system with two stations served by a single server in an alternating exhaustive service fashion. Suppose it costs more to wait in the station under service, than in the other station. We analyze the socially and individually optimal routing policy for the customers under three scenarios: no information, partial information (which station is under service), and complete information (also the queue lengths). We assume that the static parameters of the system are known.

4 - A Product Form Solution to a System with Multi-type Jobs and Multi-type Servers

Ivo Adan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612 AZ, Netherlands, iadan@tue.nl

We consider a memoryless service system with multiple servers, and with multiple job types. Service is skill based, so that a server can serve a subset of job types only. Waiting jobs are served on a first come first served basis, while arriving jobs that find several idle servers are assigned to a feasible server randomly. We show that there exist assignment probabilities under which the system has a product form stationary distribution, and obtain explicit expressions for it.

■ MD08

C - Room 205

Hybrid Methods II: Search

Sponsor: Computing Society/ Constraint Programming and Integrated Methods

Sponsored Session

Chair: Louis-Martin Rousseau, École Polytechnique de Montréal, C.P. 6079, Succ. Centre-ville, Montréal, Canada, louis-martin.rousseau@polymtl.ca

1 - A General Nogood-learning Framework for Pseudo-Boolean Multi-valued SAT

Ashish Sabharwal, Researcher, IBM Watson Research Center, 11 Kitchawan Rd, Route 134, Yorktown Heights, NY, 10598, United States of America, ashish.sabharwal@us.ibm.com, Siddhartha Jain, Meinolf Sellmann

We formulate a general framework for pseudo-Boolean multi-valued nogood-learning, generalizing conflict analysis performed by modern SAT solvers and its recent extension for disjunctions of multi-valued variables. This framework can handle more general constraints as well as different domain representations, such as interval domains for bounds consistency in CP and even set variables. Our solver, built upon this framework, works robustly across a number of challenging domains.

2 - Faster Integer Feasibility in MIPs by Branching to Force Change

John Chinneck, Professor, Carleton University, 1125 Colonel By Drive, Ottawa, ON, K1S 5B6, Canada, chinneck@sce.carleton.ca, Jennifer Pryor

Most MIP branching heuristics try to find the branch that has the most impact on the objective function. A different approach is needed when the goal is reaching the first integer-feasible solution quickly. Intuition says that branching to maximize the probability of reaching a feasible solution is best. This is wrong: the most effective strategies branch in the direction that has the least probability of reaching feasibility! This gives rise to the new principle of branching to force change.

3 - Sampling-based Complete Tree Search

Tuomas Sandholm, Professor, Carnegie Mellon University, Pittsburgh, PA, United States of America, sandholm@cs.cmu.edu, John Dickerson

Deciding how to branch in tree search (e.g., IPs and CSPs) is hard, and impacts runtime drastically. We introduce approaches for using random samples of the variable assignment space to guide construction of a tree certificate (some not even using tree search). They repeatedly throw a dart into the space, minimize that dart, and use it to guide what to do next (e.g., adding it as a nogood). Even when used merely as a preprocessor, darts can yield significant speedups and reduce runtime variance.

4 - Semantic Typing of Variables

Tallys Yunes, Assistant Professor, University of Miami, Department of Management Science, Coral Gables, FL, 33124-8237, United States of America, tallys@miami.edu, Andre Cire, John Hooker

A variable in an optimization model typically has a type, such as integer or real. However, that type does not tell whether the variable is the ID of a job, or a production quantity, or something else. That is, variable declarations lack meaning. Some of that meaning may be recovered from the constraints in which the variable appears, but this is often ineffective. We argue that giving specific meaning to variables can be beneficial, and refer to that practice as semantic typing.

■ MD09

C - Room 206A

Pricing and Revenue Management with Consumer Behavior Models

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Hongmin Li, Arizona State University, Department of Supply Chain Management, Tempe, AZ, 85287, United States of America, Hongmin.Li@asu.edu

1 - Markdown Pricing under Uncertain Strategic Customer Behavior

Dan Zhang, University of Colorado, Leeds School of Business, Denver, CO, United States of America, dan.zhang@colorado.edu., Adam Mersereau

We examine the implications of seller ignorance of strategic customer behavior in a two-period markdown pricing setting. In a single-season setting, we develop a robust pricing policy that requires no knowledge of the extent of strategic behavior. However, we show that a seller who adopts an erroneous assumption about strategic customer behavior can experience convergence to suboptimal prices or even spiraling-down to zero revenues over multiple seasons.

2 - Search Engine Marketing: Dynamic Pricing and Advertising for an Online Retailer

Goker Aydin, Associate Professor, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States of America, ayding@indiana.edu, Shanshan Hu, Shengqi Ye

Many online retailers rely on search engine marketing, i.e., paying a search engine to promote the retailer's website. We consider an online retailer that dynamically updates its price as well as its ad spending. We show that the retailer's ability to update its ad spending may have surprising effects on the retailer's optimal pricing. For example, larger inventory levels might lead to higher prices, if such inventory levels also encourage aggressive ad spending.

3 - Customizing Coupons over Time: Balancing the Tradeoff between Learning and Profitability

Paulo Rocha e Oliveira, IESE Business School, Av. Pearson, 21, Barcelona, Spain, paulo@iese.edu, Rene Caldentey

Firms that offer customized coupons must decide to which product(s) the coupon should apply and its value. Knowing customer preferences enhances the ability to design and market the right offer in terms of content and price. In order to learn preferences one must allocate resources in order improve the understanding of the preferences. We apply a learning model to the analysis of the firm's optimization problem to quantify the trade-off between the value of the coupon and the cost of learning.

4 - Tractable Markdown Optimization (MDO) for Multiple Items under Uncertainty

Georgia Perakis, Massachusetts Institute of Technology, Cambridge, MA, United States of America, georgiap@mit.edu, Pavithra Harsha

We study the MDO problem faced by a vendor selling multiple seasonal items with fixed inventory in the presence of business rules and demand learning. We assume a distribution-free notion of demand uncertainty and study the MDO problem under the max-min robust objective. We provide analytical bounds that explore the tradeoff between limited MDs and a large number of optimal MDs and use them to derive approximate closed loop-pricing policies. We further discuss our experimental results.

■ MD10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - Responsive Learning Technologies, Inc. - Online Games to Teach Operations and Supply Chain Management

Sam Wood, President, Responsive Learning Technologies, 4546 El Camino Real, #243, Los Altos, CA, 94022, United States of America, wood@responsive.net

Learn about online competitive exercises that are used in Operations Management courses and Supply Chain Management courses to teach topics like capacity management, lead time management, inventory control, supply chain design and logistics. These games are typically used as graded assignments.

2 - Forio Online Simulations - How to Convert Your Desktop Simulation Into a Sharable Web Simulation Using Forio Simulate

Michael Bean, President, Forio Online Simulations, 333 Bryant Street #370, San Francisco, CA, 94107, United States of America, madams@forio.com

Forio Simulate allows modelers to develop and present simulations on the Web with no programming. During this 45-minute workshop, we will demonstrate how to create web simulations, discuss commonly occurring web simulation design challenges and potential solutions, and show examples of web simulations that have been used by thousands of users. We will also provide a series of guidelines for creating simulations online. Forio Simulate can import models from Any Logic, Excel, Vensim, iThink and other desktop simulation packages.

■ MD11

C - Room 207A

Analysis, Design and Control of Queueing Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Nilay Argon, University of North Carolina, Department of Statistics and Operations, CB 3260, Chapel Hill, NC, 27599, United States of America, nilay@unc.edu

1 - Optimal Control of the N-Network with Impatient Customers, Finite Buffers, and Holding Costs

Hoda Parvin, University of Michigan, Ann Arbor, MI, United States of America, hoda@umich.edu, Mark Van Oyen, Hyun-Soo Ahn

We provide structural properties and an effective heuristic server control policy for a basic flexible queueing network control problem. We treat a two-server "N" network with two classes of impatient customers. We allow heterogeneity of reneging costs, buffer overflow costs, as well as holding costs.

2 - Service Systems with Finite and Heterogeneous Customer Arrivals

Rowan Wang, University of Minnesota, Industrial & Systems Engineering, 111 Church Street SE, Minneapolis, MN, 55455, United States of America, wang1075@umn.edu, Oualid Jouini, Saif Benjaafar

We consider service systems where a finite number of customer arrivals occur over a period of time followed by few or no arrivals for an extended period thereafter. During the period over which arrivals take place, inter-arrival times between consecutive customers can be different and so can be their service times. We characterize analytically various performance measures and describe several insights into the impact of arrival and service heterogeneity.

3 - Control of Queueing Systems with Sequencing Flexibility

Nilay Argon, University of North Carolina, Department of Statistics and Operations, CB 3260, Chapel Hill, NC, 27599, United States of America, nilay@unc.edu

We consider a queueing network where each job needs to go through each station only once. However, the sequence of stations can be flexible. For such a system, we seek optimal dynamic policies that maximize the system throughput. We prove that the policy that gives priority to jobs that are closest to departure maximizes the steady-state throughput under certain conditions. We also show that changing the sequence of stations dynamically can increase the system throughput substantially.

4 - Diffusion Approximations for Some Queueing Systems with Customer Abandonment

Junfei Huang, National University of Singapore, PhD Program, BIZ 2 Building, B2-03, 1 Business Link, Singapore, Singapore, junfeih@gmail.com, Hanqin Zhang

We establish diffusion approximation of the queue length and virtual waiting time processes for many-server queue with a general customer abandonment distribution, either under non-degenerate slowdown (NDS) regime with exponential service times, or under Halfin-Whitt regime with general service times. To get the diffusion approximations, an asymptotic relationship between the customer abandon process and the functional process given by the queueing length is established.

■ MD12

C - Room 207BC

Advances in Simulation Optimization

Sponsor: Computing Society/ Computational Stochastic Optimization

Sponsored Session

Chair: Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, enluzhou@illinois.edu

1 - Simulation-Optimization Framework for Setting Risk Budgets in Financing Institutions

Bex Thomas, Researcher, General Electric Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, thomasb@ge.com, Kete Chalermkraivuth, Srinivas Bollapragada

We present a framework to allocate a company's overall risk appetite into risk budgets for relevant risks. Our framework provides a method to assess risks of the company's various business units, their correlations and allocate economic capital for consistent distribution of risk across these units to meet predefined business goals.

2 - Quasi-Newton Methods for Optimizing Stochastic Simulations

Michael W. Trosset, Professor, Indiana University, Statistics House, 309 N Park Avenue, Bloomington, IN, 47408, United States of America, mtrosset@indiana.edu, Brent S. Castle

We propose an algorithm for stochastic optimization, e.g., for optimizing the parameters of a stochastic simulation, that synthesizes ideas from response surface methodology (local approximations of the objective function by regression experiments, confidence sets for constrained minimizers of quadratics) and numerical optimization (trust regions, secant updates). We describe two variants of the algorithm, discuss relevant convergence theories, and present numerical results.

3 - Nonparametric Multivariate Convex Regression and Value Function Approximation

Lauren Hannah, Duke University, Box 90251, Durham, NC, 27708, United States of America, lh140@duke.edu, David Dunson

Convex regression problems are common in operations research yet current multivariate methods are computationally infeasible. We introduce two new methods for multivariate convex regression, a Bayesian and a frequentist version. We give consistency results and apply the methods to value function approximation for sequential decision problems including response surface estimation, pricing American basket options and inventory management.

■ MD13

C - Room 207D

The Next Frontier of RM Innovation – Merging and Enhancing Pricing and RM Principles and Algorithms

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Evan Brott, Scientist, PROS, 3100 Main Street #900, Houston, TX, 77025, United States of America, ebrott@prospricing.com

1 - Merchandize Group Optimization

Lila Rasekh, Sr. Operations Research Analyst, Walt Disney World, Orlando, FL, United States of America, lila.rasekh@disney.com

Pricing and revenue optimization is becoming an increasingly popular subject in the retail industry. A revenue management system with accurate forecasting and price optimization becomes the competitive advantage in retail industry. It also provides a better tool for managers to act faster in a volatile market. Specifically, this paper presents a unique linear model that is used to maximize the total revenue of merchandises items, based on the forecasted demand and historical price points.

2 - A New Approach to Forecast Priceable Demand

Edward Kambour, Director of Science, PROS Pricing, 3100 Main Street #900, Houston, TX, 77002, United States of America, ekambour@prosrm.com

Historically priceable demand forecasts have been based on historical bookings and availability or historical wins/loss information. In this discussion we will examine a new approach to estimating the willingness to pay that is robust to issues in gathering availability or loss data.

3 - The Many Faces of Predictor Selection

Evan Brott, Scientist, PROS, 3100 Main Street #900, Houston, TX, 77025, United States of America, ebrott@prospricing.com

While a straightforward concept, predictor selection is used in many widely varying forms in various applications. We will briefly present a simple version of the algorithm, and show its use in Customer Segmentation, Win-Rate Forecasting, calculating Seasonal Trends, estimating Elasticity Curves, and conducting Agent-Based Modeling. Direct applications will be shown for the Distribution, Airline, Hotel/Cruise, Retail, and Petroleum industries.

4 - Refining Airline Revenue Management Models to Better Capture Passenger Demand Behavior

Tom Gorin, PROS Pricing, 3100 Main Street, Houston, TX, 77002, United States of America, tgorin@prospricing.com, Darius Walczak

As the airline environment evolved (and continues to evolve), the science of revenue management has adapted to the new challenges and strived to get ever closer to revenue optimality. In this presentation, we examine some of the most recent improvements and advances that have allowed revenue management to increasingly capture passenger demand behavior and get closer to revenue optimality while balancing business constraints.

■ MD14

C - Room 208A

Renewables Integration, Demand Response and Carbon Regulation

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Shmuel Oren, Professor, University of California Berkeley, IEOR Department, 4135 Etcheverry hall, Berkeley, CA, 94720, United States of America, oren@ieor.berkeley.edu

1 - Multi-area Stochastic Unit Commitment for Wind Penetration in a Transmission Constrained Network

Anthony Papavasiliou, University of Callifornia-Berkeley, IEOR Department, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States of America, tonypap@berkeley.edu, Shmuel Oren

We present a two-stage stochastic programming model for committing reserves in systems with large amounts of wind power, transmission constraints and contingencies. We use a scenario selection algorithm inspired by importance sampling for selecting representative multi-area wind production and contingency scenarios, and present a parallel dual decomposition algorithm for solving the resulting stochastic program. We analyze a test model of California with 122 buses, 375 lines and 124 generators.

2 - The Impact of Carbon Cap and Trade Regulation on Congested Electricity Market Equilibrium

Tanachai Limpaitoon, University of California at Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States of America, Limpaitoon@berkeley.edu, Yihsu Chen, Shmuel Oren

This paper develops an equilibrium model of an oligopoly electricity market in conjunction with a cap-and-trade policy to study interactions of demand elasticity, transmission network, market structure, and strategic behavior. We study their potential impacts through a small network test case and a reduced WECC 225-bus model of the California market. The results show that market structure and congestion can have a significant impact on the market performance and the environmental outcomes.

3 - Thermostats for SmartGrid: Models, Benchmarks and Insights

Yong Liang, University of California at Berkeley, 1117 Etcheverry Hall, Berkeley, CA, 94720, United States of America, yongliang@berkeley.edu, Z. Max Shen, David Levine

Dynamic pricing is preferred to flat-rate in the SmartGrid. This preference leads to the exploration of demand response (DR) mechanisms. Since a great portion of electricity is consumed by HVAC activities, this paper studies the performance of three types of thermostats for SmartGrid. We model these thermostats and compare their performance both theoretically and via numerical simulations. We demonstrate the benefits of having smart thermostats and obtain economical insights for policy makers.

4 - Evaluation of CAES Plants under Uncertain Prices Based on Real Options

Dogan Keles, Karlsruhe Institute of Technology (KIT), Hertzstrasse 16, Karlsruhe, Germany, dogan.keles@kit.edu, Wolf Fichtner, Massimo Genoese

A modelling approach based on stochastic methods is introduced to evaluate energy storage plants, considering uncertain market parameters. Electricity prices are simulated with a regime-switching approach. Based on these simulations, the investment in an energy storage plant is evaluated considering the real options value (ROV). A main outcome is that the regime-switching approach delivers appropriate prices for the evaluation. Besides, the consideration of ROV increases the value of the plant.

■ MD15

C - Room 208B

Decision Analysis Society Awards

Sponsor: Decision Analysis

Sponsored Session

Chair: Vicki Bier, Professor, University of Wisconsin, 1513 University Avenue, Madison, WI, 53706, United States of America, bier@engr.wisc.edu

1 - DAS Student Paper Award

Jun Zhuang, University at Buffalo, SUNY, 435 Bell Hall, Buffalo, NY, United States of America, jzhuang@buffalo.edu, Lea Deleris

DAS gives the Student Paper Award annually to the best decision analysis paper by a student author, as judged by a panel of members of the Society. We will recognize the finalists, and the winning paper will be presented.

2 - The Decision Analysis Practice Award

Robert Bordley, Booz-Allen, 101 West Big Beaver Suite #505, Troy, MI, 48085, United States of America, Bordley_robert@bah.com

The Decision Analysis Practice Award is awarded to the best example of decision analysis practice as judged by the decision analysis practice committee. The purpose of the award is to publicize and encourage outstanding applications of decision analysis practice. Of the many quality example of applications submitted to the award committee, three examples of excellent applications were invited to present in the fall informs meeting. The winner of the award was chosen from these finalists.

3 - DAS Publications Award

Gregory Parnell, Distinguished Visiting Professor, United States Air Force Academy, Department of Management, 2354 Fairchild Drive, Suite 6H130, USAF Academy, CO, 80840, United States of America, greg.parnell@gmail.com, James E. Matheson, Ali Abbas

The DAS Publications Award will be presented for the best paper published in 2009. This year's winners are Ali Abbas and James E. Matheson, authors of "Normative Decision Making with Multiattribute Performance Targets," Journal of Multi-Criteria Decision Analysis, vol. 16, no. 3-4, May-August 2009.

4 - Ramsey Medal Award of the Decision Analysis Society

Detlof von Winterfeldt, Director, International Institute for Applied Systems Analysis, Schlossplatz 1, Laxenburg, 2361, Austria, detlof@iiasa.ac.at, Don Kleinmuntz

The Ramsey Medal of the Decision Analysis Society is awarded for distinguished contributions in decision analysis. Distinguished contributions can be internal, such as theoretical and procedural advances in decision analysis, or external, such as developing or spreading decision analysis in new fields. We will introduce the 2011 Ramsey Medal winner, followed by a presentation by the winner. This year's winner is Don Kleinmuntz, President of Strata Decision Technologies. Dr. Kleinmuntz has also held academic positions at the University of Texas, the Massachusetts Institute of Technology, and the University of Illinois.

■ MD16

C - Room 209A

Forestry: Forest Industry Applications

Sponsor: Energy, Natural Resources and the Environment/ Forestry

Sponsored Session

Chair: Marc McDill, Associate Professor, Pennsylvania State University, 310 Forest Resources Bldg, University Park, PA, 16802, United States of America, mem14@psu.edu

1 - Robust Planning of Sawmill Operations

Jorge Vera, Universidad Catolica de Chile, Department of Industrial and System Engineeri, Santiago, Chile, jvera@ing.puc.cl, Pamela Alvarez

Robust Optimization models appear as a promising alternative in the forest industry. Such a model will generate robust solutions which remain valid even when data is uncertain, without incurring a considerable loss in revenue. In this work we consider the planning of sawmill operations, both at a tactical and operational level, using a robust planning model in rolling horizon. We investigate factors affecting robustness and how the degree of robustness can be analyzed in a dynamic fashion.

2 - Market Prices in an Integrated Market for Sawlogs, Pulp Logs and Forest Fuel

Jiehong Kong, Norwegian School of Economics and Business Admin, Helleveien 30, No-5045, Bergen, Norway, jiehong.kong@nhh.no, Mikael Rönnqvist, Mikael Frisk

The use of forest fuel for heating plants has increased. However, in many areas the forest fuel supply is limited and this has led to competition for pulp logs as fuel at heating plants. Pulp logs are more expensive, as compared to forest fuel (e.g. branches and tops), but is more efficient to transport and has a higher energy content. We study a large case in Sweden and develop a model for equilibrium price setting where the supply of different assortments also depends on the market price.

3 - Robust Planning of Inventories at Södra Cell

Mikael Rönnqvist, Professor, NHH, Helleveien 30, Bergen, NO-5045, Norway, Mikael.Ronnqvist@nhh.no, Dick Carlsson, Patrik Flisberg

We study the distribution planning for a major pulp company using their own distribution network. Some customers use SMI (Supplier Managed Inventory) whereas other purchase on the spot market. As the transportation may take 2-15 days, it is important to keep enough inventory at the terminals. We apply a robust optimization planning strategy to plan distribution, including ship routing and inventory levels. The model can recognize many types of uncertainties in demand.

4 - Integrated Strategic Forest Management and Tactical Demand and Production Planning

Sophie DAmours, Laval University, Quebec City, QU, Canada, Sophie.Damours@gmc.ulaval.ca, J. Troncoso, Patrik Flisberg, Andres Weintraub, Mikael Rönnqvist

We study a vertically integrated forest company and develop an integrated planning strategy that is more efficient than a decoupled strategy where several planning problems are solved sequentially. These problems are forest management, harvest planning and transportation, and production planning. The proposed integrated strategy does not require any additional data and can be shown to improve the overall performance by up to 5%. Short term, 1-5 years, performance can be improved by up to 8.5%.

■ MD17

C - Room 209B

Pierskalla Award Finalists

Sponsor: Health Applications

Sponsored Session

Chair: Soroush Saghafian, PhD Candidate, University of Michigan, Ann Arbor, MI, United States of America, soroush@umich.edu

Chair: Wallace Hopp, University of Michigan, 701 Tappan St., Ann Arbor, MI, United States of America, whopp@umich.edu

1 - Optimizing Colonoscopy Screening for Colorectal Cancer Prevention and Surveillance

Fatih Safa Erenay, Assistant Professor, University of Waterloo, 200 University Ave. CPH 4323,, Waterloo ON, Canada, ferenay@uwaterloo.ca

We develop a partially observable Markov decision process model to find the optimal colonoscopy screening policies for colorectal cancer (CRC) prevention and surveillance. Our objective is maximizing total quality-adjusted life years for a particular patient with respect to age, gender, and personal history. We use clinical data in our numerical experiments and find that more frequent colonoscopy screening than the guidelines should be recommended to achieve maximal benefit from CRC screening.

2 - An Evidence-Based Incentive System for Medicare's End-Stage Renal Disease Program

Donald Lee, Yale University, School of Management, New Haven, CT, United States of America, donald.lee@yale.edu, Stefanos Zenios

In anticipation to the Medicare dialysis program's switch to pay-for-process compliance in 2012, we develop an empirical method to estimate the incentive dynamics between Medicare and the dialysis providers. We use our estimates to design a payment system that maximally aligns the providers' incentives with Medicare's. Numerical results suggest that the optimized system can lengthen patient hospital-free lifespan by 2 weeks per patient per year without increasing Medicare expenditures.

3 - Fairness, Efficiency and Flexibility in the Organ Allocation for Kidney Transplantation

Nikolaos Trichakis, Harvard Business School, 15 Harvard Way, Morgan 493, Boston, MA, 02163, United States of America, ntrichakis@hbs.edu, Dimitris Bertsimas, Vivek Farias

We propose a method for designing point systems for the allocation of kidneys to patients on a waitlist. Our method does not presume any fairness principle or priority criterion, but rather offers the flexibility to the designer to make her own selection. We design a point system that is based on the same criteria as the one recently proposed by policymakers, but delivers an 8% increase in extra life years, while preserving the same fairness properties.

4 - Optimal Selection of Screening Assays for Infectious Agents in Donated Blood

Ebru Bish, Associate Professor, Virginia Tech, Department of ISE, 250 Durham Hall, Blacksburg, VA, 24061-0118, United States of America, ebru@vt.edu, Douglas Bish, Ryan Shiguang Xie, Anthony D. Slonim

Blood collection centers are faced with the problem of determining a set of screening tests to administer to donated blood so as to minimize the risk of a transfusion-transmitted infection. However, blood screening tests are imperfectly reliable and the decision-maker is resource-constrained. Our optimization-based approach generates region-specific test composition by explicitly considering the regional infection prevalence rates and test efficacy characteristics.

■ MD18

C - Room 210A

New Trends in Scheduling

Cluster: Scheduling and Project Management

Invited Session

Chair: Lei Lei, Professor, Rutgers University, 94 Rockafeller Road, Piscataway, NJ, 08854, United States of America, llei@business.rutgers.edu

1 - Appointment Scheduling - Structural Properties and Priority Rules

Michael Pinedo, Professor and Chair, New York University, Stern School of Business, 44 West 4th Street, Room 8-59, New York, NY, 10012, United States of America, mpinedo@stern.nyu.edu, Christos Zacharias

We consider a fixed number of timeslots. Customers with different weights have to be assigned to the times slots. Each customer has a probability of not showing up. We analyze priority rules that minimize the total expected waiting cost of the customers, the expected cost of time slots remaining idle and the expected cost of the service provider working overtime.

2 - Throughput Optimization in Dual-Gripper Robotics Cells under a Circular Layout

Kyung Sung Jung, PhD Student, The Unversity of Texas at Dallas/School of Management, 800 W. Campbell Rd, SM30, Richardson, TX, 75083, United States of America, kysung63@utdallas.edu, Chelliah Sriskandarajah, Neil Geismar

Consider the problem of scheduling operations in dual-gripper bufferless robotic cells with circular layout. The cell is designed to produce identical parts under the free-pickup criterion with additive intermachine travel time. The objective is to find a cyclic sequence of robot moves that maximizes the throughput. A polynomial algorithm is provided with 5/3-approximation to optimal k-unit cycle. This study is a stepping stone for researching the complexity status of the corresponding domain.

3 - Production Scheduling with History-dependent Setup Times

Kangbok Lee, Research Associate Professor, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, kangblee@business.rutgers.edu, Lei Lei, Michael Pinedo

We consider a parallel-machine scheduling problem with jobs that require setups. The length of a setup time depends on a number of predecessor jobs. We solve several special cases assuming fixed job sequences, and propose strongly polynomial time algorithms to determine the optimal insertion positions of the major setups in the job sequences.

4 - Multiple Subset Sum with Inclusive Assignment Set Restrictions

Chung-Lun Li, Hong Kong Polytechnic Univ, Hung Hom, Kowloon, Hong Kong - PRC, lgtclli@polyu.edu.hk, Joseph Leung, Hans Kellerer

We study the multiple subset sum problem with inclusive assignment set restrictions, in which the assignment set of one item (i.e., the set of bins that the item may be assigned to) must be either a subset or a superset of the assignment set of another item. We present an efficient 0.6492-approximation algorithm and a PTAS for this problem.

■ MD19

C - Room 210B

Computational Methods in Finance

Sponsor: Financial Services Section

Sponsored Session

Chair: Zhen Liu, Engineering Management & System Engineering, University of Missouri-Rolla, Rolla, MO, 65409, United States of America, zliu@mst.edu

1 - Time Change and Exact Simulation of the SABR Model

Ning Cai, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, ningcai@ust.hk, Nan Chen, Yingda Song

The SABR model enjoys great popularity in the financial industry due to its strong capability of capturing the volatility smiles. However, there exists no analytical solution for the SABR model that can be simulated directly. This paper proposes a method for the exact simulation of the forward price and the volatility under the SABR model, which can be used to generate unbiased estimators for derivative prices. Numerical experiments indicate the method is efficient and simple to implement.

2 - A Series Expansion Method for SABR Model
Nan Chen, Assistant Professor, The Chinese University of Hong Kong, Shatin, Hong Kong, China, nchen@se.cuhk.edu.hk, Ning Cai, Yingda Song

The SABR model draws popularity in the financial industry to model implied volatility skewness and smiles. In this paper we develop a new series expansion method to evaluate vanilla and exotic options on the basis of total volatility-of-volatility scaling, near-Gaussian coordinate transformation and image method.

3 - Portfolio Liquidation with a Nonlinear Temporary Price Impact Function
Jingnan Chen, PhD Student, University of Illinois at Urbana-Champaign, 104 S Mathews Avenue, Urbana, IL, 61801, United States of America, jchen98@illinois.edu, Liming Feng, Jiming Peng

When unwinding a portfolio, one often needs to take permanent and temporary price impact into account. Empirical evidence shows that the temporary price impact function is nonlinear, and the square root function is plausible. In this paper, we present analytical results on optimal portfolio liquidation when the temporary price impact function is a square root function. Our results extend those that have been obtained for linear price impact functions under restrictive assumptions.

4 - Local Discontinuous Galerkin Methods for Option Pricing and Hedging
Zhen Liu, Engineering Management & System Engineering, University of Missouri-Rolla, Rolla, MO, 65409, United States of America, zliu@mst.edu

We present a robust and high-order numerical method for convection-dominated Partial Differential Equations (PDEs) for option pricing to overcome the artificial oscillations from second-order central difference scheme. Delta can be obtained as a by-product of this method.

■ MD20

C - Room 211A

Optimization in Data Mining

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Onur Seref, Assistant Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States of America, seref@vt.edu

1 - Global Optimization for a Piecewise Linear Regression Spline Function
Nadia Martinez, Student, The University of Texas at Arlington, Campus Box 19017, Arlington, TX, 76019, United States of America, nadia.martinezcepeda@mavs.uta.edu, Diana Martinez, Jay Rosenberger, Victoria Chen

This research develops a global optimization method for a Piecewise Linear (PL) version of Multivariate Adaptive Regression Splines (MARS). MARS terms are based on truncated linear functions, where the univariate terms are PL, but the interaction terms are not. To enable use of fast Mixed Integer Linear Programming (MILP) methods, the interaction terms of a MARS model are transformed to PL forms. A MILP model to optimize the MARS function is formulated, and it is solved using branch and bound.

2 - Robust Support Vector Classifiers for Multiple Instance Learning
Mohammad H. Poursaeidi, Ph.D. Candidate, University of Houston, E206 Engineering Bldg. 2, Houston, TX, 77204-4008, United States of America, mpoursaeidi@uh.edu, Erhun Kundakcioglu

We investigate the multiple instance classification problem that can be used for drug activity prediction and image annotation. In order to model a more robust representation of outliers, hard margin loss formulations that minimize the number of misclassified instances are proposed and compared. Medium sized problems can be solved to optimality via our constraint programming formulation. Due to NP-hardness of the problem, we also develop a two-phase heuristic algorithm for larger problems.

3 - L1-norm Principal Component Analysis
Paul Brooks, Assistant Professor, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, United States of America, jpbrooks@vcu.edu, Sapan Jot, Jose Dula

Traditional principal component analysis (PCA) can be viewed as minimizing the sum of L2-norm distances of points to their projections on a subspace. In the interest of increasing resistance to outlier observations, several investigators have introduced the L1-norm in the optimization problem. We describe an L1-norm PCA method that relies on a connection between L1 projection and L1 regression. We present an R package that contains an implementation of three L1-norm PCA methods.

4 - Discrete K-Median Clustering for Time Series Data
Onur Seref, Assistant Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States of America, seref@vt.edu, Art Chaovalitwongse

We propose mathematical programming formulations for solving the discrete k-median clustering problem. We introduce mixed integer programming formulations with arbitrary distance matrices. We develop approximations using an uncoupled bilinear program algorithm and a very fast sequential method. We compare the clustering performance of the exact solution model and the approximations to other clustering methods on simulated random walk, public benchmark, and real life EEG time series data.

■ MD21

C - Room 211B

Nash Games under Uncertainty: Analysis and Algorithms for Computation and Learning

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Uday Shanbhag, University of Illinois, Department of ISE, Urbana, IL, United States of America, udaybag@illinois.edu

1 - Methods for Nash Equilibrium Approximation in Simulation-Based Games
Yevgeniy Vorobeychik, Sandia National Laboratories, 2632 8th Avenue, Oakland, CA, United States of America, eug.vorobey@gmail.com, Michael Wellman

We formalize the notion of simulation-based games and present several algorithms for approximating a player's best response as well as a Nash equilibrium in such games. One of our algorithms is provably convergent (in probability). We study empirically the performance of our algorithms in several canonical auction games, and then apply our methodology to the analysis of equilibrium behavior and mechanism design in keyword auctions.

2 - Learning Equilibria in Constrained Nash-Cournot Games with Misspecified Demand Functions
Hao Jiang, UIUC, 117 TB, 104 S. Mathews Avenue, Urbana, IL, 61801, United States of America, jiang23@illinois.edu, Uday Shanbhag, Sean Meyn

We consider a constrained stochastic Nash-Cournot oligopoly: The demand function is linear, and firms know either its intercept or slope. We introduce a learning process in which firms simultaneously update their profit-maximizing quantities and their beliefs regarding the unknown parameter. We develop best response and gradient response schemes to learn the correct equilibrium and the expected value of the unknown parameter, and benchmark the performance against Tikhonov regularization schemes.

3 - On the Existence of Equilibria in Stochastic Nash Games
Uma Ravat, University of Illinois at Urbana Champaign, Urbana-Champaign, IL, ravat1@illinois.edu, Uday Shanbhag

Analyzing the variational conditions of stochastic Nash games is generally quite challenging. We present a framework for the tractable verification of existence of equilibria of stochastic Nash games; importantly, this avenue does not necessitate the evaluation of an expectation or its derivatives. Extensions to nonsmooth regimes are also presented. The talk concludes with some illustrative example from risk-averse Nash-Cournot games.

■ MD22

C - Room 212A

Algorithms for Nonlinear Optimization

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Frank E. Curtis, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, United States of America, frank.e.curtis@gmail.com

1 - CPLEX' Indefinite QP Solver
Christian Bliek, IBM, 1681 HB2 Route de Dolines, Valbonne, 06560, France, bliek@fr.ibm.com, Philip Starhill

Starting with version 12.3 CPLEX can solve indefinite QP problems. In this talk we will describe the implementation of this new solver and present numerical results.

2 - Unconstrained (Non)smooth Optimization via Adaptive Gradient Sampling

Frank E. Curtis, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, United States of America, frank.e.curtis@gmail.com, Xiaocun Que

Gradient sampling has been developing as a competitor of bundle methods for the solution of nonsmooth optimization problems. In this talk, we present a novel gradient sampling algorithm with a variety of practical enhancements compared to previously proposed approaches. These include an adaptive sampling strategy and the incorporation of variable Hessian matrices. Numerical experiments on nonsmooth and smooth problems are presented.

3 - An Efficient Algorithm for Convex Nonparametric Least Squares

Andy Johnson, Assistant Professor, Texas A&M University, Department of I&SE, College Station, TX, 77843-3131, United States of America, ajohnson@tamu.edu, Chia-Yen Lee

This paper improves the computational performance of the Convex Nonparametric Least Squares (CNLS) in small samples and makes larger problems feasible to solve. An elementary Afriat theorem is used to identify an initial constraint set and adds violated constraints iteratively. A Monte Carlo simulation is performed to evaluate the computational performance of CNLS and multiple variants. In many cases a 20 fold improvement in terms of computational time can be achieved.

■ MD23

C - Room 212B

Joint Session IAC/QSR: European Journal of Operational Research

Cluster: INFORMS International Activities Committee (IAC)-Invited International Journal Sessions/Quality, Statistics and Reliability

Invited Session

Chair: Roman Slowinski, Professor, Poznan University of Technology, Institute of Computing Science, 60-965 Poznan, Poland, roman.slowinski@cs.put.poznan.pl

Co-Chair: Robert Dyson, Warwick Business School, University of Warwick, Gibbet Hill Road, Coventry, United Kingdom, robert.dyson@wbs.ac.uk

Co-Chair: Lorenzo Peccati, Universit‡ Bocconi, Department of Decision Sciences, Via Roentgen, Milano, 20139, Italy, lorenzo.peccati@uni-bocconi.it

1 - Some Facts about the European Journal of Operational Research (EJOR)

Roman Slowinski, Professor, Poznan University of Technology, Institute of Computing Science, 60-965 Poznan, Poland, roman.slowinski@cs.put.poznan.pl

During this presentation, the editors of EJOR will give some characteristics of the journal. They will also explain their approach to evaluation and selection of articles, and will point out topics in which methodological papers, invited reviews and application papers are particularly welcome. Some general questions will be welcome after the presentation. The following three presentations in the session will be done by authors of representative and highly cited papers published recently in EJOR.

2 - Data Envelopment Analysis (DEA) Thirty Years On: A Review

Wade Cook, Professor, York University, Schulich School of Business, Toronto, ON, Canada, wcook@schulich.yorku.ca

This paper provides a sketch of some of the major research thrusts in data envelopment analysis (DEA) over the three decades since the appearance of the seminal work of Charnes, Cooper and Rhodes (1978). Attention is primarily paid to (1) the various models for measuring efficiency, (2) approaches to incorporating restrictions on multipliers, (3) considerations regarding the status of variables, and (4) modeling of data variation.

3 - A Review of the Recent Contribution of Systems Thinking to OR and Management Science

Leroy White, Professor, University of Bristol, Department of Management, 12 Priory Road, Bristol, BS8 4PW, United Kingdom, Leroy.white@bristol.ac.uk

This paper is a review of the contribution that the systems approach or systems thinking has been making more recently, especially to the practice of OR. We have looked at the literature from both a theoretical and an applications orientation. Our overall conclusion is that while systems may not be well established institutionally, in terms of academic departments, it is incredibly healthy in terms of the quantity and variety of its applications.

4 - An Improved Typology of Cutting and Packing Problems

Gerhard Waescher, Professor, Otto-von-Guericke University Magdeburg, P.O. Box 4120, Magdeburg, D-39016, Germany, Gerhard.Waescher@WW.Uni-Magdeburg.DE

In this paper, an improved typology of cutting and packing (C&P) problems is presented, which is partially based on ideas from Dyckhoff (1990), but also introduces new categorization criteria. Furthermore, a new, consistent system of names is suggested for these problem categories. The practicability of the new scheme is demonstrated with respect to the design of a data base of C&P literature and the development of problem generators and benchmark problems in the area.

■ MD24

C - Room 213A

Advances in Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Jean-Philippe Richard, Associate Professor, University of Florida, 303 Weil Hall, Gainesville, United States of America, richard@ise.ufl.edu

1 - Priming the Feasibility Pump

Faramroze Engineer, University of Newcastle, School of Mathematical & Physical Scienc, Callaghan, 2308, Australia, Faramroze.Engineer@newcastle.edu.au, Angelos Tsoukalas, Andrew C. Eberhard, Nastashia L. Boland, Matteo Fischetti, Martin Savelsbergh

The Feasibility Pump (FP) has proved to be an effective method for finding feasible solutions to Mixed-Integer Programming problems. We investigate the benefits of replacing the rounding procedure with a more sophisticated integer line search that efficiently explores a larger set of integer points with the aim of obtaining an integer feasible solution close to an FP iterate. An extensive computational study on 1000+ benchmark instances demonstrates the effectiveness of the proposed approach.

2 - Bilevel Integer Min-Max Optimization Problems

Yen Tang, University of Florida, Gainesville, FL 32611, yentang@ufl.edu, Jean-Philippe Richard, J. Cole Smith

We consider mixed-integer bilevel min-max problems, in which a leader seeks to minimize a follower's maximum objective, and where both the leader and the follower decisions can be restricted to be integer. This talk proposes a new methodology to solve this class of problems by constructing an easily solvable restriction of the follower's problem, and iteratively refining this restriction until the procedure converges to an optimal leader-follower solution.

3 - Lifting in the Node Packing Polyhedron

Todd Easton, Associate Professor, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66503, United States of America, teaston@ksu.edu

This talk presents previously undiscovered induced substructures that are facet defining for the node packing polyhedron. These structures can combine several known structures, e.g. odd holes, wheels, cliques, antiholes, which lead to fractional lifting coefficients.

4 - On Convexification of Posynomial Functions by Mixed Integer Programming

Andriy Shapoval, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, United States of America, ashapoval3@gatech.edu, Eva Lee

Several convexification and underestimation techniques for nonlinear MIPs were proposed in the last decade. Recently, a particular optimization problem for choosing minimal number of variables needed in power transformation for posynomial and signomial terms was addressed. In this work, we consider an MIP with posynomial terms, and develop solution techniques for large-scale instances by analyzing its polyhedral structure with the use of conflict graph and hypergraph theory.

■ MD25

C - Room 213BC

Assortment Planning

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Dorothee Honhon, Assistant Professor, University of Texas at Austin, McCombs School of Business, 1 University Station, Austin, TX, United States of America, dorothee.honhon@mccombs.utexas.edu

1 - Bargaining for an Assortment

H. Sebastian Heese, Indiana University, 1309 E 10th St, Kelley School of Business, Bloomington, IN, 47405, United States of America, hheese@indiana.edu, Goker Aydin

We consider a retailer who must compose an assortment from products that are offered by several different manufacturers. We propose a model in which the retailer engages in simultaneous bilateral negotiations with the individual manufacturers. We characterize the equilibrium assortment and profit allocation, and we explore how the equilibrium depends on manufacturer and product characteristics.

2 - Solving the One-period Assortment and Pricing Problem with Locational Choice Model

Dorothee Honhon, Assistant Professor, University of Texas at Austin, McCombs School of Business, 1 University Station, Austin, TX, United States of America, dorothee.honhon@mccombs.utexas.edu, Aydin Alptekinoglu, Canan Ulu

We study the one-period assortment planning and pricing problem under a locational choice model with a general distribution of customer preferences. We show that, after discretizing the attribute space in a finite number of segments, one can obtain prices and product locations by solving a shortest path problem. We find that a small number of equidistant segments (4 or 5) usually provides a very good solution and obtain some interesting comparative statics.

3 - Joint Product Assortment and Inventory Management Optimization

Argyro Katsifou, PhD candidate, École Polytechnique Fédérale de Lausanne (EPFL), EPFL - TOM Odyssea 4.15, Station 5, Lausanne, 1015, Switzerland, argyro.katsifou@epfl.ch, Ralf Seifert, Jean-Sébastien Tancrez

We study a retailer's joint problem of product assortment planning and inventory management given limited shelf space. The product assortment is composed of 'standard' and less profitable, 'variable' products. The purpose of this strategy is to increase store traffic by attracting heterogeneous classes of customers. We propose an iterative heuristic to find the optimal combined product assortment and the inventory level for each product that maximize retailer's overall profitability.

4 - Mathematical Programming for Integrated Retail Assortment, Pricing, and Inventory Management

Bacel Maddah, American University of Beirut, Bliss Street, Beirut, 1107 2020, Lebanon, bacel.maddah@aub.edu.lb, Ahmed Ghoniem

We study joint pricing, assortment and inventory decisions for a retailer's product line composed of substitutable items. We focus on consumable, fast-moving goods and formulate a nonlinear integer programming model. We then investigate solution methodologies and develop a linearization scheme that greatly enhances the solution efficiency. Effective heuristics which build on the linearized model are developed. These are applicable to large-scale, industry-size problems.

5 - Pricing Structure and Assortment Optimization for a Two-stage Choice Model

Li Zhao, Antai College of Economics and Management, Shanghai Jiao Tong University,, No.535, Fahuazhen Road, Shanghai, 200052, China, zhaoli128@yahoo.com.cn, Xiangyong Li, Peng Tian

We study the pricing structure and assortment optimization problem faced by a profit-maximizing monopolist using a two-stage choice model with consideration effects. Through numerical examples, we investigate the interplay between consumer choice parameters, products attributes, optimal price structure and assortment selection in a dynamic network enviornment.

■ MD26

C - Room 213D

Service Contracting

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Guillaume Roels, Assistant Professor, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90066, United States of America, groels@anderson.ucla.edu

1 - The Dynamics of Collaborative Service Processes

Morvarid Rahmani, PhD Student, University of California-Los Angeles, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, morvarid.rahmani.2013@anderson.ucla.edu, Uday Karmarkar, Guillaume Roels

In this paper, we study where and when collaboration takes place in collaborative projects, and how the dynamics of collaboration are affected by the project deadline, the observability of efforts, and the type of contract. We characterize the structure of equilibrium under three types of contract: revenue sharing, fixed fee, and time and material.

2 - Pricing and Service Performance in Discretionary Services

Raj Rajagopalan, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States of America, srajagop@marshall.usc.edu, Chunyang Tong

In discretionary services, the value or quality derived by a customer from a service depends upon the time the service provider (SP) devotes to the customer and the valuation differs across customers. We identify the optimal pricing scheme and explore the impact of two widely used pricing schemes, time-based billing and fixed fee, on many dimensions of service performance including SP's profitability, demand, utilization, and congestion level.

3 - Collaborative Cost Reduction and Component Procurement under Information Asymmetry

Sang-Hyun Kim, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06511, United States of America, sang.kim@yale.edu, Serguei Netessine

We investigate how information asymmetry and procurement contracting strategies interact to influence the supply chain parties' incentives to collaborate on cost reduction efforts. We consider a number of procurement contracting strategies, and identify conditions under which one contract performs better than others in terms of promoting collaboration. We also find that ex-post efforts to enhance supply chain efficiency may hinder ex-ante collaboration that precedes production.

4 - Outsourcing a Service when the Vendor Chooses the Process Design

Hsiao-Hui Lee, Assistant Professor, University of Hong Kong, Meng Wah Complex, Room 607, Pok Fu Lam, Hong Kong - ROC, hhlee@hku.hk, Edieal Pinker, Robert Shumsky

Consider a client that outsources a service process to a vendor. The process may be operated as either a single level of experts or with two levels of servers, where the first level is a gatekeeper for the second level. We assume that the vendor may choose to operate a one or two-level system. We describe incentive-compatible contracts for the vendor and examine the potential costs to the client of allowing the vendor to make this design decision.

■ MD27

C - Room 214

Empirical Research in Operations and Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Fuqiang Zhang, Professor, Washington University in St. Louis, Operations & Manufacturing Management, St. Louis, MO, United States of America, FZhang22@wustl.edu

1 - Does Inventory Turnover Predict Future Financial Returns?

Yasin Alan, Cornell University, The Johnson School, 201J Sage Hall, Ithaca, NY, 14853, United States of America, ya47@cornell.edu, Vishal Gaur, George Gao

We examine the impact of inventory turnover performance of US publicly-listed retailers on their stock returns. Our analysis controls for the correlation of inventory turnover with other firm-level performance variables discovered in past research, such as gross margin, capital intensity, and sales surprise. We show that inventory turnover has a consistent positive correlation with stock returns and risk adjusted stock returns.

2 - Is Warranty Worth It? Evidence from the Automotive Industry
Serguei Netessine, Professor, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, serguei.netessine@insead.edu, Jose A. Guajardo, Morris A. Cohen

We propose a structural estimation model to analyze the value of warranties in the US automotive industry.

3 - An Empirical Analysis of Online Market Places for Software Development
Christian Terwiesch, University of Pennsylvania, The Wharton School, 3730 Walnut St., Philadelphia, PA, United States of America, terwiesch@wharton.upenn.edu, Antonio Moreno-Garcia, Elena Krasnokutskaya

We empirically study the reputation effects that arise in online service marketplaces, by analyzing a detailed dataset with more than 400,000 bids corresponding to 40,000 projects posted in a leading on-line intermediary for the outsourcing of software development services.

4 - Inventory Write-downs, Sales Growth, and Ordering Policy: An Empirical Investigation
Danko Turcic, Assistant Professor of Operations, Olin Business School, Washington University in St. Louis, Box 1133, St. Louis, MO, United States of America, turcic@wustl.edu, Fuqiang Zhang, Chad Larson

We examine the relationships between sales growth, purchasing policies, and inventory write-downs. We report that extreme sales growth firms are significantly more likely to experience a future inventory write-down than moderately growing firms. We find that, on average, all growing firms purchase more inventory than they sell, i.e., responding to growth, they tend to build up stock. The extreme sales growth firms, however, purchase less inventory than their moderately growing counterparts.

■ MD28

C - Room 215

Queuing Models for Revenue Management

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Laurens Debo, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, United States of America, Laurens.Debo@chicagobooth.edu

1 - Cheap Talk in Queues with Multiple Customer Classes
Gad Allon, Northwestern University, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Achal Bassamboo

We examine the problem of information communication by considering a model in which both the firm and the customers act strategically. In this model, the customers are heterogeneous both with regards to their waiting cost and the value they obtain from the service. The customer type is private information. We characterize the equilibrium language that emerges between the service provider and her customers.

2 - Price Signaling in a Congested Environment
Laurens Debo, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, United States of America, Laurens.Debo@chicagobooth.edu, Senthil Veeraraghavan

We study how prices and queues can be used to signal quality. We show that a high-quality firm can signal quality with a higher price than the low-quality firm. However, high-quality firm leaves one valuable and natural source of information for the consumers un-used: the queue length. We demonstrate the existence of pooling equilibria in which the high and low-quality firm both select the same price. The high-quality firm signals quality with longer queues that naturally emerge.

3 - Revenue Maximization via Service Differentiation in a Queueing System
John Yao, Doctoral student, Columbia University, GSB, 3022 Broadway, New York, NY, 10027, United States of America, jyao14@gsb.columbia.edu, Assaf Zeevi, Costis Maglaras

We study a revenue maximization problem for a firm that offers a service that is subject to congestion to a market of users with different valuations and delay sensitivities. The system is modeled as a multi-server queue. Using a deterministic relaxation, justified via a large scale asymptotic, we highlight the structure of the optimal solution: When and how does the firm offer differentiated services? How does the system capacity impact these decisions and what operating regimes do they induce?

4 - Pricing Time-sensitive Services Based on Realized Performance
Philipp Afeche, University of Toronto, 105 St. George Street, Toronto, ON, M5S3E6, Canada, Philipp.Afeche@Rotman.Utoronto.Ca, Yoav Kerner, Opher Baron

Services such as Fedex charge an upfront fee but reimburse customers if their orders are delayed. In contrast, most studies of congestion pricing restrict attention to the upfront fee but ignore the possibility of subsequent price adjustments based on realized performance. This paper contributes to filling this gap. It studies for a provider who serves multiple classes of time-sensitive customers the optimal design of more general price contracts that also charge based on actual performance.

5 - The underlying Economics Behind Physicians' Test-ordering Behavior in Outpatient Services
Mustafa Akan, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue Posner 381C, Pittsburgh, PA, 15213, United States of America, akan@andrew.cmu.edu, Tinglong Dai, Sridhar Tayur

Motivated by a collaborative study with a major ophthalmology clinic, we study physicians' test-ordering patterns when serving patients covered by insurance. First, we show that setting a low reimbursement ceiling cannot eliminate overtesting. Second, the existence of misdiagnosis risks, along with the insurance effect, can lead to both overtesting and undertesting. Third, with asymmetric information physicians' signaling efforts can lead to more salient overtesting behavior.

■ MD29

C - Room 216A

Credit and Counterparty Risk

Cluster: Quantitative Finance

Invited Session

Chair: Agostino Capponi, Purdue University, 315 N.Grant Street, West Lafayette, IN, 47906, United States of America, capponi@purdue.edu

1 - Decision-based Corporate Default Prediction
Xin Guo, Associate Professor, University of California, Berkeley, Berkeley, CA, United States of America, xinguo@ieor.berkeley.edu, Xingwei Wu

We present a decision-based default prediction framework where we incorporate the forecaster's utility into default classification and derive an optimal decision rule. By combining the forecaster's utility into Support Vector Machines(SVMs), we show that minimizing the utility-adjusted hinge loss align our interest in minimizing utility-adjusted classification loss. Our empirical classification result demonstrates more accuracy and flexibilities in comparison to traditional statistical methods.

2 - Importance Sampling for Event Timing Models
Alexander Shkolnik, Graduate Student, Stanford University, Huang Engineering Center, 475 Via Ortega 053P, Stanford, CA, 94305, United States of America, ads2@stanford.edu, Kay Giesecke

This paper provides an efficient Monte Carlo method for estimating rare-event probabilities in point process models of correlated event timing, which have applications in finance, insurance, reliability, and many other areas. It develops an importance sampling scheme for the tail of the distribution of the total event count at a fixed horizon, and provides conditions on the stochastic intensity of the point process guaranteeing the asymptotic efficiency of this scheme.

3 - Dynamic Portfolio Optimization with a Defaultable Security and Regime Switching
Jose Figueroa-Lopez, Assistant Professor, Purdue University, 250 N. University Street, West Lafayette, IN, 47907, United States of America, figueroa@purdue.edu, Agostino Capponi

We consider a portfolio optimization problem in a defaultable regime-switching market model consisting of a defaultable bond, a stock, and a money market account. We deduce the dynamics of the defaultable bond price process in terms of a Markov modulated SDE and derive Hamilton-Jacobi-Bellman equations for the post- and pre-default optimal value functions. In the case of a logarithmic utility function, we also derive explicit optimal investment strategies.

4 - Counterparty Risk in Multiple Funding Rates Environment
Tomasz Bielecki, Professor, Illinois Institute of Technology, 10 W 32nd Street, E1 Building, Room208, Chicago, IL, 60616, United States of America, bielecki@iit.edu

The talk has been motivated by recent developments in financial markets that brought into the focus of attention the issues of valuation and hedging of financial contracts in presence different funding rates. Our intention is to discuss these issues in a unified, martingale framework. In particular, we discuss the impact that asymmetry in costs of funding and collateralization have on valuation of counterparty risk.

■ MD30

C - Room 216B

Interface of Finance, Operations, and Risk Management

Sponsor: Manufacturing & Service Oper Mgmt/ iFORM SIG

Sponsored Session

Chair: Kevin Shang, Duke University, Fuqua School of Business, Durham, NC, United States of America, khshang@duke.edu

Co-Chair: Volodymyr Babich, Georgetown University, McDonough School of Business, 37th and O St NW, Washington, DC, 20057, United States of America, vob2@georgetown.edu

1 - Lot Sizes in Serial Production Lines with Random Yield and AR Demand

Volodymyr Babich, Georgetown University, McDonough School of Business, 37th and O St NW, Washington, DC, 20057, United States of America, vob2@georgetown.edu, Matthew Sobel

We look for the optimal lot-sizing policy for a make-to-stock serial system with random production yields at each stage, an autoregressive demand process, general convex costs of finished-goods inventory, linear production costs and holding costs for the work-in-process inventory. We prove that the same myopic, simple to compute, policy is optimal for the infinite- and finite-horizon problems with discounted cost criterion and the infinite horizon problem with long-run-average cost criterion.

2 - Integrating Inventory Replenishment and Cash Payment Decisions in Supply Chains

Wei Luo, Duke University, Durham, NC, United States of America, wl54@duke.edu, Kevin Shang

We study a two-stage supply chain in which each location procures inventory based on cash available. We consider different payment schemes and derive joint optimal and near-optimal inventory and payment policies. Our study reveals insights on how firms should manage their working capital in order to achieve the supply chain efficiency. We also characterize the conditions under which supplier or buyer cash subsidy is crucial.

3 - Joint Optimization of Investment in Phase II and III New Drug Development

Zhili Tian, PhD Candidate, Washington University in St. Louis, Campus Box 1133, One Brookings Drive, St. Louis, MO, 63130-4899, United States of America, tianzh@wustl.edu, Panos Kouvelis

Phase 3 clinical study is more expensive than Phase 2 study because an investigation firm tests the drug on much larger sample of patients. If the firm can identify inferior drug in Phase 2, it will avoid investment in such drug in Phase 3. We develop methodologies to jointly optimize the investment in both phases and to determine the sample size for Phase 2 study. The value of the investment in a drug is larger in joint decision making than in independent decision making for Phases 2 and 3.

4 - Capacity Management for Oilseeds Processors

Onur Boyabatli, Assistant Professor, Singapore Management University, 50 Stamford Road 04-01, Singapore, 178899, Singapore, oboyabatli@smu.edu.sg, Dang Quang Nguyen

This paper analyzes the capacity investment portfolio of a processor that uses a single commodity input to produce two products in proportions, one of which is also a commodity. The main motivation comes from palm industry where the input and one of the outputs are commodities and are traded on the spot markets. We investigate the effect of input and output spot price variability, correlation on the optimal capacity investment portfolio and the expected profit of the processor.

■ MD31

C - Room 217A

Radiation Therapy Treatment Planning

Sponsor: Health Applications

Sponsored Session

Chair: Edwin Romeijn, Professor, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, romeijn@umich.edu

1 - Models and Algorithms for IMAT and VMAT Arc Therapy Plan Optimization in Radiation Oncology

Fei Peng, Ph.D. Candidate, University of Michigan, IOE Department, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, feipeng@umich.edu, Marina Epelman, Edwin Romeijn

In contrast with traditional IMRT, an IMAT or VMAT machine delivers radiation in a non-stop fashion while the gantry moves continuously during treatment. IMAT/VMAT machines allow the possibility of delivering high-quality treatments in shorter time than IMRT. However, their complex settings require new classes of models and algorithms to design treatment plans that take advantage of this technology. We propose some exact and heuristic approaches, and present results on real patient data.

2 - Biological IMRT Optimization with Fraction Constraints

Ronald Rardin, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rrardin@uark.edu, Mark Langer, Behlul Saka

Although radiation therapy is typically planned as a single overall treatment, it is delivered over 30-50 sessions or "fractions," and both cumulative and per-fraction dose constraints apply. Tumor hypoxia (low oxygenation) is a biological cause of resistance to radiation quantified by the recent molecular images. We propose an optimization approach that adjusts IMRT plans to the tumor hypoxia while meeting the dose requirements and present our experiments on a realistic head and neck case.

3 - Approximate Inverse Optimization for Intensity-modulated Radiation Therapy Treatment Planning

Timothy Chan, University of Toronto, 5 King's College Rd, Toronto, ON, M5S3G8, Canada, tcychan@mie.utoronto.ca, Taewoo Lee, Tim Craig, Michael Sharpe

We present an inverse optimization approach to determine objective function weights in radiation therapy treatment planning optimization problems. Using a clinical prostate case, we demonstrate that our inversely optimized treatments are comparable to clinical treatments, but can be generated using fewer, more intuitive objective functions and weights. This approach has the potential to streamline the planning process and guide the design of future treatments.

4 - Accounting for the Intrafraction Motion Using the Direct Aperture Optimization Approach

Ehsan Salari, Postdoctoral research fellow, Massachusetts General Hospital and Harvard Medical School, Department of Radiation Oncology, 30 Fruit Street, Boston, MA, 02114, United States of America, esalari@ufl.edu, Edwin Romeijn

IMRT treatment plans are typically delivered in a sequence of daily treatment fractions. Organ motion during a fraction, the so-called intrafraction motion, is a source of uncertainty that may compromise the treatment outcome. To investigate this effect, we model changes in patient geometry as a stochastic process and formulate the aperture modulation problem as a stochatsic Binary Quadratic Programming problem. A branch-and-price algorithm is developed to solve the resulting optimization model.

■ MD32

C - Room 217BC

Revenue Management with Flexible Capacity

Sponsor: Railway Applications

Sponsored Session

Chair: Aihong Wen, Manager, Operations Research, CSX, 500 Water st, Jacksonville, FL, 32202, United States of America, Aihong_Wen@csx.com

1 - An Application of Revenue Management at Con-way Freight

Charlie Rosa, Operations Research Principal Sr, Con-way Freight, 2211 Old Earhart Road Suite 100, Ann Arbor, MI, 48105-2751, United States of America, Rosa.Charles@con-way.com, Eric Bartlett, Brendt Reif

We develop a Revenue Management application that helps find loadplan compliant or near compliant lanes across which freight can be flowed at low cost. We also investigate how these solutions change as we change our use of third party contracted highway subservice.

2 - Yield Management – The Next Advance in Railroad Profitability
Jason Kuehn, Associate Partner, Oliver Wyman, One University Square Drive, Suite 100, Princeton, NJ, 08540, United States of America, Jason.Kuehn@oliverwyman.com

The next logical step for the railroad industry after operations optimization is to maximize the revenue produced by an essentially fixed constrained asset base. Revenue maximization for network transportation requires identifying capacity bottlenecks then strategically allocating this capacity across the various lines of business. This approach can also be a key input into the carrier's capital planning process.

3 - Revenue Management Approaches for Intermodal Freight
Bruce Patty, Vice President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, brucep@veritecsolutions.com, Warren Lieberman

Intermodal Freight has 4 principal components: 1) Railroads that provide capacity on their trains and terminals, 2) Container owners that provide the equipment that is transported, 3) Intermodal Marketing Companies (IMCs) that arrange for transportation on behalf of their customers, and 4) Chassis owners that provide the chassis to transport containers. In this presentation, we explore the Revenue Management opportunities for each of these as well as approaches that have been taken.

4 - Hybrid Forecast and Leg Optimization in Passenger Rail System
Victoria Huynh, Scientist, PROS, 3100 Main Street, Suite #900, Houston, TX, 77002, United States of America, VHuynh@prospricing.com

Many legs are limited by the market and there's simply not enough demand to fill the train, resulting in availability being put to the lowest leg class. However there are customers with higher willingness to pay who would be willing to purchase tickets at the higher leg classes. We will go through hybrid forecast method to determine the amount of demand that will buy down and how that will change the availability accordingly.

■ MD33

C - Room 217D

Panel Discussion: Meet with Journal Editors

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER 240, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

1 - Meet with Journal Editors
Moderator: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER 240, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu, Panelists: Hugh Chipman, Jianjun Shi, Dan Apley

Learn from journal editors about dos and donts in paper submission.

■ MD34

C - Room 218A

Operations Research in Primary Care

Sponsor: Health Applications

Sponsored Session

Chair: Hari Balasubramanian, Assistant Professor, University of Massachusetts, 160 Governors Drive, Amherst, MA, 01003, United States of America, hbalasubraman@ecs.umass.edu

1 - The Impact of Case Mix on Timely Access to Appointments for a Primary Care Physician
Asli Ozen, Graduate Student, University of Massachusetts, Amherst, 160 Governors Drive, Amherst, MA, 01003, United States of America, aslozen@gmail.com, Hari Balasubramanian

Using data from a primary care practice, we show empirically using simulation that not only the panel size but also the case mix plays a crucial role in the appointment burden of physicians. To model case-mix, we categorized patients according to their number of comorbidities (simultaneous chronic conditions) and calculated the overflow by finding the percentage of time when the patients' visit requests exceed the capacity of the physician.

2 - The Impact of Flexibility and Capacity Allocation on the Performance of Primary Care Practices
Xiaoling Gao, Doctoral Student, University of Massachusetts, Amherst, 160 Governors Drive, Amherst, MA, 01003, United States of America, xiaoling@engin.umass.edu, Hari Balasubramanian, Ana Muriel, Liang Wang

We adapt ideas of manufacturing process flexibility to the management of continuity and timely access in primary care practices. Timely access focuses on the ability of a patient to get access to a physician. Continuity refers to building a strong relationship between patient and physician by maximizing patient visits. We develop a two-stage stochastic integer program to investigate optimal capacity allocation for prescheduled and same-day patients, and the value of different flexible policies.

3 - Dynamic Capacity Allocation in Primary Care with Physician Flexibility
Hari Balasubramanian, Assistant Professor, University of Massachusetts, 160 Governors Drive, Amherst, MA, 01003, United States of America, hbalasubraman@ecs.umass.edu, Ana Muriel, Sebastian Biehl

We consider the dynamic allocation of appointment requests to slots in a multi-physician primary care practice. Using a stochastic dynamic program we test the impact of flexibility (the ability of a primary care physician to see patients of other physicians) and report on heuristic allocation strategies.

■ MD35

C - Room 218B

Joint Session QSR/ENRE: Reliability and Optimization in Wind Power Systems

Sponsor: Quality, Statistics and Reliability/Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Eunshin Byon, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48105, United States of America, ebyon@umich.edu

1 - Maintenance Decision-making of Wind Turbine Fleet
Haitao Liao, Assistant Professor, University of Tennessee, 211 Pasqua Building, Knoxville, TN, 37996, United States of America, hliao4@utk.edu, Faranak Fathi, Janet Twomey

Prognostics and timely maintenance of wind turbine components are critical to the continuing operation of a wind farm. To maximize the power generation of the wind farm, limited maintenance resources with uncertainty must be appropriately dealt with based on the current health status of wind turbines. This research addresses a new approach to making maintenance decisions and assigning service parts to wind turbines based on prognostic information.

2 - Assessing Extreme Loads on Wind Turbines by Using In-field Load Measurements
Eunshin Byon, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48105, United States of America, ebyon@umich.edu, Yu Ding, Giwhyun Lee

This study develops a Bayesian parametric model to estimate an extreme load on a wind turbine using limited field data. We devise a systematic procedure to find the extreme load distribution considering stochastic weather conditions and model uncertainties. Bayesian Spline Regression model is used for establishing the relationship between weather characteristics and loads. The proposed method is applied to three different field measurement data sets.

■ MD36

C - Room 219A

Optimization Models in Chronic Disease Treatment

Sponsor: Health Applications

Sponsored Session

Chair: Jennifer Mason, PhD Student, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, 27695, United States of America, jemason2@ncsu.edu

1 - Optimization of Treatment Decision for Blood Glucose Control for Patients with Type 2 Diabetes

Yuanhui Zhang, PhD Student, North Carolina State University, 111 Lampe Drive, Raleigh, NC, 27695, United States of America, yzhang29@ncsu.edu, Jennifer Mason, Brian Denton, Nilay Shah, Steven Smith

The main objective for care of type 2 diabetes is to control the patient's glycated hemoglobin (HbA1c) to reduce the risk of the diabetes complications. Uncertainty in the progression of HbA1c and the treatment effects make treatment decisions challenging. We discuss a Markov decision process to maximize the time a patient's HbA1c is within a clinically defined range. We present structural properties for the model and numerical results comparing the optimal policy to current guidelines.

2 - Prevalence Estimates of Maternal Diabetes in the US

Odette Reifsnider, Clemson University, Clemson, SC, United States of America, osaleeb@clemson.edu, Maria Mayorga, Kelly Hunt

We estimate the prevalence of diabetes during pregnancy among white and black women in the US from 1980 to 2008 using data from the US Census, NHANES, and regional hospital records. Binomial regression techniques are applied to estimate the risk of maternal diabetes. We identify racial/ethnic disparities and find that diabetes prevalence among black women who are pregnant is higher than that of white women.

3 - An Optimal Decision Model for Breast Cancer Patients with Spontaneous Disease Regression

Shengfan Zhang, Assistant Professor, University of Arkansas, Fayetteville, AR, 72701, United States of America, shengfan@uark.edu, Julie Ivy

Some medical evidence has shown that breast cancer may actually resolve spontaneously in the absence of treatment. Under these circumstances a woman may benefit from delaying treatment upon diagnosis and continuing to screen (a variant on watchful waiting). In this research, we develop a model to find the optimal screening and treatment strategies for women upon diagnosis under conditions in which a cancer may resolve on its own.

4 - The Effect of Pipeline Drugs on HIV Treatment

Amin Khademi, PhD student, University of Pittsburgh, 1061 Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15261, United States of America, amk130@pitt.edu, Ronald Scott Braithwaite, Andrew Schaefer

The time to initiate Antiretroviral drugs has been one of the most controversial questions in HIV care. No prior work has considered the new drugs. In fact, new drugs and new classes of drugs have been approved by the FDA recently. Therefore, the effect of pipeline drugs should be considered in policy recommendations in HIV care. We developed a model of the arrival of pipeline drugs, including their mutation and cross-resistance properties and incorporate into a previously validated simulation.

■ MD37

C - Room 219B

Quality Engineering

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Connie Borror, Arizona State University, Glendale, AZ, 85301, United States of America, conni@asu.edu

1 - Case Study: An Application of Logistic Regression in a Six Sigma Project in Health Care

Frank van der Meulen, Delft University of Technology, Delft Institute of Applied Mathematics, Netherlands, f.h.vandermeulen@tudelft.nl, Pieter Willems, Thijs Vermaat

Health care today is facing serious problems: quality of care does not meet patients' needs and costs are exploding. In the cardiology department of the Virga Jesse Hospital in Belgium, discharged patients are advised to participate in a rehabilitation program. However, many of the discharged patients do not join the program, and others quit before being declared cured (a so-called dropout). An improvement project was started that aims to increase revenues by either attracting more patients to the rehabilitation program or reducing the fraction of dropouts. We model the probability that a patient joins the program as a function of various numerical and categorical influence factors. First an exploratory data analysis is performed, using bar charts and box plots. This is followed by a more formal statistical analysis using logistic regression. The logistic regression model reveals the important influence factors. The probability of joining the program depends on whether a patient has a car at his or her disposal and the distance from a patient's home to the hospital. As a solution, various measures to stimulate carpooling were implemented. Prior to the implementation, a cost–benefit analysis was conducted using the fitted regression model.

2 - Screening for Fuel Economy: A Case Study of Supersaturated Designs in Practice

Phil Scinto, The Lubrizol Corporation, Cleveland, OH, United States of America, Phil.Scinto@lubrizol.com, Robert G. Wilkinson, Dennis K. J. Lin

A successful use of supersaturated design and analysis is demonstrated through a case study completed at the Lubrizol Corporation. In the study, a 28-run supersaturated design is used to screen the effects of more than 70 possible model terms (linear effects, quadratic effects, interactions, and measured covariates) on engine motor oil coefficient of friction (COF). Of the over 70 model terms of interest, 50 are two-way linear interactions. A Lubrizol-developed model-averaging technique known as Bayesian variable assessment (BVA) is used to identify the important high-level factors and model terms from the experiment. This study is unique in the literature due to complications in multiple factor levels, physical correlations and constraints on the factors, curvature, and the desire to screen for a large amount of interactions. The test results are subject to common cause variation and unknown special causes such as operator error and test instrument error. Due to time and cost constraints, supersaturated designs are necessary to screen for phenomena such as gasoline-powered engine fuel economy. Based on the results from a 10-run follow-up experiment, the use of the supersaturated design analyzed using BVA is concluded to be a success in this case study.

3 - Mixture-process Experiment Involving Noise Variables in a Split-plot Structure

Tae-Yeon Cho, Arizona State University, AZ, United States of America, Tae-Yeon.Cho@asu.edu, Douglas Montgomery, Connie Borror

When a process involves mixture components, control variables, and noise variables, the size of the design necessary to fully characterize the process can become prohibitively large. In addition, it is not uncommon for a restriction on complete randomization to exist. In this presentation, the mixture-process design experiment with noise variables within a split-plot structure is discussed. We will discuss how, without a proper analysis, the experiment can lead to a suboptimal model resulting in poor prediction. An illustration of the approach to a grinding wheel manufacturing problem will be presented.

■ MD38

H- Johnson Room - 4th Floor

Location Models I

Sponsor: Location Analysis

Sponsored Session

Chair: Hossein Abouee-Mehrizi, University of Waterloo, Department of Management Sciences, Waterloo, ON, Canada, haboueem@uwaterloo.ca

1 - A Production-inventory-Transportation Model with Capacitated Cross-docks and Suppliers

Hossein Abouee-Mehrizi, University of Waterloo, Department of Management Sciences, Waterloo, ON, Canada, haboueem@uwaterloo.ca, Oded Berman

We analyze a production-inventory-transportation system problem where capacitated suppliers and cross-docks are to be established to satisfy the demand of retailers for different products. We consider the pipeline and retailers' inventory together with transportation, facility location and truck capacity costs in determining the optimal number and location of suppliers and cross-docks, allocation of retailers to suppliers, and truck capacity

2 - A Hybrid Solution Approach to Robust Facility Location Problems

Nezir Aydin, Research/Teaching Assistant, Wayne University, 4815 4th St., MEB, Detroit, MI, 48202, United States of America, aydin@wayne.edu, Leslie Monplaisir, Alper Murat

We consider a stochastic two-stage multi-facility location problem with uncertain and independent demand at customer locations. With increasing number of customers and demand realizations, the total number of scenarios increases exponentially and exact methods are not applicable. We introduce a new hybrid approach to solve this type of problems more accurate than Sample Average Approximation (SAA) and more efficient than Progressive Hedging Algorithm (PHA).

3 - A Joint Location-inventory-Transshipment Problem

Oleksandr Shlakhter, Postdoctoral Fellow, Joseph L. Rotman School of Management University of Toronto, 105 St. George Street, Toronto, ON, M4P 1Y8, Canada, alex.shlakhter@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

We consider a location-inventory-transshipment problem in a supply chain which consists of one supplier and multiple retailers. The chain is coordinated through replenishment, customer allocation, and transshipments between retailers. The problem is to determine the locations and replenishment policy of retailers, allocation of customers to retailers and the transshipment policy to minimize the expected average cost. We show that the problem can be solved using a sample-path-based procedure.

■ MD39

H - Morehead Boardroom -3rd Floor

Coordination and Information Management

Sponsor: E-Business

Sponsored Session

Chair: Subodha Kumar, Texas A&M University, Mays Business School, College Station, TX, 77843, United States of America, subodha@tamu.edu

1 - Relationship Retailing Using Online and Store Channels

Amit Mehra, ISB, Indian School of Business, Gachibowli, India, amit_mehra@isb.edu, Jagmohan Raju, Subodha Kumar

We study a multichannel retailer who engages in an extended retail relationship with customers in two channels (store and online). Our analysis focuses on customer channel use behavior and provides insights on pricing strategies and inventory allocation in this integrated retail setting.

2 - Co-production and Co-creation of Value: A Differential Games Approach

Emre Demirezen, Texas A&M University, Mays Business School, College Station, TX, United States of America, edemirezen@mays.tamu.edu, Bala Shetty, Subodha Kumar

In this paper, we study the contracting issues in collaborative services. We assume that the client may get utility from the project throughout the development period. The service output is contingent on the effort level of each party the effort levels are allowed to vary with time. Hence, the client firm needs to optimally decide on the terms to offer in the contract so as to maximize the service output. We analyze the performance of different contracts and glean useful managerial insights.

3 - Lock-in Effects of Recommendation Systems: A Competitive Analysis

Abhijeet Ghoshal, The University of Texas at Dallas, 800 West Campbell Road, 2011, Richardson, TX, 75080, United States of America, abhijeet.ghoshal@utdallas.edu, Vijay Mookerjee, Subodha Kumar

We consider two firms selling similar products, but only the first firm provides recommendations. Since the first firm builds profile based on each purchase, a customer can get better recommendation if it purchases more from the first firm. However, the first firm charges relatively higher price. Hence, we first obtain the demand for each firm by optimizing customer's utility function, and then optimize the price for each firm. Based on our results, we present useful managerial insights.

4 - Analyzing Store-level Inventory Record Inaccuracy

Hao-Chun Chuang, Texas A&M University, Mays Business School, College Station, TX, United States of America, hchuang@mays.tamu.edu, Subodha Kumar, Rogelio Oliva

This paper tackles store-level inventory record inaccuracy (IRI) in the retail sector. We first develop a system dynamics model and estimate the hazard rate to infer inspection efficacy. Then we identify the distribution of IRI and investigate the impact of inspection frequency on error distributions through Monte-Carlo simulation. The forgoing modeling efforts enable us to analytically derive the optimal inspection policy.

■ MD40

H - Walker Room - 4th Floor

Joint Session TMS/NPD: TMS Distinguished Speaker

Sponsor: Technology Management/New Product Development

Sponsored Session

Chair: Janice Carrillo, Associate Professor, Warrington College ot Business Administration, University of Florida, P.O. Box 117169, 355E STZ, Gainesville, FL, 32611-7169, United States of America, jc@ufl.edu

1 - Technology Management Section (TMS) Distinguished Speaker

Linda Argote, David M. Kirr and Barbara A. Kirr Professor, Carnegie Mellon University, 5000 Forbes avenue, Pittsburgh, PA, 15215, United States of America, argote@cmu.edu

Professor Linda Argote will join us this year as the TMS Distinguished Speaker. Professor Argote is the David M. and Barbara A. Kirr Professor of Organizational Behavior and Theory, and also the Director for the Center for Organizational Learning, Innovation and Knowledge at CMU. Professor Argote is an expert in the areas of organizational learning, transactive memory, and knowledge transfer. She will share her insights on these topics with members of the TMS community.

■ MD41

H - Waring Room - 4th Floor

Product Development and Design

Contributed Session

Chair: Niyazi Taneri, PhD Student, University of Cambridge, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, n.taneri@jbs.cam.ac.uk

1 - New Product Introduction Modularity and Sustainability

John Khawam, Naval Postgraduate School, United States of America, jhkhawam@nps.edu, Stefan Spinler

When developing new products, a manufacturer has the ability to introduce products with varying levels of modularity. Modularity affects both the profit and the sustainability of the product. A modular product contains modules that can be removed and replaced. The manufacturer can develop new modules rather than entirely new products. Therefore, customers buying upgraded modules only dispose of a portion of the product, thus reducing the total amount of waste. However, since a customer upgrading a module does not have an entirely new product (they still have the product base from their previous purchase), the value of an upgraded modular product may be less than the value of an entirely new product. Therefore, there may exist a tradeoff between the profits and the sustainability of modular and non-modular products. Our goal is to study these tradeoffs.

2 - A Framework for Proactive Assessment and Management of Complexity in Product Development

Darrell Williams, PhD Candidate, Wayne State University, Detroit, MI, United States of America, darrell_d_williams@yahoo.com, Ratna Chinnam

Today's PD organizations continue to be challenged by complex products employing increasingly sophisticated subsystems, greater functionality, and a higher degree of component interaction. We present a novel approach for quantifying system complexity up front, in order to effectively plan for and align necessary resources for product development. Results from applying the proposed approach in a defense industry project will also be discussed.

3 - A New Customer Choice Model, VMC, for Pricing of the Option Features of a New Product

Hiroshi Kashio, Tokyo Gas Co., Ltd., 1-5-20 Kaigan Minato, Tokyo, 105-8527, Japan, kashio@tokyo-gas.co.jp, Naoki Nishiyama, Yoshitaka Nakamura, Ritsu Nakazaki

We propose a new customer choice model, Value Measurement by Configuration (VMC), for pricing of the option features of a new product. This model improves Conjoint Analysis with regards to the measurement of customer value and the mitigation of survey participants' load. We show how to use it in practice when we make a decision of introducing a new product. In addition, we apply it to household gas heating appliances and examine its effectiveness.

4 - Understanding the Complexities of Medical Device Development
Lourdes A. Medina, Industrial Engineering, The Pennsylvania State University, University Park, PA, lam458@psu.edu, Richard A. Wysk, Gül E. Okudan Kremer

Medical device development (MDD) is a complex area in New Product Development due to the complex nature of these products, multiple stakeholder groups, and the regulatory processes involved. This work addresses these complexities with the development of a conceptual model of the development process and environment, a discussion of main success factors and the identification of relevant Design for X methods, to provide a complete framework for inexperienced developers to follow in MDD endeavors.

5 - The Equity vs. Royalty Dilemma in University Technology Transfer
Niyazi Taneri, PhD Student, University of Cambridge, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, n.taneri@jbs.cam.ac.uk, Nicos Savva

We develop a model, based on asymmetric information, which provides a rational explanation for the persistent use of royalty along equity. Royalties act as a screening tool that allows a less informed principal (technology transfer office) to elicit private information from the more informed spinoffs. The modeling framework also shows that contracts with contingent royalties are far superior to regular royalty contracts. The model generates several findings consistent with empirical observations.

■ MD42

H - Gwynn Room - 4th Floor

IT Outsourcing, Offshoring, and Sourcing Governance

Sponsor: Information Systems Society

Sponsored Session

Chair: Ramanath Subramanyam, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 S. 6th Street, 350 Wohlers Hall, Champaign, IL, 61820, United States of America, rsubrama@illinois.edu

1 - The Role of Organizational Capital and Social Capital in Compensation of India BPO Professionals
Jonathan Whitaker, University of Richmond, 1 Gateway Road, Richmond, VA, 23229, United States of America, jwhitaker@richmond.edu, Sunil Mithas, Violet Ho

While prior IS research has studied the role of Human Capital in compensation of IT professionals, the Organizational Behavior literature suggests that organizational and co-worker factors also contribute to employee performance. We develop theory on the role of Organizational Capital and Social Capital in compensation, and test the theory with archival data on more than 4,000 India BPO professionals.

2 - Moral Hazard and Non-verifiable Quality in Multisourcing IT Services
David Zeng, University of California Irvine, Irvine, CA, United States of America, qzeng04@exchange.uci.edu, Shivendu Shivendu

When quality of services is non-verifiable, providing incentives to reduce moral hazard costs is even more difficult. We study the features of incentive contacts the client may employ to reduce the inefficiencies resulting from moral hazard and non-verifiable quality in the context of multisourcing IT services. We find that the free-rider problem can be solved by the incentive contract that involves group incentives and penalties.

3 - Information Asymmetry in Information Systems Development Efforts
Frank MacCrory, University of California, Irvine, SB 332, Irvine, CA, 92697-3125, United States of America, frank.maccrory@uci.edu, David Fitoussi, Alain Pinsonneault

We develop a production theory for multi-function IS development teams that relaxes the assumption that all members are substitutes or all members are complements. Members within a function are substitutes while different functions are complements. Increasing the number of functions on a team mitigates moral hazard via incentives but reduces the manager's ability to monitor workers directly. We confirm our analytical results with empirical tests of shirking and span-of-control.

4 - Contractual Governance of Innovative IT Sourcing Activities
Ramanath Subramanyam, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 S. 6th Street, 350 Wohlers Hall, Champaign, IL, 61820, United States of America, rsubrama@illinois.edu, Anjana Susarla

Literature on strategy and economics has traditionally focused on the make-versus-buy firm boundary choice despite the proliferation of independent vendor contracts for development of innovative products and services. Here, we characterize IT outsourcing activities along dimensions of effort measurability and nature of solution search. We propose a framework for understanding contract designs, and analyze inter-firm IT services contracts from the field.

■ MD43

H - Suite 402 - 4th Floor

Capacity Expansion

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Ramteen Sioshansi, Assistant Professor, The Ohio State University, Integrated Systems Engineering, 240 Baker Systems, Columbus, OH, 443215, United States of America, sioshansi.1@osu.edu

1 - A Grid Expansion Model of Centralized and Decentralized Electricity Infrastructure Development
Todd Levin, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, todd.levin@gatech.edu, Valerie Thomas

The choice between centralized and decentralized electricity generation is examined for 144 countries as a function of population, transmission cost, and the costs of decentralized and centralized electricity generation. Transmission requirements are developed through a network expansion model that is based on minimum spanning tree algorithms. The economics of centralized and decentralized electrification are analyzed and key factors affecting centralized electrification rates are identified.

2 - Energy Efficiency Contracts between Power Producers and End Users
Seth Borin, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30318, United States of America, sborin3@gatech.edu, Valerie Thomas

An often overlooked alternative to capacity expansion of the electric grid is the use of contracts to promote and enforce efficiency and conservation by end users. These contracts are analyzed in a principal-agent framework for commercial, industrial, and residential users based on minimizing the total cost of providing electricity by regulated power producers. Contracts are first designed independently for each type of end user and then designed simultaneously.

3 - Expansion Planning for Combined Electricity and Natural Gas Systems
Alexey Sorokin, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, sorokin@ufl.edu, Vladimir Boginski, Qipeng (Phil) Zheng

Natural gas is playing an increasingly important role in global energy market because of its environment friendly properties. We consider transmission expansion problem for natural gas and electricity networks, as well as for LNG terminal location planning. The long-term planning horizon introduces an uncertainty in demand for both natural gas and electricity. We employ Conditional Value-at-Risk to account for possible unsatisfied demand due to the lack of transmission capacity.

4 - Long-Term Energy Portfolio Investment with Delayed Entry Decisions
Jianjun Deng, Research Assistant, Missouri University of Science and Technology, 600 W. 14th St., 223 Engineering Management Building, Rolla, MO, 65401, United States of America, jddxc@mst.edu, Scott E. Grasman, Zhen Liu

This paper studies the optimal entry strategies of a firm that has a coal plant and considers introducing a solar plant. The firm's decision includes the optimal entry time of the solar plant, and the optimal dispatch between the two plants with the objective to maximize the expected profit. We formulate the problem as a mixed stochastic control and optimal stopping problem.we solve the original problem numerically and characterize the optimal strategies by numerical experiments.

■ MD44

H - Suite 406 - 4th Floor

From Applying to Thriving: Panel Discussion on Graduate School

Cluster: Undergraduate Operations Research Prize

Invited Session

Chair: David Czerwinski, San Jose State University, 1 Washington Square, San Jose, CA, 95192, United States of America, david.czerwinski@sjsu.edu

1 - A Panel Discussion on Graduate School

Moderator:Kathleen King, Cornell University, 257 Rhodes Hall, Ithaca, NY, 14853, United States of America, kak59@cornell.edu, Panelists: Kris Johnson, Jessica McCoy

In this panel discussion, current graduate students will provide advice on all aspects of graduate school. Topics will include applying to graduate school, getting the most out of your graduate school experience, and succeeding on the job market. Please bring questions.

■ MD45

H - Suite 407 - 4th Floor

Behavioral Market Design

Cluster: Auctions

Invited Session

Chair: Kemal Guler, HP Labs, 1501 Page Mill Rd MS 1040, Palo Alto, CA, United States of America, kemal.guler@hp.com

1 - CDS Auctions

Alexander Gorbenko, Assistant Professor, London Business School, Finance, Regent's Park, London, NW14SA, United Kingdom, agorbenko@london.edu, Igor Makarov, Mikhail Chernov

In this paper we study efficiency of CDS settlement auctions. In our theoretical analysis we identify several sources of inefficiency and suggest ways to mitigate them. In our empirical analysis we find support for our theoretical predictions. When there are more sellers than buyers (a typical situation), the auction undervalues bonds by at least 10% on average. We document a V-shaped underpricing pattern during the days leading to and following the auction day, with a trough on the auction day.

2 - Empirical Analysis of Large-scale Procurement Combinatorial Auctions

Gabriel Weintraub, Columbia University, Columbia Business School, New York, NY, United States of America, gyw2105@columbia.edu, Marcelo Olivares, Sang Won Kim

In this talk we discuss how empirical analysis can inform combinatorial auction design. We describe a reduced-form and a structural estimation approach that can be used to uncover elements of the firms' cost structure and their strategic behavior. The two approaches complement each other and are useful to analyze improvements to the auction design. We apply the methods to the Chilean auction for school meals in which the government procures 1/2 billion dollars worth of meal services every year.

3 - Identification of First-price Auctions with Non-separable Unobserved Heterogeneity

David McAdams, Duke University, 100 Fuqua Drive, Durham, NC, United States of America, mcadams.david@gmail.com

We propose a methodology for identification of first-price auctions with unobserved heterogeneity, when bidders' private values are independent conditional on unobserved product characteristics. We extend the existing literature by allowing the unobserved heterogeneity to be nonseparable from bidders' valuations. Our approach can also be extended to identification given conditionally independent private values, as well as in models with unobserved bidding costs.

4 - Procurement Auctions with Most-favored-customer Clauses

Alper Sen, Assistant Professor, Bilkent University, Department of IE, Ankara, 06800, Turkey, alpersen@bilkent.edu.tr, Hande Yaman, Ece Z. Demirci, Kemal Guler

We study a stochastic optimization model for supplier selection in procurement auctions where some suppliers' conditional offers include most-favored-customer clauses that tie a supplier's discount level to future realization of a random event that can be mutually verified.

■ MD46

H - Suite 403 - 4th Floor

Advances in Statistics Education

Sponsor: INFORM-ED

Sponsored Session

Chair: Richard Forrester, Associate Professor of Mathematics, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States of America, forrestr@dickinson.edu

1 - Teaching a First Statistics Course to Engineering and Mathematics Students from an OR Perspective

David Rader, Rose-Hulman Institute of Technology, 5500 Wabash Avenue, Terre Haute, IN, 47803, United States of America, david.rader@rose-hulman.edu

At Rose-Hulman we teach two distinct flavors of our first statistics course - one for majors that assumes prior knowledge of probability, and one for engineers that assumes nothing more than calculus. This talk discusses some of the atypical topics we cover (e.g., bootstrapping, stationarity) and the effect these courses have on our statistics/operations research major concentration. We'll also discuss this concentration and how the two topics blend nicely for math majors.

2 - Evaluating the Use of Technology Advances in Business Statistics

Michael Gorman, Professor, University of Dayton, School of Business, 2130, 300 College Park, Dayton, OH, 45469, United States of America, Michael.gorman@udayton.edu

This research explores the use of computer technology (specifically Microsoft Excel spreadsheets and the WebCT content delivery and student evaluation mechanism) as enablers of content delivery and as ways to improve pedagogy and learning in Introductory Business Statistics. I compare high technology and low technology methods of delivery.

3 - Recent Trends in the Teaching of Statistical Inference

Richard Forrester, Associate Professor of Mathematics, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States of America, forrestr@dickinson.edu

In this talk we discuss some of major ideas fostered by the statistics education reform movement. This includes emphasize on statistical thinking, the use of real data, and utilizing active learning.

4 - Incorporating Sports Analytics in Introductory Statistics

Kevin Hutson, Furman University, 3300 Poinsett Hwy, Greenville, SC, 29613, United States of America, kevin.hutson@furman.edu

In this talk, we give examples of how to incorporate sports analytics in an introductory statistics course. We also give an overview of the many resources available to instructors who want to use these topics in their courses.

■ MD47

H - Dunn Room - 3rd Floor

Topics in Transportation

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Ronald Askin, Professor and Director, Arizona State University, 699 S. Mill Avenue, Sch Compt Infor & Dec Sys Engr, Tempe, AZ, 85287-8809, United States of America, ron.askin@asu.edu

1 - Integrated Inventory Replenishment and Vehicle Routing

Ronald Askin, Professor and Director, Arizona State University, 699 S. Mill Avenue, Sch Compt Infor & Dec Sys Engr, Tempe, AZ, 85287-8809, United States of America, ron.askin@asu.edu, Mingjun Xia

We consider selecting the optimal order frequency and delivery routes for supplying multiple retailers from a single distribution center. Several VR heuristics are adapted to consider delivery frequency considerations and compared to metaheuristic approaches and a lower bound on total cost of inventory and shipping subject to customer service, vehicle capacity and tour length constraints. A modified sweep heuristic is found to provide good solutions with minimal computational requirement.

2 - A Nuclear Medicine Production and Routing Problem

Byung-In Kim, Associate Professor, POSTECH (Pohang University of Science & Technology), San 31, Hyoja-Dong, Pohang. Kyungbuk, 790-784, Korea, Republic of, bkim@postech.ac.kr, Seongbae Kim

This talk presents a nuclear medicine production and routing problem. Nuclear medicine is used in PET(Position emission tomography) scans for diagnosis, staging, and monitoring treatment of cancers. The unique characteristic of the medicine is its two-hour half-life. After production, its strength is reduced to a half in every two hours and hence production and delivery of orders should be carefully scheduled. A MIP model and a heuristic algorithm are developed for the problem.

3 - Safety Investment and Airline Accidents

Zuozheng Wang, University of Maryland, College Park, MD, United States of America, zuowang@rhsmith.umd.edu, Martin Dresner, Christian Hofer

This study investigated how airlines choose their level of safety investment with tradeoffs between safety and economic efficiency. On one hand, airlines increase safety investment to reduce accident risk. On the other hand, the higher the cost of safety investment, the less the incentive for an airline to implement such risk mitigation. Therefore, in this research, we employ a structural model to estimate the bidirectional influence between safety investment and safety performance. Our results show that if an airline's safety expenses (i.e. total maintenance and training expenditure) per mile increase by 10%, this will decrease by 8.39% its average accident rate. Therefore, if an airline has sufficient information to quantify the negative effect of accidents, it can choose an optimal level of safety investment by balancing the cost of investment and the benefits of lower accident rate.

■ MD48

H - Graham Room - 3rd Floor

Transportation Supernetwork – Subnetwork Analysis

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Chi Xie, Research Associate, University of Texas at Austin, 1 University Station, C1761, Austin, TX, 78759, United States of America, chi.xie@mail.utexas.edu

1 - A Fixed-point Equilibrium Travel Demand Model over Multimodal Transportation Networks

Ti Zhang, Graduate Research Assistant, University of Texas as Austin, 1 University Station C1761, ECJ 6.2, Austin, TX, 78712, United States of America, tizhang@mail.utexas.edu, Chi Xie, Travis Waller

This paper presents an integrated travel demand modeling problem, which is characterized by a closed –form fixed point model. The method of successive averages is adopted for solutions, and the proposed model and solution method is further implemented to study travel demand distribution variations caused by model and data uncertainties.

2 - Dynamic Origin-destination Demand Flow Estimation under Congested Traffic Conditions

Xuesong Zhou, University of Utah, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu, Chung-Cheng Lu, Kuilin Zhang

A single-level nonlinear optimization model is presented to estimate Dynamic OD demand. Using Newell¤s macroscopic kinematic wave traffic flow model, we derive analytical gradient formulas for the link flow, density and travel time change as a function incoming time-dependent path flow rate changes in a general network under traffic congestion conditions.

3 - Transportation Flow Problem with Electric Vehicles

Nan Jiang, University of Texas, Austin, TX, 78701, United States of America, njiang@mail.utexas.edu, Chi Xie, Jennifer Duthie, Travis Waller

The widespread adoption of electric vehicles will inevitably shift traffic congestion patterns due to their different operating cost structure and technological restriction from gasoline vehicles. This talk presents a set of network equilibrium models and methods for predicting traffic network flows with distance-restricted electric vehicles. The scenarios of mixed gasoline and electric vehicular flows and electric vehicular flows with different driving ranges will be extensively discussed.

4 - Application of Network Contraction Methods for Subnetwork Analysis

Steve Boyles, University of Wyoming, 1000 E. University Avenue, Laramie, WY, 82071, United States of America, sboyles@uwyo.edu

Network simplification methods can be used to conduct rapid sensitivity analysis of static traffic assignment problems. This presentation considers its application as a screening tool for network design problems or other applications, and compares the efficiency of various implementation options and algorithm variants.

5 - Subnetwork Origin-Destination Flow Matrix Estimation

Chi Xie, Research Associate, University of Texas at Austin, 1 University Station, C1761, Austin, TX, 78759, United States of America, chi.xie@mail.utexas.edu

This talk presents an elastic O-D flow matrix estimation problem for subnetwork analysis. We proposed a maximum entropy-least squares estimator, by which O-D flows are distributed to maximize the trip distribution entropy while elastic parameters are estimated for achieving the least sum of squared estimation errors. In the Frank-Wolfe solution framework, the solution complexity is greatly reduced by problem transformation and decomposition and column generation.

■ MD49

H - Graves Room - 3rd Floor

Agent-based Simulation of Complex Adaptive Systems

Sponsor: Simulation

Sponsored Session

Chair: Moeed Haghnevis, PhD Student, Arizona State University, 699 S. Mill Avenue, Sch Compt Infor & Dec Sys Engr, Tempe, AZ, 85281, United States of America, mhaghnev@asu.edu

1 - Hierarchical Agent Modeling Framework for Pedestrian-vehicle Interaction at Crosswalks

Hui Xi, Graduate Research Assistant, University of Arizona, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, huix@email.arizona.ed u, Young-Jun Son

Execution of crowd simulation involving each individual as an agent is computationally demanding. To resolve this issue, an aggregation methodology is proposed, where each crosswalk is represented as an agent. Pedestrian counts collected near crosswalks are used to derive the binary choice probability from a utility maximization model. The probability function is utilized to estimate average pedestrian delay with corresponding traffic flow rate and traffic light control at each crosswalk.

2 - Evaluation of Demand Response Program Using Agent-based Model

Huan Zhao, PhD Economics Candidate, Iowa State University, Economics Department, Heady Hall 260, Ames, IA, 50011, United States of America, hzhao@iastate.edu, Abhishek Somani, Leigh Tesfatsion

In energy markets, demand response during periods of high demand alleviates strain on the system and increases system reliability. Conventional demand response programs treat demand response resources as extra energy supply. Price-responsive demand passes real-time cost information to final customers. In this study we build an agent-based model to study and compare the two kinds of demand response programs. The result will shed light on how agents behave under the two different programs.

3 - Large-scale Agent-based Modeling Applications

Charles Macal, Senior Systems Engineer, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439, United States of America, macal@anl.gov, Michael North

Large-scale applications of agent-based models (ABM) are growing rapidly due to the availability of ABM toolkits, micro-data on individuals, and advancing computational capabilities. Large-scale applications have real data on agents and their behaviors, geography and geo-spatial representations, been validated, and provide new kinds of information essential for making decisions. We present some recent ABM applications to consumer goods markets, electric power deregulation, and epidemics.

4 - A Multi-layer Optimization and Agent-based Simulation for a Non-linear Complex Dynamic System

Moeed Haghnevis, PhD Student, Arizona State University, 699 S. Mill Avenue, Sch Compt Infor & Dec Sys Engr, Tempe, AZ, 85281, United States of America, mhaghnev@asu.edu, Ronald Askin, Amit Shinde

In this study, a multi-layer descriptive framework and agent-based modeling approach composed of conceptual behavior and structural entity aspects is developed to calibrate the current structure of the US power complex adaptive system and to predict its dynamic behaviors. Given uncertainties in social responses, prescriptive integrated optimization and agent-based simulation is built and used to evaluate the performance of optimal social policies and encapsulate descriptive paradigms.

■ MD50

H - Ardrey Room - 3rd Floor

Decision Making in Different Contexts

Sponsor: Behavioral Operations Management

Sponsored Session

Chair: Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, c.loch@jbs.cam.ac.uk

1 - Individual Differences in Newsvendors: Prospects and Pains

Neil Bearden, INSEAD, 1 Ayer Rajah Avenue, Singapore, Singapore, neil.bearden@insead.edu

There has been considerable experimental work on ordering decisions in newsvendor settings, and some basic very systematic departures from normative ordering have been documented repeatedly. That said there is also considerable heterogeneity in the ordering behaviour of individual subjects. One natural tendency (on the part of researchers) is to seek to explain this observed variance by assuming, for example, heterogeneity in risk attitudes and preference functions, or by evoking the concept of bounded rationality (which, if examined closely, is just another way of naming variance). We propose another perhaps complimentary route: trying to link the observed ordering behaviour to measurable personality traits that are a bit more psychologically rich such as narcissism, and to measurable affective states. We will show some promising initial results, and also discuss some of the difficulties in doing (persuasive) individual differences work.

2 - Inducing Effort through Problem Specification in Innovation Contests

Sanjiv Erat, Assistant Professor, University of California-San Diego, Rady School, San Diego, CA, United States of America, serat@ucsd.edu, Raul Chao

Innovation contests involve a firm (principal) that poses a problem to a population of searchers (agents). We consider innovation contests occurring in situations where it is costly for the principal to specify their problem. We develop a simple model that explores the relationship between problem specification and search effort, and we test the main insights through a laboratory experiment. Our results highlight a new lever that can be used by firms to induce effort in innovation contests.

3 - Stress on the Ward: How Does Organizational Workload Affect Service Quality?

Stefan Scholtes, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, United Kingdom, s.scholtes@jbs.cam.ac.uk, Ludwig Kuntz, Roman Mennicken

We study the effect of workload variation on professional service quality, such as hospital services. Focusing on (i) the need to ration limited resources, (ii) conscious decisions of autonomous professionals on service composition, and (iii) their subconscious stress responses, we argue that quality improves when workload increases from low levels, but deteriorates, often rapidly, when workload passes a critical tipping point. We test the hypothesis for hospital mortality.

4 - Decentralized Balancing of Complementary Tasks

Enno Siemsen, Assistant Professor, University Minnesota, Carlson School, Minneapolis, MN, United States of America, siems017@umn.edu, Sridhar Balasubramanian, Pradeep Bhardwaj

We analyze how teams with complementary tasks achieve balance. Analytical results suggest that balance in equilibrium can both be achieved through helping or effort adjusting, depending on a comparison between the productivity loss of helping and the productivity gap at the bottleneck. Optimal incentive systems provide stronger incentives for the bottleneck resource. We conduct a behavioral experiment that explores whether there is a trade-off between rationally optimal and fair incentives.

■ MD51

H - Caldwell Room - 3rd Floor

Emergency Evacuation II

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Hong Zheng, Postdoc Researcher, University of Arizona, 1209 E. Second Street, Bldg. 72, Bldg. 72, Tucson, AZ, 85721-0072, United States of America, hzheng@email.arizona.edu

1 - An Efficient Heuristic for Solving the Evacuation Contraflow Design Problem

Mark Hickman, Associate Professor, University of Arizona, 1209 E. Second Street, Bldg. 72, Tucson, AZ, 85721-0072, United States of America, mhickman@email.arizona.edu, Neema Nassir, Hong Zheng

The proposed heuristic finds a close to optimal solution for evacuation contraflow problem very efficiently. It is built on a single-destination, system-optimal DTA model using an efficient network flow approach. The basic idea is to relax the capacity constraints, find the optimal solution to the relaxed problem, and find a feasible solution from the relaxed optimal solution. The model characteristics and an example are illustrated.

2 - Determining Coordinated and Reliable Pre-emergency Evacuation Routes under Uncertain Road Capacity

Lixing Yang, State Key Laboratory of Rail Traffic Control and Safety, Beijing Jiaotong University, Beijing, China, lxyang.utah@gmail.com, Xuesong Zhou

Focusing on a pre-earthquake evacuation route planning application, we present a system-wide least expected time optimization model for finding coordinated reliable evacuation routes for evacuees with multiple origins and destinations. A Lagrangian relaxation approach is proposed for seeking the high-quality solutions subject to stochastic and time-dependent road capacity constraints.

3 - Heuristic Algorithm for the Earliest Arrival Flow Problem with Multiple Sources

Hong Zheng, Postdoc Researcher, University of Arizona, 1209 E. Second Street, Bldg. 72, Bldg. 72, Tucson, AZ, 85721-0072, United States of America, hzheng@email.arizona.edu, Pitu Mirchandani, Yi-Chang Chiu

In this talk we present a new heuristic algorithm for the multi-source earliest arrival flow problem. The main body of the algorithm consists of a series of earliest arrival s-t flow computations, via solving the shortest paths repeatedly. As an application, the algorithm can be used to solve the CTM model based system optimal dynamic traffic assignment problem efficiently.

■ MD52

H - North Carolina - 3rd Floor

SpORts (Sports Analytics) III

Sponsor: SpORts (Sports Analytics)

Sponsored Session

Chair: Joel Oberstone, Professor, Business Analytics, University of San Francisco, School of Management, Department of Analytics & Technology, 2130 Fulton Street, Malloy Hall 219, San Francisco, CA, 94117, United States of America, joel@usfca.edu

1 - Using Sports Examples to Illustrate Concepts in Modeling and Mathematical Programming

James Cochran, Bank of Ruston Barnes, Thompson, & Thurmon Endowed Research Professor, Louisiana Tech University, College of Business, Ruston, LA, 71272, United States of America, jcochran@cab.latech.edu

Several authors have reported on the effectiveness of sports examples in engaging students in opera-tions research/management science courses. However, while sports examples are frequently cited in mathematical programming courses, these exam-ples often deal with problems that occur in sched-uling of leagues and tournaments. In this presenta-tion, which will focus primarily on developing stu-dents' modeling skills and understanding of dis-crete and nonlinear optimization, we attempt to expand the range of mathematical programming examples for classroom use by featuring alterna-tives from a variety of sports (which will, of course, include baseball).

2 - Shooting for the Top Spot: Exploring the Use of NBA Combine Data to Predict Draft Position

Michael Crotty, Research Statistician, SAS Institute, Cary, NC, United States of America, Michael.Crotty@jmp.com, Clay Barker

Each summer, the National Basketball Association (NBA) drafts sixty college and international players into the league. The teams draft sequentially, so it is crucial to choose the "best" player among the remaining players. The NBA combine is an event held before the draft that measures physical and athletic ability attributes of each player. Based on these measurements and college or international performance, NBA teams choose the player that they expect to make the greatest contribution to their team. The data from the combine are often cited during pre-draft analysis and predictions, but what effect, if any, do the combine measurements have on player selection? Using a combination of variable selection and data mining techniques, we will determine which factors impact draft position and we will attempt to predict the 2011 NBA draft.

3 - Using Statistical Analysis to Replace the Impressions and Notions of Expert Opinion

Joel Oberstone, Professor, Business Analytics, University of San Francisco, School of Management, Department of Analytics & Technology, 2130 Fulton Street, Malloy Hall 219, San Francisco, CA, 94117, United States of America, joel@usfca.edu

The use of "statistics" in European football analysis, much more often than not, is limited to the representation of performance, such as goals scored, or shot attempts, or number of passes, or the percent of shots on goal. In turn, these statisticsódescriptive statisticsóare then used to support impressions or notions of the "analyst." Rarely is there an attempt to consider what the numbers mean in terms of basic principals of probability so that the validity of the findings can be statistically assessed. This paper demonstrates how the impressions used to make such comparisons can be re-placed with statistical testing methods that elevate the numbers beyond merely opinion to a level of inferentially supportable findings.

■ MD53

H - South Carolina - 3rd Floor

Data Mining and Machine Learning

Sponsor: Data Mining

Sponsored Session

Chair: Cynthia Rudin, Assistant Professor of Statistics, Massachusetts Insititute of Technology, Sloan School of Management, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rudin@mit.edu

1 - Orthogonalizing Penalized Regression

Peter Qian, Associate Professor, University of Wisconsin-Madison, Department of Statistics, 1300 University Avenue, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

Finding a solution of the likelihood function with the smoothly clipped absolute deviation penalty is an open problem in machine learning. We propose a new algorithm, called the OEM algorithm, to fill this gap. It draws impetus from a missing-data problem in design of experiments. By using a procedure called active orthogonization, the algorithm applies broadly to problems with arbitrary regression matrices. It also works for other penalties like the MCP, lasso and nonnegative garrote.

2 - Adaptive Pain Management

Victoria Chen, Professor, The University of Texas at Arlington, Arlington, TX, 76019, United States of America, vchen@uta.edu, Ching-Feng Lin, Robert Gatchel

The Eugene McDermott Center for Pain Management at the University of Texas Southwestern Medical Center at Dallas conducts a two-stage interdisciplinary pain management program that considers a wide variety of treatments. We structure a decision-making process using dynamic programming to generate adaptive treatment strategies for this two-stage program. State transition models were derived using data from the two-stage pain management program.

3 - A Hierarchical Rule Mining Approach for Sequential Medical Symptom Prediction

Cynthia Rudin, Assistant Professor of Statistics, Massachusetts Insititute of Technology, Sloan School of Management, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rudin@mit.edu, Tyler McCormick, David Madigan

The Hierarchical Association Rule Model (HARM) predicts a patient's possible future symptoms given the patient's current and past history of symptoms. The core of HARM is a Bayesian hierarchical model for selecting predictive association rules (symptom1 & symptom2 -> symptom3). This method "borrows strength" using symptoms of many similar patients, so it is able to provide predictions specialized to any given patient, even when little information about the patient's history is available.

4 - Spatiotemporal Healthcare Surveillance Methods in Non-homogeneous Population

Sung Won Han, Researcher, University of Pennsylvania, 423 Guardian Dr, Philadelphia, PA, United States of America, hansungw@mail.med.upenn.edu, Lianjie Shu, Kwok-Leung Tsui, Wei Jiang

Motivated by the applications in healthcare surveillance, this presentation discusses the spatiotemporal surveillance problem of detecting the mean change of Poisson count data in non-homogeneous population environment. Through Monte Carlo simulations, we investigate several likelihood ratio-based approaches and compare them under various scenarios depending on the factors such as the population trend, the change magnitude, the change coverage, and the change time.

■ MD54

H - Charlotte Hall - 3rd Floor

Daniel H. Wagner Prize for Excellence in Operations Research

Cluster: The Daniel H. Wagner Prize for Excellence in Operations Research

Invited Session

Chair: Allen Butler, Daniel H Wagner Associates, 2 Eaton Street Suite 500, Hampton, VA, 23669, United States of America, Allen.Butler@va.wagner.com

1 - Integrated Planning and Scheduling in a Complex Automotive Manufacturing Environment

Ada Y. Barlatt, University of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, abarlatt@uwaterloo.ca, Amy Cohn, Oleg Gusikhin, Yakov Fradkin, Rich Davidson, John Batey

Nontrivial setup times and interdependent resource constraints make planning of a stamping plant a difficult task, not amenable to a traditional MILP model. We present novel models and algorithms for solving the underlying large-scale workforce planning and production scheduling problem. Ford Motor Company implemented the integrated decision support, supply chain data visualization and optimization tool, leading to significant reductions in premium freight, overtime and inventory costs.

2 - Designing Guest Flow and Operations Logistics for the Dolphin Tales

Eva Lee, Professor & Director, Georgia Insitute of Technology, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu, Chien-Hung Chen

Effective strategies for managing guest flow are imperative for the successful operations of tourist attractions. The Georgia Aquarium and Georgia Tech team worked together to prepare for the 2011 grand opening of a new exhibit, the Dolphin Tales. The team aimed to explore critical issues including 1) Understand current guest flow and behavior patterns (choice/selection patterns). 2) Predict new exhibit flow and impact to surrounding areas and overall guest flow. 3) Optimize operations and logistics, and resource allocation. 4) Determine optimal scheduling, loading, unloading, and exit strategies. And 5) Investigate smart space usage. In this talk, we present novel modeling and computational advances that offer solutions to the new exhibit operations.

■ MD55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS: OR in Roundtable Companies

Sponsor: Analytics/New Product Development

Sponsored Session

Chair: Olga Raskina, Operations Research Principal, Con-way Freight, 2211 Old Earhart Road, Ann Arbor, MI, United States of America, Raskina.Olga@con-way.com

1 - Troubleshooting Business Analytics

Brendt Reif, Director Operations Research, Con-way Freight, 2211 Old Earhart Road Suite 100, Ann Arbor, MI, 48105-2751, United States of America, Reif.Brendt@con-way.com, Eric Bartlett

Solutions to business problems are not always adopted because of conflict between the data, analysis, and/or business intuition. Trouble shooting the disagreement is not easy as multiple stakeholders defend their territories. It is important when evaluating a solution that all areas are called into question and fully understood. Only after there is agreement on the business intuition, data, and analysis will a solution have a realistic chance of being adopted and implemented.

2 - Developing and Delivering OR at Sasol
Michele Fisher, Principal Operations Researcher, Sasol Technology (Pty) Ltd, 1 Klasie Havenga, Sasolburg, 1947, South Africa, michele.fisher@sasol.com, Marlize Meyer

Building an OR capability in a company is challenging and rewarding. Base that company in South Africa and flexibility and creativity are key. Sasol's OR team has grown from one analyst to over 30 internationally recognized experts in 15 years. The petrochemical company now relies on OR to analyze logistics, simulate plants, improve reliability, model processes and optimize performance. We will describe how we apply advanced analytics to improve decision making and impact Sasol's bottom-line.

3 - Managing Operational Complexity through Lean and Advanced Analytics
Stefan Karisch, Director OR and Optimization, Jeppesen, 55 Inverness Drive East, Englewood, CO, 80112, United States of America, Stefan.Karisch@jeppesen.com

For more than 75 years Jeppesen has made it possible for pilots and their passengers to safely and efficiently reach their destinations. In 1997, the company saw its service deteriorate as a growing line of over 100,000 aviation charts overwhelmed its production system. Jeppesen responded by applying OR to manage the growing complexity of its operations. I will review how the OR department has applied a wide variety of analytical methods to improve operations and to support decision making.

■ MD56

H - Biltmore Boardroom - 2nd Floor

Nurse and Patient Scheduling

Contributed Session

Chair: Daisuke Nagai, Waseda University, 3-4-1 Okubo, Shinjuku-ku, Tokyo, 169-8555, Japan, daisuke-n@asagi.waseda.jp

1 - A Stochastic Integer Programming Approach to Chemotherapy Scheduling
Michelle McGaha, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, michelle.mcgaha@neo.tamu.edu, Lewis Ntaimo, Tanisha Cotton, Eduardo Perez

Scheduling of chemotherapy treatments is a difficult task due to limited resources, the cyclic nature of the prescribed treatment regimen, variability of treatment lengths, and patient acuity levels. We propose a stochastic integer programming model to optimize the scheduling process to minimize the expected deviation from prescribed start dates while providing the patient with advance notification of their appointment schedule and maintaining balanced nurse workloads.

2 - Chemotherapy Nurse Staffing and Patient Scheduling
Ayten Turkcan, Northeastern University, 360 Huntington Avenue, Boston, United States of America, a.turkcan@neu.edu

In this study, we propose optimization-based nurse staffing and patient scheduling methods based on acuity levels. The objectives are balancing workload, satisfying patient preferences, and minimizing overtime. We compare the performance of sequential and simultaneous approaches for nurse assignment and patient scheduling in terms of staffing and overtime costs.

3 - Scheduling Oncology Patients Using a Mean-Risk Stochastic Programming Approach
Tanisha Cotton, PhD Candidate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, tanbgreen05@neo.tamu.edu, Lewis Ntaimo, Eduardo Perez, Michelle McGaha

Scheduling chemotherapy patients and limited resources in outpatient oncology clinics is challenging due to the cyclic nature and variability of treatment regimens, and uncertainty in patient response to treatment. We present a mean-risk two-stage stochastic programming methodology for scheduling patients. In this methodology patient appointments are assigned in the first stage, while resource (nurses, chairs) workload balancing is done in the second stage based on future uncertainty.

4 - Appropriate Nurse's Staffing Including Admission and Discharge of Patient and Capacity of Nurse
Daisuke Nagai, Waseda University, 3-4-1 Okubo, Shinjuku-ku, Tokyo, 169-8555, Japan, daisuke-n@asagi.waseda.jp, Hiroto Suzuki, Takahiro Ohno

This paper proposes a system for appropriate nurse's staffing, including admission and discharge of patient and capacity of nurse. First, we model patient's admission and discharge as stochastic events and estimate nursing workload using regression model. Then, using the availability of the nursing service, we calculate the number of nurse appropriate to nurse's capacity. Therefore, this system allows a nursing supervisor to equalize workload per nurse and decide appropriate nurse's staffing.

■ MD57

W - Providence I- Lobby Level

Modeling and Computational Advancements of Aviation Applications

Sponsor: Aviation Applications

Sponsored Session

Chair: Jon Petersen, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, Petersen@gatech.edu

1 - On the Strengthening of Benders Cuts
Jon Petersen, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, Petersen@gatech.edu, Ellis Johnson, John-Paul Clarke

Several aviation optimization modules require the integration of multiple problems. In many instances Benders cuts serve as an important feedback mechanism that are essential for integration. While computationally tractable, Benders decomposition may exhibit slow convergence. We discuss how the main algorithm may be accelerated through various procedures to strengthen the cuts and show results validating our procedure.

2 - New Methods for Stochastic Scheduling of Runway Operations
Gustaf Sölveling, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332-0205, United States of America, gustaf.solveling@gatech.edu, Ellis Johnson, Senay Solak, John-Paul Clarke

We present the stochastic version of the airport runway scheduling problem for single and multiple runways. We solve the problem by incorporating a deterministic scheduling model into the stochastic branch and bound algorithm. For practical validity it is important that the resulting algorithm solves fast. We explore several methods to increase the number of iterations in a given time horizon, which improves the solution quality in this sampling based framework.

3 - Performance Improvement on Column Generation Applied to Tail Assignment Problem
Dong Liang, Sr. Operations Research Analyst, Sabre Airline Solutions, 3150 Sabre Drive, Southlake, TX, 76092, United States of America, dong.liang@sabre.com, Ashwin Naik, Sureshan Karichery, Peng Duan

Tail assignment problem is to assign specific aircraft to flights with the restriction of operational constraints, while minimizing the total cost. Generally, column generation approach is utilized in order to solve large scale instances. In this presentation, we discuss techniques used for improving the performance of column generation applied to tail assignment problem.

4 - A Study of Capacity and Conflict Resolution for a Hexagonal Airspace
Clayton Tino, Doctoral Student, Georgia Institute of Technology, Guggenheim School of Aerospace Engineer, Atlanta, GA, United States of America, clayton.tino@gatech.edu

Growth in airline traffic loads continue to strain the capacity limits of the national airspace system (NAS), particularly in terms of controller workload. Currently, en-route air traffic control sectors are defined ad-hoc to accommodate both traffic volume and sociopolitical requirements. The result is a sector-specific control system optimized to solve immediate needs at the expense of both capacity and controller interchangeability. This paper explores the notion that by restructuring individual en-route sectors into interchangeable hexagons with fixed traffic patterns, it is possible to both improve the capacity performance of the NAS and introduce a minimal set of control procedures, thus reducing controller workload.

■ MD58

W - Providence II - Lobby Level

Social Network Analysis in National Security Studies

Sponsor: Military Applications Society

Sponsored Session

Chair: Dick Deckro, Professor of Operations Research, Air Force Institute of Technology, AFIT/ENS; Bldg 641, 2950 Hobson Way, Wrright-Patterson AFB, OH, 45433, United States of America, richard.deckro@afit.edu

1 - A Likelihood Approach to Determining the Significance of Detected Clusters in Network Data

Marcus Perry, University of Alabama, Box 870226, Tuscaloosa, AL, United States of America, mperry@cba.ua.edu

Network clustering algorithms detect clusters. A growing body of research exists to guide the user in determining the correct number of groups. An equally important problem, though, is determining if the output of these clustering algorithms is simply the result of randomness associated with the stochastic process that produced the network under consideration. This work proposes a likelihood-ratio test for performing formal hypothesis testing on the output of any network-clustering algorithm.

2 - Evaluating the Reliability of Multi-state Social Network under Conditional Influence

Kellie Schneider, University of Arkansas, Fayetteville, AR, 72701, United States of America, kellie@uark.edu, Chase Rainwater, Edward Pohl

In this work, we consider a social network in which the level of influence provided by an actor is a function of the influence levels received from preceding actors in the network. Both explicit enumeration and Monte-Carlo simulation are used to evaluate the reliability of the multi-state social network.

3 - Imperfect Data in Social Network Analysis

James Morris, Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 455433, United States of America, james.morris@afit.edu, Dick Deckro

Difficulties in collecting accurate data depicting actors' involvement and interactions inevitably generate social network models containing imperfect information. Missing, inaccurate, and extraneous data can stem as an artifact of the data collection technique or as a consequence from the information sources. In this preliminary investigation, questions of impact and potential mitigating approaches are discussed.

4 - Covert Network Disruption

Susan Martonosi, Assistant Professor, Harvey Mudd College, Claremont, CA, 91711, United States of America, martonosi@hmc.edu

We examine network flow centrality as a metric for visibility and network participation. Given a covert social network, we seek vertices whose removal from the network maximizes the visibility of a clandestine individual. We present graph-theoretic and computational techniques for network disruption on the basis of this metric. We demonstrate its application in the context of drug interdiction networks.

■ MD59

W - Providence III - Lobby Level

IT Service Management

Sponsor: Service Science

Sponsored Session

Chair: Kush Varshney, IBM Thomas J Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, krvarshn@us.ibm.com

1 - Classification of IT Service Tickets for Defect Prevention

Kush Varshney, IBM Thomas J Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, krvarshn@us.ibm.com, Aleksandra Mojsilovic, Dongping Fang, Aliza Heching, Moninder Singh

At information technology outsourcing providers, quality analysts label service tickets into categories to analyze and prevent frequently occurring defects at client installations. We develop automatic labeling methods to increase the productivity of quality analysts and service teams that support different products, clients, and geographies.

2 - The Role and Implementation Methodology of IT Service Management in post-ERP Adoption Stage

Ye Fu, Associate Professor, Fudan University, 670 Guoshun Rd., Shanghai, 200433, China, fuye@fudan.edu.cn

This article investigates 95 firms which are in the first 2 years in post ERP-adoption stage, and find that the communication channel between IT department and end users, formality of IT service process, availability and stability of IT infratrsucture have significant influence on ERP performance. It means that a successful ERP project requests both BPR and ITSM. By a survey of 23 firms, this article then uses AHP analysis to study the implementation methdology of ITSM.

3 - Dual Channel Coordination Based on Different Service Structure in Software-as-a-Service

Haiqing Hu, Nan Kai University, Business School, No.94,Weijin Road,Nankai District, Tianjin, China, huhaiqing_2008@yahoo.com.cn, Jianyuan Yan

Software-as-a-Service realizes the transformation from product to Service through put the software into 'clouds'. We separate service from commercial interchange, form three service patterns including the independent service pattern, retailers in charge of service pattern and the manufacture in charge of service pattern, and research the coordination contract between manufacture and retailer in vertical and horizontal dimension.

■ MD60

W - College Room - 2nd Floor

Combinatorial Optimization Techniques for Generalizations of Clique

Sponsor: Optimization/Networks

Sponsored Session

Chair: Illya Hicks, Associate Professor, Rice University, Houston, TX, United States of America, ivhicks@rice.edu

1 - New Polyhedral Results for the 2-club Polytope of Graphs

Foad Mahdavi Pajouh, Oklahoma State University, Industrial Engineering & Management, Stillwater, OK, 74078, United States of America, mahdavi@okstate.edu, Balabhaskar Balasundaram, Illya Hicks

Clique relaxations are used to model clusters in social networks, biological networks and internet graphs. A k-club is an induced subgraph of diameter at most k. This defines a clique for k=1 and is a clique relaxation for k>1. This talk will outline the research challenges that differentiate this model from the classical clique via relevant complexity results. New theoretical results concerning the 2-club polytope and preliminary numerical results will be presented.

2 - Maximum co-k-plexes and an Application in Genetics

Benjamin McClosky, Research Scientist, Nature Source Genetics, 33 Thornwood Drive, Suite 300, Ithaca, NY, 14850, United States of America, BMcClosky@naturesourcegenetics.com

Seidman and Foster introduced co-k-plexes as a degree-based stable set relaxation. We present some new complexity and polyhedral results for the maximum co-k-plex problem. We also discuss a novel application of co-k-plexes in genetics.

3 - Decomposition of betweenness Computation in Graph Clustering

Yiming Yao, Lawrence Livermore National Lab, 7000 East Avenue, Livermore, CA, 94550, United States of America, yao3@llnl.gov

Betweenness centrality, which has long been a valuable measure in social network analysis, has recently been applied to the effective identification of node clusters or communities in graphs. We present a decomposition approach for computing edge betweenness that is highly efficient for many sparse graphs.

■ MD63

W - Tryon North - 2nd Floor

Evolutionary Multi-Objective Optimization 3

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Emily Zechman, Assistant Professor, Texas A&M University, 3136 TAMU, 205M WERC, College Station, TX, 77843-3136, United States of America, ezechman@civil.tamu.edu

1 - A Need for Multiple Criteria Evolutionary Computation in Uncertainty Analysis

Ken Harrison, Assistant Research Scientist, UMD ESSIC / NASA GSFC, Mail Code 614.3, 8800 Greenbelt Rd, Greenbelt, MD, 20771, United States of America, ken.harrison@nasa.gov, Sujay Kumar

Monte Carlo algorithms for Bayesian analysis are designed to yield samples of model parameter values reflective of underlying uncertainties. Designed for sampling and not optimization, at first much computation time is wasted searching for high probability density regions, and significant local modes can be missed. Here, the configuration of multi-criteria evolutionary optimization to ensure random sampling from disparate, high probability modes is discussed using hydrologic modeling examples.

2 - Assessment of Search Controls and Failure Modes in Many-objective Evolutionary Optimization

Patrick Reed, Associate Professor, The Pennsylvania State University, 212 Sackett Building, University Park, PA, 16802, United States of America, preed@engr.psu.edu, David Hadka

This comparative analysis applies ten state-of-the-art MOEAs for test problems drawn from the DTLZ, WFG and CEC 2009 test suites with between 2 to 8 objectives. From these results, we quantitatively compare the effectiveness and controllability of the algorithms. The study concludes by using Sobols' global variance decomposition to provide guidance on how the top performing algorithms' non-separable, multiparameter controls change as a function of problem properties and objective dimension.

3 - Minimizing Total Tardiness and Unavailability Using Ant Colony Approach in Parallel Machine Shop

Ali Berrichi, University M'hamed Bougara of Boumerdes, Computer Science Department, Boumerdes, 35000, Algeria, aberrichi@umbb.dz, Farouk Yalaoui, Lionel Amodeo

Production scheduling and maintenance planning are among the most important activities in manufacturing industry. Generally, the two activities are considered separately. In this paper, we present an integrated model to simultaneously optimize system unavailability for the maintenance part, and total tardiness for the production part, in parallel machine case. An algorithm based on Multi Objective Ant Colony approach has been developed to generate Pareto sets for the model.

■ MD64

W - Queens Room - 2nd Floor

Humanitarian Logistics and Disaster Relief III

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Irina Dolinskaya, Assistant Professor, Northwestern University, 2145 Sheridan Road, IEMS, Evanston, IL, 60208, United States of America, dolira@northwestern.edu

1 - Impact of Decentralized Decision Making on Access to Cholera Treatment in Haiti

Jessica Heier Stamm, Kansas State Univesity, Manhattan, KS, United States of America, jlhs@k-state.edu, Brian Moore

During the Haiti cholera response, many different organizations opened cholera treatment facilities. The location decisions impact accessibility of health services and can influence individuals' ability to cope with the outbreak. We measure accessibility under this decentralized system and compare it to a hypothetical centralized system in which facility locations are chosen to ensure equitable access for all.

2 - Humanitarian Logistics Allocation and Distribution Model with Explicit Consideration of Social Costs

Noel Perez, Rensselaer Polytechnic Institute, 110 8th St JEC 4033, Troy, NY, 12180, United States of America, perezn@rpi.edu, Jose Holguin-Veras

The literature in humanitarian logistics suggests that current formulations do not fully account for the unique challenges in disaster response. Operational costs are usually of secondary importance for responders more concerned about humanitarian suffering. This research considers the loss in welfare associated with victims not having access to critical commodities and develops formulations minimizing total disaster response costs, as determined by both operational and social considerations.

3 - Management of Debris Operations

Kael Stilp, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, mstilp3@isye.gatech.edu, Ozlem Ergun, Pinar Keskinocak

Disasters can generate a significant amount of debris spread over a large affected region, with the operations required for clearing, collecting, and disposing of debris being long and costly. These debris operations are closely tied to the effectiveness of response and recovery operations, where resources for handling debris can be limited and need for aid high. We present decision models for clearance and collection stages, and present solution and bounding methods for these stages.

4 - Fleet Management in Humanitarian Logistics

Alfonso J. Pedraza-Martinez, Assistant Professor, Kelley School of Business, Indiana University, Kelley School of Business, 570B, Indiana University, Bloomington, In, 47401, United States of America, alpedraz@indiana.edu, Luk Van Wassenhove

What is different about humanitarian logistics (HL)? Like commercial and military logistics, HL faces supply and demand uncertainty. Unlike commercial logistics, HL is not profit seeking. Unlike military logistics, HL does not have well defined command and control structures. Unique to HL is the influence of donors via funding structures. In a comprehensive project on fleet management we investigate the defining characteristics of HL and propose opportunities for future research.

■ MD65

W - Kings Room - 2nd Floor

Service Science Prize

Sponsor: Service Science

Sponsored Session

Chair: Grace Lin, VP, Advanced Research Center, Institute for Information Industry, Taipei, Taiwan - ROC, gracelin@iii.org.tw

1 - Service Science Student Paper Competition

Yolanda Rankin, IBM Research - Almaden, 650 Harry Rd., San Jose, CA, United States of America, yarankin@us.ibm.com

The goals of the SSS student paper competition is to encourage students to conduct service science related research and applications, and to recognize excellence among its student members. The submitted papers are evaluated by an award committee based on academic significance and engineering or business relevance. In this session, finalists will present their papers. For the selected finalists and the abstracts of the selected papers, please refer to the online program.

■ MD66

W - Park Room - 2nd Floor

Workforce in Smarter Organizations

Cluster: Workforce Engineering and Management

Invited Session

Chair: Gyana Parija, IBM Research, India, New Delhi, India, gyana.parija@in.ibm.com

1 - Project Planning Based on Assignment of Highly Skilled Professionals

Merav Aharoni, IBM Research, Haifa University Campus, Haifa, 31905, Israel, MERAV@il.ibm.com, Sigal Asaf, Haggai Eran, Michael Veksler, Daniel Connors, Yael Ben-Haim, Donna Gresh, Julio Ortega, Michael McInnis

We built a tool based on constraint programming technology for supporting the assignment of highly skilled professionals to high-end positions. This tool is currently integrated into IBM's resource-management platform, Professional Marketplace. Based on this tool, we have also developed an application for project planning. Assuming knowledge of all future projects in plan, we compute estimations on the probabilities for staffing each of these projects.

2 - Towards Resilient Organization: Issues and Directions
Sameep Mehta, IBM Research, New Delhi, 110070, India, sameepmehta@in.ibm.com, Vinayaka Pandit, Gyana Parija

We present an overview of resilient organizations. To be resilient, the organization should be well prepared to counter any outage as well as to leverage opportunities. We present our view of resilient organizations where different parts of organizations are connected with each other via data flow. Such connections will enable holistic and data driven real time decision making as well as planning tasks. We present some of our recent efforts in this direction.

3 - Identifying Optimal Sales Team Composition for Business Opportunities
Aleksandra Mojsilovic, IBM Thomas J Watson Research Center, Route 134, 1101 Kitchawan Road, Yorktown Heights, NY, United States of America, aleksand@us.ibm.com, Moninder Singh, Kush Varshney, Jun Wang

A good view into resource needs is critical for business success, especially in sales organizations, as different prospects require different sales teams. We present an approach for analyzing ERP data to understand the impact of resource mix on sales performance and determine staffing recommendations. Our recommendations will be used in decision support tools to facilitate better staffing choices, training initiatives and sales strategies.

4 - A Branch & Price Solution of the Discontinuous Tour Scheduling Problem at Check-in Counters
Jens Brunner, Technische Universitat Munchen, LS f Tech Dienst u Oper Mgmt, Arcisstr 21, Munchen, D-80333, Germany, Jens.Brunner@som.wi.tu-muenchen.de

We address the problem of staff scheduling at check-in counters with varying demand. The main objective is to minimize the assignment periods for a given workforce subject to flexible labor regulations. We extent the basic reduced set covering formulation by including lunch break assignments. To solve the problem we developed an exact branch-and-price algorithm. Several stabilization techniques are tested. Preliminary computational results using real data show the efficiency of the algorithm.

■ MD69

W - Grand D - 2nd Floor

Measuring and Modeling Carbon Emissions in Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Edgar Blanco, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-295, Cambridge, MA, 02139, United States of America, eblanco@MIT.EDU

1 - Carbon Optimal and Carbon Neutral Supply Chains
Rob Zuidwijk, Erasmus University, Department of Decision and Information S, Rotterdam, Netherlands, rzuidwijk@rsm.nl, Felipe Caro, Tarkan Tan, Charles Corbett

A supply chain in which all firms exert effort levels that minimize the total supply chain emissions is "carbon optimal", while a supply chain in which firms offset all emissions is "carbon neutral". We compare centralized and decentralized scenarios in terms of carbon optimality and carbon neutrality, using various emission allocation rules. We find that carbon optimal effort levels can be induced only by over-allocating emissions, in contrast with the LCA literature focus on avoiding this.

2 - The Impact of Carbon Footprint Aggregation Levels on Meeting Carbon Reduction Targets
Josue Velàzquez, PhD Candidate, ITESM, Carlos Lazo 100, Col. Santa Fe, Mexico City, DF, 01389, Mexico, josue.velazquez@itesm.mx, Jan C. Fransoo, Edgar Blanco, Jaime Mora-Vargas

Many methods exist to estimate the carbon footprint in transportation. E.g., the GHG protocol suggests a more aggregate estimation than NTM. We implement a detailed and an aggregate method for transportation in the Dynamic Lot-sizing Model. Analytical results show the restrictions of the aggregate model in terms of not complying with the carbon constraint and in wrongly estimating emissions. Extensive numerical experimentation shows that the magnitude of errors can be substantial.

3 - Measuring Carbon Emissions and its Impact in Supply Chain Performance - Part 1
Edgar Blanco, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-295, Cambridge, MA, 02139, United States of America, eblanco@MIT.EDU, Jan C. Fransoo

Companies are facing an increasing number of standards and methodologies to measure their corporate and supply chain emissions. In addition, and given the complexity of modern global operations, companies need to balance the use of internal and external data, as well as various levels of precision. This research presents a framework to understand the implications of the various carbon emissions methodologies and its impact in supply chain decision-making.

4 - Measuring Carbon Emissions and its Impact on Supply Chain Performance – Part 2
Jan C. Fransoo, Professor, Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, Pav F4, Eindhoven, 5600 MB, Netherlands, j.c.fransoo@tue.nl, Edgar Blanco, Xu Yang

In the second part of this paper, we analyze the various policies that are being deployed in various regions of the world. We argue that due to low price elasticities, and the specific characteristics of the role of transportation in the supply chain, policies based on monetary incentives are unlikely to be effective. Voluntary policies may provide the best opportunity to provide effective incentives to reduce carbon emissions in transportation.

Tuesday, 8:00am - 9:30am

■ TA01

C - Room 201A

Cooperation and Competition in Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Greys Sosic, Associate Professor, University of Southern California, Marshall School of Business, Bridge Hall 401, Los Angeles, CA, 90089, United States of America, sosic@marshall.usc.edu

1 - Joint Selling of Complementary Products under Downstream Competition

Shuya Yin, UC Irvine, Paul Merage School of Business, CA, 92697, United States of America, shuya.yin@uci.edu, Yuhong He

This paper considers complementary suppliers' incentives to form alliances and jointly sell their components when final products compete with each other for demand. We examine how horizontal competition among final products and vertical decentralization affect suppliers' motivations to form coalitions. We show that both horizontal and vertical competition discourages alliance formation.

2 - Subgame Perfect Consistent Stability

Eran Hanany, Tel Aviv University, Ramat Aviv, Tel Aviv, 69978, Israel, hananye@post.tau.ac.il, Daniel Granot

Farsighted solution concepts provide insightful results in many game applications. However simple examples demonstrate that existing concepts are not sufficiently farsighted. We propose a new solution, the Subgame Perfect Consistent Set, based on vN-M stability and subgame perfection. We show that it leads to satisfactory predictions and always achieves Pareto efficiency in farsighted normal form games. This is demonstrated in various oligopolistic and supply chain settings.

3 - Ex-ante versus Ex-post Information Sharing in a Cournot Duopoly

Karthik V.Natarajan, University of North Carolina, Kenan-Flagler Business School (3301), Chapel Hill, NC, 27599, United States of America, Karthik_Natarajan@unc.edu, Adam Mersereau, Dimitris Kostamis

We study incentives for firms to engage in horizontal information sharing of demand signals in a duopoly setting with uncertain demand. We study both ex-ante and ex-post information sharing where the decision to share or to not share signals with the competitor is made before and after observing the signal respectively. We explore the sensitivity of the "no information sharing" equilibrium established in the literature to the timing of sharing decisions and to the way information is modeled.

4 - Product Variety, Pricing and Differentiation in a Supply Chain

Raj Rajagopalan, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States of America, srajagop@marshall.usc.edu, Nan Xia

The costs and benefits of product variety vary across different players in a supply chain and this has interesting ramifications. We present a model wherein a manufacturer sells product variants at a wholesale price to two competing but differentiated retailers. We provide results on the impact of retailer differentiation, manufacturer and retailer costs, etc. on variety, prices and margins. We also explore some coordination issues in the channel.

■ TA02

C - Room 201B

Optimization in Finance V

Cluster: Optimization in Finance

Invited Session

Chair: Kenneth Kortanek, Adjunct Professor, University of Pittsburgh, Department Industrial Engineering, Benedum Hall, Pittsburgh, PA, 16261, United States of America, kortanek@pitt.edu

1 - Optimizing Financial and Operational Performance of Firms in Green Markets

Parijat Dube, IBM, Hawthorne, NY, United States of America, pdube@us.ibm.com, Genady Grabarnik

Traditional financial analysis of firms do not model effect of green solutions and green market elements on earnings. Green solution and policies effect operational performance which in turn is guided by service level agreements (SLAs). We provide a holistic modeling and optimization framework for financial analysis of firms in green markets by exploiting interdependence between SLAs, operational performance, and costs from green solutions,carbon trading and carbon taxation.

2 - DEA-Based Stock Selection Using Fundamental, Macro and Forward-looking Indicators

Irene Song, Columbia University, 313 Mudd Building 500 W. 120th Street, New York, NY, 10027, United States of America, is2306@columbia.edu, Iraj Kani, Soulaymane Kachani

In this talk, we propose a Data Envelopment Analysis (DEA)-based method that utilizes financial statement data, macro indices and forward-looking indicators for stock selection. We test our approach on various U.S. industries and report on the performance of our method vs. widely used regression-based benchmarks.

3 - Solving Dynamic Cash Flow Matching Problems under Uncertainty: Tests with U.S. Data

Kenneth Kortanek, Adjunct Professor, University of Pittsburgh, Department Industrial Engineering, Benedum Hall, Pittsburgh, PA, 16261, United States of America, kortanek@pitt.edu

A LP model is presented for selecting a least cost portfolio of Government Securities whose cash flows cover those required by a stream of future liabilities whose maturities exceed the maturities of available bonds. Conditional Tail Expectation constraints appear on the liability shortfalls in any period. The Hull-White stochastic spot interest rate is simulated for calculating future bond prices, while an extracted forward rate function from U.S. Treasury Quotations is inputted.

■ TA03

C - Room 202A

Using Python as a Tool for Solving Real-world Optimization Problems

Sponsor: Computing Society/ Open Source Software (Joint Cluster Optimization)

Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Addressing Performance Issues with Numerical Software in Python

Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore Street, Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

We will start the session with a quick tutorial, that will demonstrate the many features of Python that make it good language for scientific computing, comparing it with other languages such as C/C++, Java and C#. Then we will demonstrate use of libraries such as Numpy and Scipy and how to gain increased performance for your Python applications.

2 - Comparison of Python Modeling Capabilities

Sandip Pindoria, Optimization Consultant, Maximal Software, Ltd., Boundary House, Boston Road, London, W7 2QE, United Kingdom, sandip@maximalsoftware.com

We will demonstrate several examples on to how to build and deploy optimization applications with Python. Many of the examples will be based on Maximal own libraries MPLPY, but we will also be showing examples with other Python libraries, such as GUROBI, CPLEX, LPSolve, PYOMO and PULP-OR, while pointing out the differences between them.

3 - A Survey of Python Optimization Software

William Hart, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, United States of America, wehart@sandia.gov

A wide variety of optimization packages have been developed with Python, including both native Python packages as well as Python wrapper libraries. We survey these packages to critique their capabilities and ease of use. We also describe efforts to integrate these packages with modeling tools like Pyomo.

■ TA04

C - Room 202B

Surrogate and Derivative Free Optimization I

Sponsor: Computing Society/Optimization: Surrogate and Derivative-free Optimization(Joint Clusters)

Sponsored Session

Chair: Nick Sahinidis, Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, United States of America, sahinidis@cmu.edu

1 - A Stochastic Mixture Surrogate Model Algorithm for Expensive Global Optimization Problems

Juliane Müller, Tampere University of Technology and Cornell University, 422-424 East State Street, Apt. B, Ithaca, NY, 14850, United States of America, jm768@cornell.edu, Robert Piché, Christine Shoemaker

The literature on solving global optimization problems using surrogate models shows that the choice of the surrogate model and the choice of the sample site where to do the next computationally expensive simulation may greatly influence the solution quality. In this talk the influence of mixture surrogate models and a stochastic sampling procedure on the solution quality will be demonstrated. This is a collaborative work between Tampere University of Technology and Cornell University.

2 - Large-scale Optimization of Expensive Black-box Functions Subject to Expensive Black-Box Constraints

Rommel Regis, Saint Joseph's University, Philadelphia, PA, United States of America, rregis@sju.edu

This talk presents radial basis function (RBF) algorithms for large-scale optimization problems whose objective and constraint function values are outcomes of a time-consuming computer simulation. These algorithms perform better than many alternatives on test problems and they are among the best known algorithms on a large-scale automotive problem proposed by Jones (2008) that has 124 decision variables and 68 inequality constraints.

3 - Quadratic Models of Quantifiably Noisy Functions

Stefan Wild, Argonne National Laboratory, 9700 S. Cass Avenue, Bldg 240, 1154, Argonne, IL, 60439, United States of America, wild@mcs.anl.gov, Aswin Kannan

When derivatives of a nonlinear objective are unavailable, many derivative-free optimization algorithms rely on interpolation-based models of the function. But what if the function values are contaminated by noise, as in most simulation-based problems? We obtain linear and quadratic models by making use of knowledge of the level of noise in a function. We develop an efficient algorithm for obtaining the model coefficients and discuss properties of the corresponding quadratic program.

4 - Global Optimization of Surrogate Approximations in Derivative-free Optimization

Satyajith Amaran, Graduate Student, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15217, United States of America, satyajith@cmu.edu, Nick Sahinidis

We aim to minimize an expensive, deterministic, unknown function with the least number of function evaluations. Towards this aim, an iterative trust-region framework that incorporates sampling, interpolation by a surrogate model and minimization of this model is implemented. Our approach is based on the premise that global minimization of the surrogate model could decrease the overall number of function evaluations. We provide extensive computational results.

■ TA05

C - Room 203A

Dynamic Optimization in Radiotherapy

Cluster: Tutorials

Invited Session

Chair: Archis Ghate, University of Washington, Industrial and Systems Engineering, Box 352650, Seattle, WA, 98195, United States of America, archis@u.washington.edu

1 - Dynamic Optimization in Radiotherapy

Archis Ghate, University of Washington, Industrial and Systems Engineering, Box 352650, Seattle, WA, 98195, United States of America, archis@u.washington.edu

The goal in radiotherapy is to maximize tumor-damage while limiting toxic effects on nearby healthy anatomies. This is achieved through spatial localization and temporal dispersion of radiation dose using static-deterministic optimization methods. In this tutorial, we review a recently proposed stochastic control framework, where the ultimate objective is to design treatment strategies that dynamically adapt to tumor-response, to deliver the right dose to the right location at the right time.

■ TA06

C - Room 203B

Contract Complexity and Performance: A Brief Look at Theory and Behavior

Cluster: Tutorials

Invited Session

Chair: Feryal Erhun, Stanford University, MS&E, Stanford, CA, United States of America, feryal.erhun@stanford.edu

1 - Contract Complexity and Performance: A Brief Look at Theory and Behavior

Feryal Erhun, Stanford University, MS&E, Stanford, CA, United States of America, feryal.erhun@stanford.edu

This tutorial discusses theoretical and behavioral aspects of contract design with an emphasis on complexity as a design factor. We first introduce the concept of dynamic procurement and then establish a link between dynamic procurement and quantity discounts. Next, we introduce behavioral aspects of contract design and discuss trade-offs between contract design and contract performance. Finally, we demonstrate how simple quantity discount contracts can effectively eliminate inefficiencies.

■ TA07

C - Room 204

Asymptotic Analysis of Stochastic Networks

Sponsor: Applied Probability

Sponsored Session

Chair: David D. Yao, Columbia University, IEOR Department, New York, NY, United States of America, yao@columbia.edu

Co-Chair: Hengqing Ye, Associate Professor, Hong Kong Polytechnic University, Department of Logistics and Maritime Studies, Hong Kong, Hong Kong - PRC, lgtyehq@inet.polyu.edu.hk

1 - Stationary Distribution of Multiclass Multi-server Queueing System: Bounds in the Halfin-Whitt Regime

David Gamarnik, Massachusetts Institute of Technology, 100 Main Street E62-563, Sloan School of Management, Cambridge, MA, 02139, United States of America, gamarnik@mit.edu, Aleksandr Stolyar

We consider a queueing system with large number of identical servers. There are multiple Poisson input flows. A customer of each flow type has an exponentially distributed type dependent service time. We consider the sequence of stationary distribution in the Halfin-Whitt asymptotic regime. The main result is that stationary distributions have exponential moments, uniformly bounded for all non-idling service disciplines. As result, the sequence of stationary distributions is tight.

2 - Reversibility and Delay Optimality in Constrained Queueing Networks

Yuan Zhong, Student, MIT, 77 Massachusetts Avenue, Cambridge, MA, United States of America, zhyu4118@mit.edu, Devavrat Shah, Neil Walton

This talk explains how reversibility (product-form) of certain classical networks can be useful to establish (near) optimality of average delay in a large class of constrained queuing networks.

3 - Proportional Fair Allocation in a Stochastic Network: Diffusion Limit and Stationary Distributions

David D. Yao, Columbia University, IEOR Dept, New York, NY, United States of America, yao@columbia.edu, Hengqing Ye

We establish the diffusion limit for a stochastic network with multiple job classes and multiple bottlenecks, operating under the proportional fair resource control. We show that the usual traffic condition is necessary and sufficient for the existence and uniqueness of stationary distributions of both the diffusion limit and pre-limit processes. Furthermore, given an additional bounding condition, stationary distributions of the pre-limit networks converges to that of the diffusion limit.

■ TA08

C - Room 205

Hybrid Methods III: Applications

Sponsor: Computing Society/ Constraint Programming and Integrated Methods

Sponsored Session

Chair: John Hooker, Carnegie Mellon University, Tepper School of Buisness, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu

1 - Online Deployment of RAMBO Quorum Systems

Laurent Michel, Associate Professor, University of Connecticut, 371 Fairfield Rd, Storrs, CT, 06269, United States of America, ldm@engr.uconn.edu, Pascal Van Hentenryck, Elaine Sonderegger, Alex Shvartsman

Rambo is the Reconfigurable Atomic Memory for Basic Objects, a formally specified algorithm that implements atomic read/write shared memory in dynamic networks, where the participating hosts may join, leave, or fail. To use this protocol, one must provide a deployment algorithm capable of computing online a deployment of quorums on hosts to optimize future system performance. This talk investigates the role of hybrid constraint programming algorithm to solve this hard optimization problem.

2 - Application of Hybrid Constraint-based Methods in Program Verification

Michel Rueher, Professor, University of Nice Sophia Antipolis / CNRS, 930, Route des Colles - BP 145, Sophia Antipolis Cedex, 06903, France, michel.rueher@gmail.com

We discuss the capabilities of hybrid constraint-based methods on critical issues in the validation process of critical software. Practically, we address the problem of verifying programs with floating point numbers computations. We show how the refutation capabilities of constraint solvers can be used to refine over-approximations computed with abstract interpretation techniques.

3 - Hybrid Optimization for Disaster Preparedness and Response

Pascal Van Hentenryck, Brown University, Providence, RI, United States of America, pvh@cs.brown.edu, Carleton Coffrin, Russell Bent

This talk describes the use of hybrid optimization for disaster preparedness and response, reporting experimental results on the infrastructures of the United States.

4 - Cloud Computing Management with Constraint Programming

Jean-Charles Régin, Professor, University Nice-Sophia Antipolis, I3S, 2000, Route des Lucioles, Les Algorithms, Bt Euclide B, BP121, Sophia Antipolis, 06903, France, jcregin@gmail.com

The bin packing problem is one of the core problems of cloud computing management. It corresponds to the assignment of virtual machines to servers. Cloud computing also imposes a huge variety of constraints that cannot be expressed a priori. Constraint Programming (CP) has been proved efficient for solving bin packing instances and for its capability to deal with unexpected constraints. We describe some CP models for solving real life bin packing instances coming from cloud computing.

■ TA09

C - Room 206A

Revenue Management in Internet Advertising

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Hamid Nazerzadeh, Marshall School of Business, University of Southern California, Los Angeles, CA, United States of America, hamidnz@microsoft.com

1 - Computing Mean Field Equilibria of Dynamic Auctions with Learning

Ramesh Johari, Stanford University, Mgmt. Sci. and Eng., Stanford, CA, 94305, United States of America, ramesh.johari@stanford.edu, Krishnamurthy Iyer, Mukund Sundararajan

We consider a dynamic auction market where agents learn an unknown private valuation as they bid in a sequence of auction for identical copies of a good. We present a heuristic analogous to model predictive control that computes a mean field equilibrium in the market. Using this, we characterize the evolution of bids made by an agent in equilibrium. Further, we study the problem of determining a revenue-maximizing reserve price in the presence of learning.

2 - Yield Optimization of Display Advertising with Ad Exchange

Santiago Balseiro, Columbia Business School, 3022 Broadway, New York, Ny, United States of America, srb2155@columbia.edu, Jon Feldman, Vahab Mirrokni, S. Muthukrishnan

In light of the growing market of Ad Exchanges for the real-time sale of ad slots, publishers face new challenges in choosing between the allocation of contract-based reservation ads and spot market ads. In this setting, the publisher should take into account the tradeoff between short-term revenue from an Ad Exchange and the long-term benefits of delivering good quality spots to the reservation ads. We study the publisher's problem and derive an asymptotically optimal policy for ad allocation.

3 - Optimal Dynamic Buy-it-now Pricing for Sponsored Search Advertising

Ying-Ju Chen, University of California- Berkeley, 4121 Etcheverry Hall, Berkeley, CA, 94720, United States of America, chen@ieor.berkeley.edu

This paper studies a novel buy-it-now option pricing problem for sponsored search advertising. The distinguishing feature of this problem is the future uncertainty that advertisers face while exercising the buy-it-now options, as the search engine may automatically bump up the advertisers below those unoccupied positions. Thus, each advertiser shall anticipate how the search engine dynamically adjusts the prices for the remaining positions, and how subsequent advertisers make their decisions.

4 - Buy-it-now or Take-a-chance: A Simple Sequential Screening Mechanism

Hamid Nazerzadeh, Marshall School of Business, University of Southern California, Los Angeles, CA, United States of America, hamidnz@microsoft.com, Elisa Celis, Greg Lewis, Markus Mobius

We present a simple auction mechanism for a setting with irregular valuations. Our counter-factual experiments on Microsoft advertising platform suggest that our mechanism would significantly improve the revenue relative to an optimal second-price mechanism.

■ TA10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - SAS Global Academic Program – Rapid Predictive Modeler

Tom Bohannan, SAS Global Academic Program, SAS Campus Dr., Cary, NC, 27513, United States of America, tom.bohannon@sas.com, Jerry Oglesby

Using SAS Rapid Predictive Modeler, business analysts and subject-matter experts with limited statistical expertise can quickly generate their own predictive models based on their specific needs and business scenarios. This enables a wide range of individuals to use and benefit from predictive analytics without always having to rely on a potentially limited pool of overburdened analytic resources.

2 - Lumina Decision Systems, Inc. – Analytica: What it Does that Spreadsheets Can't

Paul Sanford, Consulting Decision Analyst, Lumina Decision Systems, Inc., 26010 Highland Way, Los Gatos, CA, 95033, United States of America, psanford@lumina.com

Experienced analysts prefer Analytica to spreadsheets because of its visual influence diagrams, Intelligent Arrays, fast Monte Carlo and scalability. Users say that they can build, verify and analyze models in a quarter to half the time it takes with a spreadsheet. Because it's designed by expert modelers, it's also an ideal tool for teaching students the art of effective modeling.

■ TA11

C - Room 207A

Markov Decision Processes and Queueing Models

Sponsor: Applied Probability

Sponsored Session

Chair: Sandjai Bhulai, VU University Amsterdam, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, s.bhulai@vu.nl

1 - Processor Sharing Retrial Queue: Structural Properties of the Value Function by Coupling

Flora Spieksma, Leiden University, Niels Bohrweg 1, Leiden, 2311KL, Netherlands, spieksma@math.leidenuniv.nl, Sandjai Bhulai, Anthony Brooms

The processor sharing retrial queue is a Markov process with unbounded jumps, living on a two-dimensional state space. General methods for deriving structural properties of the value function have not existed so far. Different approaches to tackle this problem have been recently developen. The method proposed here is a simple coupling method, applying to both uncontrolled model and controlled model, where the controller may initially set a certain acceptance level of customers.

2 - A New Device for Analyzing Non-uniformizable Markov Chains: The Smoothed Rate Truncation Principle

Sandjai Bhulai, VU University Amsterdam, De Boelelaan 1081a, Amsterdam, 1081 HV, Netherlands, s.bhulai@vu.nl, Flora Spieksma

Markovian control problems with unbounded jump rates usually have many structural properties such as monotonicity, convexity, and supermodularity as a function of the input parameters. However, no general methods have been developed so far to systematically study such properties and problems. We introduce the Smoothed Rate Truncation (SRT) principle that addresses this and show that the SRT principle is a flexible method that is expected to be widely applicable for a general class of models.

3 - Event-based Dynamic Programming for Non-uniformizable Systems

Herman Blok, PhD Student, Leiden University, Wildhoeve 20, Houten, 3992 PR, Netherlands, hermanblok@gmail.com, Sandjai Bhulai, Flora Spieksma

We develop event-based dynamic programming techniques to prove monotonicity results for non-uniformizable systems. We adopt the novel Smoothed Rate Truncation Principle in which transition rates for some events are smoothed. We develop new event-based DP operators for these events and show propagation results to obtain structural properties.

4 - Using Means to Bound Variances in Markov Decision Problems

Alessandro Arlotto, University of Pennsylvania, The Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104, United States of America, alear@wharton.upenn.edu, Noah Gans, J. Michael Steele

We consider self-bounding, finite horizon, total expected reward, Markov decision problems and we prove that, for this class of problems, the variance of the optimal total reward is bounded by a multiple of its expected value. We discuss the value of these bounds and describe examples of sequential decision problems in operations management, operations research and combinatorial optimization for which they hold.

■ TA12

C - Room 207BC

Computational Sustainability

Sponsor: Computing Society/ Computational Stochastic Optimization

Sponsored Session

Chair: Carla Gomes, Associate Professor, Cornell University, Computer Science Department, Ithaca, NY, 14853, United States of America, gomes@cs.cornell.edu

1 - Approximate Dynamic Programming for Energy Storage

Warren Scott, Graduate Student, Princeton University, ORFE, Princeton, NJ, 08544, United States of America, wscott@princeton.edu, Warren Powell

We use approximate dynamic programming to solve an energy storage problem which combines wind turbines, an electricity storage device, and the electrical grid in order to satisfy an electrical demand. We set up a dynamic programming problem and compare approximate policy iteration and direct policy search. For direct policy search, we apply the approximate knowledge gradient framework to efficiently optimize the energy storage policy.

2 - Approximation Algorithms for Landscape Fragmentation Against Stochastic Wildfire Igntion

Gwen Spencer, Cornell University, 116 Oak Avenue, Ithaca, NY, 14850, United States of America, gwenspencer@gmail.com, David Shmoys

Allocating limited preventative resources to protect against the spread of wildfire from a stochastic ignition point motivates a new family of stochastic optimization problems. Given a graph with edge costs and node values: find a budget-limited set of edges whose removal protects the largest expected value from a stochastic ignition node. Two-stage stochastic models capture the tradeoffs between preventative treatment and real-time response. We give approximation results for several variants.

3 - Risk-sensitive Resource Management Using Dual Dynamic Programming

Emmanuel Yashchin, IBM Reseach, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, yashchi@us.ibm.com, Dharmashankar Subramanian

Computational sustainability often involves large optimization problems that can be modeled as dynamic linear programs with uncertainties and solved similarly as POMDPs. We extend these models to include risk-aversion in the objective along with stochastic dependence across time steps. In particular, we derive a stochastic dual dynamic programming algorithm for the extended model with dynamically consistent risk measures. We present numerical evidence of the efficiency of the proposed approach.

4 - Adaptive Submodular Optimization in Conservation Planning

Andreas Krause, Assistant Professor, ETH Zurich, Universitaetsstr. 6, Zurich, 8092, Switzerland, krausea@ethz.ch, Steve Morey, Daniel Golovin, Sarah Converse, Beth Gardner

Consider the problem of protecting endangered species by selecting patches of land to be used for conservation purposes. As patch availability may change over time, recommendations must be made dynamically. We develop an efficient algorithm for this problem and prove that it obtains near-optimal performance. We further evaluate our approach on a detailed reserve design case study of conservation planning for three rare species in the Pacific Northwest of the United States.

■ TA13

C - Room 207D

Future Directions in Revenue Management and Price Optimization

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: James Lemieux, Research Statistician Developer, SAS, 3247 Renaissance Park, Cary, NC, United States of America, james.lemieux@sas.com

1 - A Functional Data Analysis Approach to Estimation in Revenue Management Systems

James Lemieux, Research Statistician Developer, SAS, 3247 Renaissance Park, Cary, NC, United States of America, james.lemieux@sas.com

Revenue management systems often use statistical techniques that do not fully exploit the dynamic patterns observed in booking data. Functional Data Analysis offers the potential benefit of more easily incorporating dynamic characteristics of booking data that would otherwise be cumbersome or error-prone to estimate using standard techniques. This research provides preliminary findings on applying Functional Data Analysis to improve estimation of models used in revenue management systems.

2 - Price Competition, Technological Precision and Product Failure

Ramanathan Subramaniam, Assistant Professor, University of Kansas, 226I, Summerfield Hall, 1300, Sunnyside Avenue, Lawrence, KS, 66045, United States of America, srama@ku.edu

We theorize that improved technology allows firms to more accurately assess the likely stress that the product needs to withstand. This allows firms to cut back on redundant expenditures on the product to make it just robust enough as necessary. The firm then passes on part of the resultant savings in variable costs to the customer. This makes the product more sensitive to unusual usage related stresses that may lead to increased breakdowns while price competition accentuates this effect.

3 - Channel Coordination in Two-period Model with Production Cost Learning

Xuili He, Assistant Professor, UNC-Charlotte, 9201 University City Blvd, BISOM Department, Charlotte, NC, 28269, United States of America, xhe8@uncc.edu, Tao Li, Suresh P. Sethi

This paper studies dynamic channel coordination with declining production cost due to volume learning. In a two-period setup, we also investigate that revenue sharing contracts can coordinate the supply chain with endogenous retail and wholesale prices.

4 - Retail Selling with All-pay Auctions

Chris Anderson, Assistant Professor, Cornell University, School of Hotel Administration, ithaca, United States of America, canderson@cornell.edu, Fredrik Odegaard

We model a setting with list prices (p1) and an all-pay auction (bids b). Bids are forfeited regardless of outcome, with highest bidder winning. Loosing bidders may purchase at the list price channel (paying p1). We consider a modification where buyers can use their sunk bid b as a credit and buy the item for p2 (paying an additional p2 - b). We characterize equilibrium in the bidding/buying strategy and derive optimal prices p1 and p2 in order for the seller to maximize revenue.

■ TA14

C - Room 208A

Capacity and Contracts in Electricity Markets I

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Golbon Zakeri, Dr, University of Auckland, #70 Symonds Street, Auckland, New Zealand, g.zakeri@auckland.ac.nz

1 - Modelling Electricity Prices and Capacity Expansions over a Long-time Horizon

Pierre Girardeau, Dr., EDF and Auckland University, 70, Symonds Street, Auckland, New Zealand, pierre.girardeau@ensta.org, Andy Philpott

We consider linked zones (countries) which all have to satisfy their own power demand. The time horizon is of fifteen to twenty years and our aim is to estimate electricity prices. We suppose a central planner tries to manage every power unit (the problem data being stochastic) in such a way that is optimal for the global system. The output of our optimization process are the power flows and electricity prices. We also consider this model as part of a capacity expansion problem.

2 - New Zealand's New Financial Transmission Rights Market

Roger Miller, Electricity Authority in New Zealand, New Zealand, roger.miller@ea.govt.nz

New Zealand is introducing Financial Transmission Rights (FTRs) to help manage wholesale electricity market price risks. FTRs will initially be offered between one major node in each island. Some important issues within the NZ context will be discussed. These include: covering the full loss-inclusive price difference, the effect of losses and HVDC link reserve requirements on revenue adequacy, the need for option products in a hydro-dominated system, and partitioning of rental streams.

3 - Determining an Emissions Allocation Factor for New Zealand

Anthony Downward, Dr, University of Auckland, Level 3, 70 Symonds Street, Auckland, 1010, New Zealand, a.downward@auckland.ac.nz

A significant deterrent for countries looking to introduce a price of carbon is leakage. Leakage occurs when a company moves to a country where there is no charge for emissions. In New Zealand, in order to protect trade-exposed businesses from increased prices, an Emissions Allocation Factor (EAF) has been computed to compensate firms for increased electricity prices. In this talk I discuss a methodology for computing an EAF, first assuming competitive and then strategic generators.

4 - Equilibrium Wind Hedge Contracts through Nash Bargaining

Harikrishnan Sreekumaran, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, United States of America, hsreekum@purdue.edu, Andrew Liu

The negotiation process of a wind hedge contract is modeled through the Nash Bargaining framework. The risk attitudes of the parties involved are captured using conditional cash flow at risk as a risk measure. The equilibrium contract price and quantity come out as the optimal solutions for a stochastic nonlinear programming problem. Solution methods are proposed using sample average approximation combined with decomposition. Numerical results are presented and sensitivity analysis is performed.

■ TA15

C - Room 208B

Decision Support Models and Sensitivity Analysis I

Sponsor: Decision Analysis

Sponsored Session

Chair: Manel Baucells, Universitat Pompeu Fabra, Ramon Trias Fargas 25-27, Barcelona, Spain, manel.baucells@upf.edu

1 - Tolerance Sensitivity Analysis: Thirty Years Later

Richard Wendell, Professor, Katz Graduate School of Business, University of Pittsburgh, Pittsburgh, PA, 15260, United States of America, wendell@pitt.edu, Wei Chen

As originally proposed, tolerance sensitivity analysis characterizes the maximum percentage by which coefficients or terms can vary simultaneously and independently from their estimated values while maintaining the same optimal basis. Over the last thirty years the original results have been extended in a number of ways and applied in a variety of applications. This paper is a critical review of tolerance sensitivity analysis, including extensions and applications.

2 - The Power of Partial Derivatives for Sensitivity Analysis in Decision Analysis

Debarun Bhattacharjya, IBM T. J. Watson Research Center, Ossining, NY, United States of America, debarunb@us.ibm.com, Ross Shachter

Sensitivity analysis provides the decision maker with insights about his/her situation. In this talk, I will show that when the appropriate partial derivatives are available, the analyst need not solve the decision problem repeatedly for sensitivity analysis; this is particularly desirable for large real-world decision systems. I will describe how the analyst can efficiently compute one-way plots, admissible intervals, value of information, strategy comparisons, etc., using a decision circuit.

3 - gPC Expansion and Random Interpolation for Sparse Grids

Greg Buzzard, Professor, Purdue University, Department of Mathematics, 150 N. University St., West Lafayette, IN, 47907, United States of America, buzzard@math.purdue.edu

Sparse-grid interpolation is an efficient method for approximating a smooth function of many variables but is quite rigid in terms of the nodes of interpolation. We describe an efficient method for converting from standard form to a gPC (generalized polynomial chaos) representation, describe how this alternative method allows for much greater flexibility in the choice of interpolating nodes, and give applications to sensitivity analysis and smoothing of noisy data.

4 - Probabilistic Sensitivity for Uncertain Cash Flow Streams: Two Levels of Analysis

Emanuele Borgonovo, Professor, Bocconi University, Via Roentgen 1, Milano, Italy, emanuele.borgonovo@unibocconi.it, Manel Baucells

In investment evaluation, it is important for decision-makers to identify the key-drivers of uncertainty to make better informed decisions and focus managerial attention. We propose a sensitivity analysis method based on measuring the distance among risk profiles. Our sensitivity measures are invariant to different specifications of utility function over net present value. Hence, the importance of each assumption can be measured independently of the (vN-M) risk preferences of the manager.

■ TA16

C - Room 209A

Economics, Supply Chain and Logistics Analysis of Biofuels I

Sponsor: Energy, Natural Resources and the Environment/ Environment and Sustainability

Sponsored Session

Chair: Wilbert Wilhelm, Texas A&M University, Department Industrial & Systems Engineering, College Station, TX, United States of America, wilhelm@tamu.edu

1 - Renewable Energy Generation: Plant Locations and Biomass Supply Chain Problems

Bhaba Sarker, Louisiana State University, Department of Industrial Engineering, Baton Rouge, United States of America, bsarker@lsu.edu, Krishna Paudel, Bingqing Wu

The primary objective of this paper is to demonstrate the models to optimally locate processing plants for converting biomass to liquid hydrocarbons and/or to use it on land as crop nutrients or electricity production. Material flow, logistics and distribution, transportation, warehousing, vehicle routing, and scheduling of resources are a few perspectives, amongst others, to deal with in this research. Other aspects of data collection and synthesis are also discussed.

2 - Bioenergy Supply Chain Optimization with Uncertainty
Taraneh Sowlati, University of British Columbia, Department of Wood Science, Vancouver, Canada, taraneh.sowlati@ubc.ca, Nazanin Shabani

This paper focuses on the supply, transportation, storage, and production of energy from forest biomass and the uncertainty inherent in the supply chain. Using a real case scenario, uncertainties in the raw material supply, prices, and customer demand will be modeled and optimized. The results would help manage risks, reduce costs and take advantage of potential opportunities.

3 - An Exact Solution Approach to Design a Lignocellulosic Biofuel Supply Chain
Heungjo An, Texas A&M University, Department Industrial & Systems Engineering, College Station, TX, United States of America, csmodel@tamu.edu, Wilbert Wilhelm, Steven Searcy

This paper formulates the time-staged biofuel supply chain design problem as a mixed integer program. This study proposes a dynamic programming algorithm to solve effectively the generalized flow sub-problem under Column Generation scheme and develops an inequality, called the partial objective constraint, which is based on the portion of the objective function associated with binary variables. Computation tests evaluate the efficacy of the approach and analyze solvability.

4 - Modeling and Analysis of a Biomass Logistics System
Jason Judd, Virginia Tech, Department Industrial & Systems Engineering, Blacksburg, VA, United States of America, jjudd@vt.edu, Subhash Sarin, John Cundiff

In this paper, we model and analyze a biomass logistics system. Our model determines optimal number, locations and sizes of satellite storage locations (used for collection and densification of biomass), and optimal number and locations of bio-crude plants, given the location of a refinery. We present a decomposition-based approach and its implementation on large-scale, real-life problem instances.

■ TA17

C - Room 209B

Decision Analysis in OM

Sponsor: Decision Analysis

Sponsored Session

Chair: Dharma Kwon, University of Illinois at Urbana-Champaign, Department of Business Administration, Champaign, IL, United States of America, dhkwon@illinois.edu

Co-Chair: Wenjie Tang, PhD Student, INSEAD, Boulevard de Constance, Fontainebleau, France, Wenjie.TANG@insead.edu

1 - Embedded Nash Bargaining: Risk Aversion and Impatience
Steven Lippman, Professor, University of California-Los Angeles, Anderson School of Mgmt., 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, slippman@anderson.ucla.edu, Kevin McCardle

Embedded Nash bargaining is an approach to modeling joint decision making. It entails Nash bargaining when the disagreement payoff is random. We establish some general results regarding the existence, uniqueness, and comparative statics (with respect to discounting, risk aversion, and time discounting) of the embedded Nash bargaining solution.

2 - Ultimatum Deadlines
Wenjie Tang, PhD Student, INSEAD, Boulevard de Constance, Fontainebleau, France, Wenjie.TANG@insead.edu, George Shanthikumar

We study an ultimatum deadline game where the proposer makes an offer to the responder with a certain deadline and the responder trades off the proposer's sure offer and possible better alternatives by the time of the deadline. In particular, we consider the case where neither the responder nor the proposer receives signal of the alternative distribution over time and the responder always has better information than the proposer.

3 - An Experimental Investigation to Enhance Adoption of Energy Efficiency Initiatives
Suresh Muthulingam, Assistant Professor of Operations Management, Cornell University, The Johnson School, 401P Sage Hall, Ithaca, NY, 14853, United States of America, sm875@cornell.edu, Andrew Davis, Alice Isen

Several studies in the literature highlight that many profitable energy efficiency opportunities are not implemented. In this study, we use experiments to identify mechanisms that can help improve adoption of energy efficiency initiatives. In particular we investigate whether the order of recommendations, the cost associated with recommendations and the total number of recommendations can impact the adoption of energy efficiency initiatives when decision makers get a set of recommendations.

4 - A Probabilistic Decision Analysis Model for Quantifying Risk for Supplier Selection
Bimal Nepal, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, United States of America, nepal@tamu.edu, Om Prakash Yadav, Ajay Pal Singh Rathore

While most supply chains are inherently risky, majority of the existing supplier selection models fail to quantify risks because of lack of objective data. This research presents a Bayesian Belief Networks (BBN) based risk analysis model for a supplier selection. The BBN allows us to quantify the qualitative risk data by employing conditional probability. The risk probabilities obtained from the BBN are incorporated into a decision tree framework to select the final supplier.

5 - A Game of Investment in Supplier Quality with Spillover Effects
Dharma Kwon, University of Illinois at Urbana-Champaign, Department of Business Administration, Champaign, IL, United States of America, dhkwon@illinois.edu, Anupam Agrawal, Suresh Muthulingam

We investigate the supplier quality investment strategies of manufacturing firms in the presence of spillover. In our model, two manufacturers could invest in improving the quality of their common supplier; however, neither firm has complete information on the true quality of the supplier. Although each investment is costly, any one firm's investment benefits both by the same amount on account of spillover effects. We obtain a number of novel results regarding the investment strategies.

■ TA18

C - Room 210A

Planning and Scheduling for Real-World Problems

Cluster: Scheduling and Project Management

Invited Session

Chair: Emrah Cimren, The Ohio State University, Integrated Systems Engineering, 210 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43202, United States of America, cimren.1@osu.edu

1 - Radiology Physicians Planning
Elif Gokce, 639 Riverview Dr, Columbus, OH, 43202, United States of America, elifilke@gmail.com, Marc Posner, Vijay Chandnani

We develop a methodology based on simulation and heuristic to determine the radiology physicians scheduling. The proposed approach provides the number of radiologists and the specializations of the radiologists needed to satisfy the workforce requirement of each potential shift. The methodology results in a robust workforce schedule that can be easily adjusted in response to environmental changes such as volume and throughput fluctuations.

2 - Polyhedral Analysis of an Evacuation Scheduling Problem
Emrah Cimren, The Ohio State University, Integrated Systems Engineering, 210 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43202, United States of America, cimren.1@osu.edu, Marc Posner

We consider the polytope of an inequality with continuous and binary variables with upper bounds. This polytope arises as a sub-problem of large scale MIP models of real life problems such as railroad scheduling and evacuation planning. We derive a set of valid inequalities by adding a new subset of variables to the flow cover inequality. We show that, under some conditions, this set is facet defining. Computational results show the effectiveness of the new valid inequalities.

3 - A Comparison of Techniques for Mitigating Schedule Nervousness in Master Production Scheduling
Martin Braun, Intel Corp, 5000 W. Chandler Blvd, Chandler, AZ, 85226, United States of America, martin.w.braun@intel.com, J ay Schwartz

With the advance of computing technologies, a Master Production Schedule can be recomputed on a more frequent basis to make the production schedule more agile. Uncertainty in the demand forecast or production model may cause "schedule nervousness". The mitigation techniques of frozen horizon, move suppression, and schedule change suppression are evaluated. To further the utility of an MPS, the frozen horizon approach is merged with the move suppression approach applied in the unfrozen horizon.

4 - Shop Scheduling with "Green" Objectives for Sustainable Manufacturing

Kan Fang, Purdue University, 315 N. Grant Street, Grissom Hall 154, West Lafayette, IN, 47906, United States of America, fang19@purdue.edu, Nelson Uhan, Fu Zhao, John Sutherland

We study scheduling as a means to address the increasing energy and environmental concerns in manufacturing enterprises. In particular, we consider a shop scheduling problem with "green" objectives, such as carbon footprint and peak power consumption, in addition to the traditional time-based objectives. We investigate both mathematical programming and combinatorial approaches to this scheduling problem, and test our approaches with instances arising from the manufacturing of cast iron plates.

■ TA19

C - Room 210B

Stochastic Models for Credit Risk and Market Crash

Sponsor: Financial Services Section

Sponsored Session

Chair: Tim Leung, Assistant Professor, Columbia University, Department of IEOR, New York, NY, United States of America, tl2497@columbia.edu

1 - Modeling Default Correlation and Clustering

Rafael Mendoza-Arriaga, Assistant Professor, University of Texas at Austin, IROM, 1 University Station, CBA 5.202, B6500 (IROM), Austin, 78712, United States of America, Rafael.Mendoza-Arriaga@mccombs.utexas.edu, Vadim Linetsky

We present a novel framework for modeling correlated defaults where it is possible to capture the so-called "default clustering effect". Time changing multi-parameter Markov processes with multivariate subordinators leads to jump-diffusion processes that are correlated through their jump measures. When unpredictable shocks arrive, the default intensity of multiple firms will shift simultaneously, which can trigger multiple defaults.

2 - Computational Methods for Stochastic Models of Event Timing

Alexander Shkolnik, Graduate Student, Stanford University, Huang Engineering Center, 475 Via Ortega 053P, Stanford, CA, 94305, United States of America, ads2@stanford.edu, Kay Giesecke

Point process models of event timing, in which arrivals are governed by a stochastic intensity, have applications in many areas, including finance, economics, insurance, reliability and queuing. We survey computational methods for these models, including transform, approximation and simulation approaches, highlighting their common probabilistic basis. Numerical results are provided.

3 - Insurance Against Market Crashes

Olympia Hadjiliadis, Professor, CUNY, 365 5th Avenue, New York, 10016, United States of America, ohadjiliadis@brooklyn.cuny.edu, Hongzhong Zhang

Drawdowns are path-dependent measures of risk which have been used extensively in the description of market crashes.We discuss various types of insurance claims against the drawdown, and the dynamic valuation of digitals on drawdowns contingent on drawups by means of a constant risk premium paid at regular time-intervals. This can be viewed as a swap contract on drawdown insurance which may come with the additional feature of termination for a fee.

4 - Drawdown Swaps

Hongzhong Zhang, Assistant Professor, Columbia University, 1255 Amsterdam Avenue, New York, United States of America, hz2244@columbia.edu, Olympia Hadjiliadis, Tim Leung

We evaluate the fair risk premium in a swap contract for insuring against drawdowns. We find the evolution of the price of such a swap contract under geometric Brownian motion dynamics in a finite and an infinite time horizon as well as the jump-to-default feature. We also introduce a callable swap which allows the protection buyer to voluntarily terminate the contract anytime. In particular, we demonstrate that the optimal exercise time is also drawdown related.

■ TA20

C - Room 211A

Advances in Global Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Hong Seo Ryoo, Associate Professor, Department of Industrial & Management Engineering, Korea University, 1, 5-Ga, Anam-Dong, Seongbuk-Gu, Seoul, 136-713, Korea, Republic of, hsryoo@korea.ac.kr

1 - A Global Optimization Algorithm

Yuntao Zhu, Assistant Professor, Arizona State University, P. O. Box 37100, Phoenix, AZ, 85069-7100, United States of America, Yuntao.Zhu@asu.edu, Roger Berger

In this talk we present a novel algorithm for maximizing a function that can be expressed as the sum of a non-increasing function and a non-decreasing function. The algorithm is guaranteed to find the global maximum within a given tolerance. Compared to a typical maximization method that simply computes the function values on a fine grid, our method requires many fewer function evaluations. The usefulness of this algorithm is also illustrated with a statistical example.

2 - Parallel Computation for SDPs FocUsing on the Sparsity of Schur Complements Matrices

Makoto Yamashita, Tokyo Institute of Technology, 2-12-1 Oh-Okayama, Meguro, Tokyo, 152-8552, Japan, Makoto.Yamashita@is.titech.ac.jp, Katsuki Fujisawa, Mituhiro Fukuda, Kazuhide Nakata, Maho Nakata

Polynomial optimization problems (POPs) and sensor network localization problems (SNLs) are becoming useful applications of Semidefinite Programs (SDPs). A common feature of the SDPs from POPs and SNLs is that they have large but very sparse Schur complement matrices(SCMs). To solve such SDPs, we apply parallel computation focusing their sparsity. Based on formula-cost-based distribution, our parallel SDP solver successfully solves large-scale SDPs with sparse SCMs in remarkably short time.

3 - Justifiable and Robust Classifiers

Endre Boros, Professor, RUTCOR, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, endre.boros@rutcor.rutgers.edu

We present an axiomatic theory for justifiability and robustness in rule based learning, in the context of Logical Analysis of Data. We demonstrate that this approach provides competitive and reliable results. (Joint work with Martin Anthony and Julien Darlay).

4 - Compact MILP Models for Optimal & Pareto-Optimal LAD

Cui Guo, PhD Candiate, Korea University,Department of Information Management Engineering, 1, 5-Ga, Anam-Dong, Seongbuk-Gu, Seoul, 136-713, Korea, Republic of, guocui@korea.ac.kr, Hong Seo Ryoo

We develop compact MILP models for various optimal and Pareto-optimal patterns for LAD that involve 2n 0-1 decision variables, where n is the number of support features for the data under analysis, hence is small.With testing on six sets of machine learning data, we demonstrate the efficiency of the new MILP models and show how differently strong prime patterns and strong spanned patterns contribute to the overall generalization capability and classification accuracy of a LAD decision rule.

■ TA21

C - Room 211B

Stochastic Dynamic Programming and Its Applications

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Masayuki Kageyama, The Institute of Statistical Mathematics, 10-3 Midori-cho, Tachikawa, Tokyo, Japan, kageyama@ism.ac.jp

Co-Chair: Katsunori Ano, Professor, Shibaura Institute of Technology, Department of Mathematical Sciences, 307 Fukasaku Minuma-ku, Saitama-city, 337-8570, Japan, k-ano@shibaura-it.ac.jp

1 - Alternate Fibonacci Duality for Multi-stage Division Problem

Yutaka Kimura, Akita Prefectural University, 84-4 Tsuchiya-Ebinokuchi, Yurihonjo, Faculty of System Science and Technology, Akita, 015-0055, Japan, yutaka@akita-pu.ac.jp, Masayuki Kageyama, Seiichi Iwamoto

In this talk, we consider quadratic optimization problems as multi-stage division problem. We show two types of alternate Fibonacci duality in these problems. Moreover, we propose alternate Fibonacci sections to find an optimal value and a point for multi-stage division problem.

2 - Bayesian Multiple Stopping for Discrete Time Swing Option with American Put Type Reward

Katsunori Ano, Professor, Shibaura Institute of Technology, Department of Mathematical Sciences, 307 Fukasaku Minuma-ku, Saitama-city, 337-8570, Japan, k-ano@shibaura-it.ac.jp

Via stochastic dynamic programing, we study the optimal multiple stopping for discrete time American put option on geometric random walk having unknown upward probability. Assume the prior probability density is Beta. Under some condition, the optimal exercise strategy is shown to be threshold one.

3 - Odds Problem in Bernoulli Sequences of Uniformly Random Length with Multiple Selections

Aiko Kurushima, Assistant Professor, Sophia University, 7-1 Kioi-cho, Chiyoda-ku, Tokyo, 102-8554, Japan, kurushima@sophia.ac.jp, Katsunori Ano

We study a variation of "odds problem" in optimal stopping problem. The original problem was introduced and solved by Bruss (2000), where the problem is to maximize the probability of selecting the last success on Bernoulli trials. Ano et al. (2010) succeeded to generalize multiple selections for the odds theorem. We present the optimal multiple stopping rule for uniformly distributed random number of trials under multiple selections in maximizing the probability of selecting the last success.

■ TA22

C - Room 212A

New Optimization Algorithms and Applications

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Hongchao Zhang, LSU, Department of Mathematics, Baton Rouge, United States of America, hozhang@math.lsu.edu

1 - An Exact Jacobian SDP Relaxation for Polynomial Optimization

Jiawang Nie, UCSD, 9500 Gilman Drive, La Jolla, CA, United States of America, njw@math.ucsd.edu

Consider the optimization problem of minimizing a polynomial function subject to polynomial equalities and/or inequalities. Jacobian SDP Relaxation is the first method that would solve the problem globally and exactly by using SDP. Its basic idea is to add new redundant polynomial equalities by using Jacobian matrix to the constraints, and then apply the hierarchy of Lasserre's SDP relaxations. The main result is that the relaxation will be exact if its order is big enough.

2 - Sparse Signal Recovery in Practical Optical Imaging

Roummel Marcia, Assistant Professor, University of California, Merced, 5200 N. Lake Road, Merced, CA, 95343, United States of America, rmarcia@ucmerced.edu

Traditionally, optical sensors are designed to collect the most directly interpretable measurements possible. However, recent advances in compressed sensing indicate that substantial performance gains are possible in many contexts via computational methods. In this talk, we explore how optimization algorithms can increase image quality and resolution without increasing the size of a camera's focal plane array.

3 - Milano: Mixed-Integer Linear and Nonlinear Optimizer

Ümit Saglam, Phd Student, Drexel University, Decision Sciences, Philadelphia, PA, 19104, United States of America, umit.saglam@drexel.edu, Hande Benson

In this talk, we present details of MILANO (Mixed-Integer Linear and Nonlinear Optimizer), a Matlab-based toolbox for solving mixed-integer optimization problems. Our focus will be interior-point methods for semi-definite programming problems and their extensions to mixed-integer cone programming and nonlinear programs with semi-definite constraints. Numerical results will be presented.

4 - A New Affine-scaling Method for Nonlinear Optimization with Bounds and Linear Constraints

Hongchao Zhang, LSU, Department of Mathematics, Baton Rouge, United States of America, hozhang@math.lsu.edu

Comparisons between this new method and traditional affine-scaling methods will be discussed. Any primal nondegenerate cluster point of generated by the method is a stationary point. The method has R-sublinear convergence for quadratic programming without any nondegenerate assumption. For general nonlinear objective function, the method has locally R-linear convergence at a nondegenerate local minimizer where the second-order sufficient optimality conditions are satisfied.

■ TA23

C - Room 212B

Joint Session IAC/QSR: Producao (Brazilian IE Journal) Journal Session

Cluster: INFORMS International Activities Committee (IAC)-Invited International Journal Sessions/Quality, Statistics and Reliability

Invited Session

Chair: Flavio Fogliatto, Professor, Federal University of Rio Grande do Sul, Av Osvaldo Aranha, 99 - 5o andar, Porto Alegre, RS, 90570150, Brazil, ffogliatto@producao.ufrgs.br

Co-Chair: Linda Lee Ho, University of Sao Paulo, Sao Paulo, Brazil, lindalee@usp.br

1 - Adaptive Approach Applied to Aggregate Production Planning under Uncertainties

Oscar S. Silva, CTI - Centro de Tecnologia da Informação Renato Archer, Rod. D. Pedro I, Km. 143,6, Campinas, 13069-901, Brazil, oscar.salviano@cti.gov.br, Wagner Cezarino

A production planning problem with uncertain demand is formulated by a stochastic model with chance-constraints. Difficulties for finding an optimal global solution lead to propose an adaptive approach. This approach considers an equivalent deterministic problem, whose solution is periodically reviewed. As an example, an inventory balance system subject to weak and strong variability of demand is analyzed by mean of this approach. The result is compared with another approach of the literature.

2 - Critical Factors for the Continuous Improvement in Brazilian Manufacturing Companies

Pedro C. Oprime, DEP/UFSCar, Rod. Washington Luìs, km 235, Monjolinho, São Carlos, 13565-905, Brazil, pedro@dep.ufscar.br, Glauco Mendes

The aim of this paper is to identify critical factors in the development of continuous improvement activities in Brazilian manufacturing companies. A conceptual model of relationship between practices and results was tested through a survey conducted in 46 manufacturing companies. Factors such as problems solving tools training, suggestion incentives, face-to-face communication, visits to the shop floor and adoption of incentive systems, have proved to be critical factors in CI activities.

3 - Monitoring the Mean Vector and the Covariance Matrix with Sample Means and Sample Ranges

Antonio F.B. Costa, Associated Professsor, UNESP, FEG, Guaratingueta, SP, 12516410, Brazil, fbranco@feg.unesp.br, Marcela, A.G. Machado

The joint mean and range charts with samples of 4 or 5 are slightly inferior to the joint mean and variance charts in shift detection. For the multivariate case, the charts based on the standardized sample means and sample ranges (MRMAX chart) or on the standardized sample means and sample variances (MVMAX chart) are similar in terms of efficiency in detecting shifts in the mean vector and/or in the covariance matrix. User's familiarity with sample ranges is a point in favor of the MRMAX chart.

■ TA24

C - Room 213A

Risk-averse Stochastic Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Jim Luedtke, Assistant Professor, University of Wisconsin-Madison, 3236 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 5370, United States of America, jrluedt1@wisc.edu

1 - Models and Methods for Dynamic Decision-Making under Joint Chance Constraints

Simge Kucukyavuz, Ohio State University, 1971 Neil Avenue, Columbus, OH, United States of America, kucukyavuz.2@osu.edu, Saumya Goel

We consider joint chance-constrained optimization problems, where the decisions are made over time. We present models to ensure time consistency, and propose a branch-and-cut method for their solution. We illustrate the modeling issues and computational results on a dynamic probabilistic lot-sizing problem.

2 - New Algorithms for the Design of Reliably Connected Networks

Yongjia Song, Research Assistant, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, ysong29@wisc.edu

We study new algorithms for the design of reliably connected networks. We formulate the problem as a stochastic integer program with chance constraints, and use a branch-and-cut decomposition algorithm by taking advantage of the network structure. Moreover, we consider an alternative formulation based on a class of inequalities derived from extension of the concept of an s-t cut to graphs with random arc failures.

3 - Risk Measures for Linear Random Variables

Daniel Espinoza, Assistant Professor, Universidad de Chile, 701 Republica, Santiago, Chile, daespino@dii.uchile.cl, Rodolfo Carvajal, Eduardo Moreno, Guido Lagos

We study risk measures which are coherent, co-monotonic and law invariant for linear random variables. We show that for discrete distributions the uncertainty sets associated to these risk measures are scalings of previously considered uncertainty sets. We present computational result that suggest that these measures could be less fragile than the Conditional Value at Risk.

4 - Disjunctive Cutting Plane Approach for Mean-Risk Averse Two-Stage Mixed-Binary Stochastic Programs

Nataly Youssef, PhD candidate, Texas A&M University, 241 Zachry,3131 TAMU, College Station, TX, 77843, United States of America, nataly.youssef@gmail.com, Lewis Ntaimo

We propose a disjunctive decomposition approach with branch-and-cut for two-stage stochastic mixed-binary programs with conditional value-at-risk. Such problems arise within the context of making strategic decisions where consideration of the variability of uncertain parameters yield more robust solutions. We report initial computations conducted on standard instances to assess the performance of our algorithm.

■ TA25

C - Room 213BC

Inventory Management and Related Models

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Woonghee Tim Huh, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z4, Canada, tim.huh@sauder.ubc.ca

1 - Distribution Center Fulfillment Tactics and the Tradeoff between Inventory and Transportation

James Bradley, Professor, College of William and Mary, Mason School of Business, P.O. Box 8795, Williamsburg, VA, 23187-8795, United States of America, james.bradley@mason.wm.edu

Different transportation policies can be used at distribution centers: for example, trucks can be dispatched to their destinations daily or they can be held until they are full. These two practices have an obvious effect on transportation cost. This research aims at evaluating the effects of transportation policy on replenishment lead time and, in turn, on inventory cost and service level. In so doing, this research integrates two functions within a more holistic supply chain perspective.

2 - On Secondary Markets for Supply Chains: Optimal Policy, Valuation, and Practical Implications

Alexandar Angelus, Singapore Management University, Lee Kong Chian School of Business, 50 Stamford Road, Singapore, 178899, Singapore, angelus@smu.edu.sg

We consider multi-stage supply chains with stochastic demand and either a series or an assembly structure, in which excess inventory can be sold in the secondary markets at each stage. For the assembly system, we find conditions that reduce this problem to an equivalent series one. For the series system, we identify a partially-optimal policy that achieves the Clark-Scarf decomposition, numerically evaluate its performance, and use it to assess the value of secondary markets for supply chains.

3 - Making Operating Decisions for a Public Health Emergency Response Network

Kathleen King, Cornell University, 257 Rhodes Hall, Ithaca, NY, 14853, United States of America, kak59@cornell.edu, John Muckstadt

Public health emergencies require federal, state, and local authorities to respond rapidly in order to prevent widespread mortality and morbidity. Current response plans seldom account for the variety of risks and uncertainties inherent in emergency scenarios. We give an overview of the models we have constructed to help officials make operational decisions related to inventory allocation, staffing, and transportation logistics once the emergency response is underway.

4 - Cooperative Spare Parts Inventory Pooling Games

Frank Karsten, Eindhoven University of Technology, P.O. Box 513, Eindhoven, Netherlands, f.j.p.karsten@tue.nl, Marco Slikker, Geert-Jan van Houtum

We consider several players who stock expensive, low-demand spare parts for their high-tech machines. The players can collaborate by full pooling of their inventories. We analyze whether such collaboration is beneficial for all parties, and we show how the collective holding and downtime costs can be fairly distributed over the participants, in a way that makes everyone better off, by applying concepts from cooperative game theory.

■ TA26

C - Room 213D

Stochastic Models of Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Ganesh Janakiraman, Associate Professor, The University of Texas at Dallas, 800 West Campbell Road, SM30, Richardson, 75080, United States of America, ganesh@utdallas.edu

1 - Asymptotic Optimality Results in Single and Multi-Echelon Inventory Models

Ganesh Janakiraman, Associate Professor, The University of Texas at Dallas, 800 West Campbell Road, SM30, Richardson, 75080, United States of America, ganesh@utdallas.edu

We present results on four inventory problems. Two of these problems involve excess demand being lost. The other two allow backordering and capacity constraints. The optimal policy in each is difficult to compute. We study these problems when the shortage cost is much larger than the holding cost(s) – thus the optimal policy would lead to a high service level. We show that certain simple policies which are known to be optimal for related problems are asymptotically optimal for our problems.

2 - Inventory Management in Assembly Systems

Alp Muharremoglu, University of Texas-Dallas, Richardson, TX, United States of America, alp@utdallas.edu, Woonghee Tim Huh, Ganesh Janakiraman

We provide an alternative proof of the famous result of Rosling that links an assembly system with a serial system. Besides being a more general version, the proof also sheds some light into the nature of optimal policies when the initial conditions do not satisfy Rosling's conditions.

3 - Regret Optimization for Stochastic Inventory Models with Spread

Retsef Levi, Massachusetts Institute of Technology, 30 Wadsworth Street, Cambridge, MA, 02142, United States of America, retsef@mit.edu, Joline Uichanco, Georgia Perakis

We propose a new framework of minimax regret in the newsvendor model, based on absolute mean spread (AMS). AMS is a first order measure of a distribution's spread. We provide closed-form solutions to the optimal solution and the optimal regret given this information. Surprisingly, our heuristics are provably near-optimal under high service levels, which are very common in practice. Our work bridges the tradeoff between model tractability and conservatism common in minimax regret problems.

4 - Single-stage Heuristics for Optimal Policies in Serial Inventory Systems with Non-stationary Demand

Kevin Shang, Duke University, Fuqua School of Business, Durham, NC, United States of America, khshang@duke.edu

We consider a serial inventory system with non-stationary random demand. We show that the optimal (time-varying) echelon base-stock level can be approximated by the optimal solution of a single-stage system with the original system parameters. We then derive a closed-form expression for the corresponding myopic solution and use it to gain insights into how to manage safety stocks. Finally, we show how the heuristic leads to a time-consistent coordination scheme for a decentralized system.

■ TA27

C - Room 214

Conspicuous Consumption

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Beril Toktay, Georgia Institute of Technology, College of Management, Atlanta, United States of America, beril.toktay@mgt.gatech.edu

1 - Pricing and Rationing of Snob-Appeal Products

Kenan Arifoglu, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, kenanarifoglu2011@u.northwestern.edu, Sarang Deo, Seyed Iravani

We study price and capacity decisions of a monopolist selling snob-appeal products such as tickets of performing arts (classical music, opera, ballet, modern dance and theater) and high-fashion luxury goods (ready-to-wear, couture and accessories) to forward looking, snobbish and risk neutral consumers. We find that snobbish consumer behavior provides another explanation for price markdowns and creation of intentional scarcity.

2 - Pricing and Production Decisions under Conspicuous Consumption

Senthil Veeraraghavan, The Wharton School, 3730 Walnut Street, Suite 500, Jon M Huntsman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu

We model a firm which makes capacity decisions when the market consists of strategic customers who may engage in conspicuous consumption. We show that the firm may be able to use limited capacity to signal its quality to the market, when there is moderate presence of consumers who engage in such behavior.

3 - New Product Introduction Strategies for Conspicuous Durable Goods

Vishal Agrawal, Assistant Professor, Georgetown University, 37th and O Streets, McDonough School of Business, Washington, DC, 20057, United States of America, va64@georgetown.edu, Stelios Kavadias, Beril Toktay

We study the implications of exclusivity-seeking consumer behavior on the design and introduction decisions for a durable product, namely the durability and pricing choices of the firm. We show that firms should consider designing products with higher durability in conjunction with a high-price, low-volume product introduction strategy. We also show that the firm has a greater incentive to introduce improved products in the presence of exclusivity-seeking consumers.

4 - Signaling Quality with Long Queues

Laurens Debo, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, United States of America, Laurens.Debo@chicagobooth.edu, Uday Rajan, Christine Parlour

In this talk, I will discuss a model that explains how rational consumers can be attracted to long queues in case that the service for which the queue develops has unknown quality. I also discuss the incentives of the firm to create queues.

■ TA28

C - Room 215

Research Practices and Opportunities in Business Process Operations

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Bo Hu, Xerox Corp., 5 Farm Field Lane, Pittsford, NY, 14534, United States of America, BO.HU@xerox.com

1 - Data-driven Print Enterprise Business Transformation

Sudhendu Rai, Xerox Fellow, Xerox Research Center Webster, MS 128-51E, 800 Phillips Road, Webster, NY, 14580, United States of America, Sudhendu.Rai@xerox.com

The talk will describe analytics-driven business transformation services to enable large print enterprises to transform their cost and performance structure amidst challenging economic times. The talk will discuss services that provide data-driven assessment of current state; optimize and redesign processes and infrastructure; deploy infrastructure, process and cultural changes; help operations dynamically adapt to changing conditions; enable business development and growth.

2 - Performance based Job Routing in Business Process Operations

Sharath Srinivas, Xerox, 800 Philiphs Road, Webster, NY United States of America, sharath.srinivas@xerox.com, Bo Hu, Johannes Koomen

In most business processes the routing of jobs to resource agents is adhoc. However, the problem with such routing schemes is that there is no incentive for performance. In this work we extend an activity based costing scheme with job routing based on performance of the agents. The people with higher performance are incentivized by transfering more jobs to them resulting in higher compensation for them. This scheme also helps the management to reduce inefficiencies due to poor performance.

3 - University and Industry Collaboration for Service Innovation

Jim Baroody, Distinguished Lecturer, Rochester Institute of Technology, E. Philip Saunders College of Business, 107 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, jbaroody@saunders.rit.edu, Fernando Naveda, Ashok Rao, Santokh Badesha

This presentation discusses the status and structure of the RIT Center for Service Innovation, formed to enable high-tech, high-value service innovation. RIT will be the hub of an ambitious NY State educational and research program aimed at developing students who can leverage technology into value-added services. This program brings together universities and businesses from across NY State to develop cross-disciplinary educational programs involving science, engineering, design and business.

4 - Dynamic Parking Pricing via Real Time Occupancy Control

Faming Li, Xerox Corporation, 128-57B, Webster, NY United States of America, Faming.LI@xerox.com, Yu-An Sun

This paper studies how to reduce the urban parking congestion and increase the utilization efficiency by pricing. A real time occupancy feedback control is proposed to regulate the parking occupancy to the desired level. Meanwhile, to reduce the price uncertainty, an assurance price is deduced with the historic occupancy data. We did modeling, simulation, control design and optimization to demonstrate the effectiveness of the proposed methods.

■ TA29

C - Room 216A

Financial Engineering and Applied Probability

Cluster: Quantitative Finance

Invited Session

Chair: Xianhua Peng, Assistant Professor, Hong Kong University of Science and Tech, Department of Mathematics, Hong Kong, Hong Kong - PRC, maxhpeng@ust.hk

Co-Chair: Ning Cai, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, ningcai@ust.hk

1 - Impulse Control of an Ito Diffusion

Haolin Feng, Assistant Professor, Sun Yat-sen University, 135 Xing Gang Xi Road, Lingnan College, Guangzhou, 510275, China, FengHaoL@mail.sysu.edu.cn, Kumar Muthuraman

We study the stochastic impulse control problem of various diffusion processes including Brownian motion, geometric Brownian motion and the mean-reverting processes. We provide a unified numerical method that solves such problems. Several theoretical guarantees as well as computational examples in different applications are also provided.

2 - Laplace Transforms of Wishart Functionals and its Application to Exact Sampling

Wanmo Kang, Assistant Professor, Korea Advanced Institute of Science and Technology, Daejon, Korea, Republic of, wanmo.kang@kaist.edu, Chulmin Kang

We characterize the Laplace transforms of Wishart functionals in terms of certain matrix Riccati integral equations with measure drift. We found Laplace transforms of the marginal distributions, transition densities, and Pitman-Yor's formula for Wishart processes. Moreover, we also consider the Laplace transforms of Wishart bridge functionals. As an application, we propose an exact simulation method of Multifactor volatility Heston model.

3 - Analytical Pricing of Asian Options under a Hyper-Exponential Jump Diffusion Model

Ning Cai, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, ningcai@ust.hk, Steve Kou

We obtain a closed-form solution for the double-Laplace transform of the Asian option price under the hyper-exponential jump diffusion model (HEM), which can be inverted numerically via a two-sided Euler inversion algorithm. Numerical results indicate our pricing method is fast, stable, and accurate. Our result generalizes Geman and Yor's celebrated pricing formula of Asian options under the Black-Scholes model. However, our method is much simpler and more general as it also applies to the HEM.

4 - Default Clustering and Valuation of Collateralized Debt Obligations

Xianhua Peng, Assistant Professor, Hong Kong University of Science and Tech, Department of Mathematics, Hong Kong, Hong Kong - PRC, maxhpeng@ust.hk, Steve Kou

The recent financial turmoil has witnessed the powerful impact of the default clustering (i.e., one default event tends to trigger more default events in the future and cross-sectionally), especially on the CDO market. We propose a model based on cumulative default intensities that can incorporate default clustering. Furthermore, the model is tractable enough to provide a direct link between single-name and multi-name credit securities. The calibration results show that the model is promising.

■ TA30

C - Room 216B

Operational and Financial Decisions

Sponsor: Manufacturing & Service Oper Mgmt/ iFORM SIG

Sponsored Session

Chair: Ankur Goel, Case Western Reserve University, 324 Peter B. Lewis Building, 10900 Euclid Avenue, Cleveland, OH, 44113, United States of America, axg312@case.edu

1 - Inventory Turnover under Risk and the Effect of Hedging

Qi Wu, Mccombs School of Business, University of Texas at Austin, IROM, 1 University Station, Austin, United States of America, Qi.Wu@phd.mccombs.utexas.edu, Kumar Muthuraman, Sridhar Seshadri

We study the effect of the firm's market risk on inventory turnover. We further investigate the firm's joint financial hedging decisions and inventory decisions, and illustrate how the inventory turnover is affected by hedging activities. We provide empirical support on our results using data from the US retail, wholesale and manufacturing sectors.

2 - Capacity Investment, Production Scheduling and Financing Choice

Derek Wang, University of Michigan, Ross School of Business, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, wangdd@umich.edu, Owen Wu, Hyun-Soo Ahn

Mining/energy projects usually require huge initial investment beyond the firm's working capital. We study the capacity investment and production decisions of a capital-constrained firm that can finance through either debt or joint venture in a multi-period model. We show how financing schemes influence the operational policies and describe the conditions under which the firm chooses debt financing over joint venture.

3 - Value of Options and Forward Contracts in Presence of Logistical Costs

Ankur Goel, Case Western Reserve University, 324 Peter B. Lewis Building, 10900 Euclid Avenue, Cleveland, OH, 44113, United States of America, axg312@case.edu

We show that under the value maximization framework and the assumption of perfect and efficient financial markets the presence of logistical costs is a sufficient reason to include option/forward contracts in the procurement portfolio. We also identify conditions under which the options contracts are more valuable than the forward contracts for the firm.

■ TA31

C - Room 217A

Stochastic Modelling Applications in Healthcare

Sponsor: Health Applications

Sponsored Session

Chair: Fatih Safa Erenay, Assistant Professor, University of Waterloo, 200 University Avenue CPH 4323,, Waterloo, ON, Canada, ferenay@uwaterloo.ca

1 - The Effect of Budgetary Restrictions on Breast Cancer Diagnostic Decisions

Mehmet Ayvaci, University of Wisconsin - Madison, 3233-1533 University Avenue, Madison, WI, 53706, United States of America, ayvaci@wisc.edu, Elizabeth Burnside, Oguzhan Alagoz

We develop a finite-horizon constrained Markov Decision Process to model diagnostic decisions after mammography where we maximize the total expected quality adjusted life years (QALYs) of a patient under resource constraints. Comparing to actual clinical practice, using optimal thresholds may result in 22% cost savings without sacrificing QALYs. Our modeling framework could be used for evaluating cost-effectiveness of diagnostic procedures.

2 - A Simulation Experiment to Improve the Performance of Mass Immunization Clinics

Michael Beeler, MASc Student, University of Toronto, 5 King's College Road, Toronto, ON, Canada, michael.beeler@utoronto.ca, Dionne Aleman, Michael Carter

A discrete-event simulation is used to estimate the cost-effectiveness of mass immunization clinics (MICs) for pandemic influenza, as well as the expected number of infections occurring within the facility due to asymptomatic infectious patients. The impact of patient spacing, infection rates, and staff levels on MIC cost-effectiveness and infections is determined through a designed experiment. The methodology can be adapted to estimate infection risks in other venues during a pandemic.

3 - Allocating Blood for Transfusions: Trading Off the Age and Availability of Transfused Blood

Michael Atkinson, Naval Postgraduate School, Operations Research Department, Monterey, CA, United States of America, mpatkins@nps.edu, Magali Fontaine, Lawrence Goodnough, Lawrence Wein

Motivated by studies showing that transfusing older blood may lead to increased mortality, we propose a family of allocation policies that span from FIFO to LIFO. Using data from Stanford Medical Center, we estimate that the proposed policy could reduce the annual number of transfused patients who die within one year by 20,000.

4 - Optimizing Colonoscopy Screening Policies Considering Associated Costs

Fatih Safa Erenay, Assistant Professor, University of Waterloo, 200 University Avenue CPH 4323,, Waterloo, ON, Canada, ferenay@uwaterloo.ca, Adnan Said, Oguzhan Alagoz

Determining the optimal colonoscopy screening policies is important to reduce the lifetime colorectal cancer (CRC) risk. We develop a finite-horizon POMDP model to determine pre-and post-CRC colonoscopy screening policies that maximize the weighted sum of total quality adjusted life-years and associated costs. Using clinical data, we approximate the Pareto-efficient colonoscopy screening policies and show that there exist more economical and effective policies than the current guidelines.

■ TA32

C - Room 217BC

Railroad Disruption Management

Sponsor: Railway Applications

Sponsored Session

Chair: Clark Cheng, Director Operating Research, Norfolk Southern Corporation, 1200 Peachtree Street NE, Box 117, Atlanta, GA, 30309, United States of America, clark.cheng@nscorp.com

1 - Railroad Disruption Management and Opportunities for Modeling

Cary Helton, VP Service Planning, CSX Transportation, Inc, 500 Water Street J250, Jacksonville, FL, 32202, United States of America, cary_helton@csx.com

Approaches used in managing short term disruptions are different than somewhat longer term disruptions. In either situation, it requires identifying and evaluating options available at hand and executing solution as quickly as possible. General approaches used in managing disruptions at CSX will be discussed. Opportunity areas for applying OR modeling techniques to assist in better managing disruptions will be presented.

2 - Simulation of Disruptions in a Class I Railroad

Yudi Pranoto, Manager Opeations Research, Norfolk Southern Corp, 1200 Peachtree St NE, Box 117, Atlanta, GA, 30309, United States of America, yudi.pranoto@nscorp.com

Disruptions in freight railroad operation can arise from scheduled track maintenance and unplanned natural disasters. We present a crew simulation model to study the impact of various types of disruptions on crew utilization and train performance. A system-wide recovery duration can be calculated through multiple iterations of the model runs.

3 - Criticality Evaluation of Railway Infrastructure Based on Freight Flow Network Optimization

Mingzhou Jin, Associate Professor, Mississippi State University, Department of Industrial and Systems Eng., P.O. Box 9542, Miss State, MS, 39762, United States of America, MJin@ise.msstate.edu, Abdullah Khaled

The routing of railway traffic in a disruptive situation is formulated as a minimum-cost network flow problem with a nonlinear objective function of the system-wide total travel time, including the classification time in the yards/stations. The nonlinear travel time function at each link is approximated with a piece-wise linear function to reduce computational burden. The criticality of a railway link/yard is evaluated by the increased delay when the link/yard is disrupted.

4 - overview of Methodologies to Estimate the Economic Impacts of Disruptions to Freight Movements

Michael Meyer, Professor, Civil & Environmental Engineering, Georgia Institute of Technology, Atlanta, GA, 30308, United States of America, michael.meyer@ce.gatech.edu

This presentation will provide an overview of the different methods and tools that can be used to estimate the impacts of disruptions to freight movement. A conceptual framework is provided that illustrates the different types of disruptions, the temporal nature of such impacts and the effects of network structure on ameliorating negative consequences. Case studies of different disuptions and their effects will be presented. Directions for further research will be discussed.

■ TA33

C - Room 217D

Nanomanufacturing and Nanoinformatics IV: Quality and Reliability in Nano-scale Systems

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Abe Zeid, Northeastern University, Room 334SN, Boston, MA, United States of America, zeid@coe.neu.edu

Chair: Sagar Kamarthi, Northeastern University, Boston, MA, sagar@coe.neu.edu

1 - Optimizing a Virtual Community for Nanotechnology Education and Research Collaboration

Jocelyn Dunn, Purdue University, 1302 Columbia St, Apt 3, Lafayette, IN, 47901, United States of America, dunn11@purdue.edu, Omid Nohadani

Virtual communities for research and learning establish global connections based on user needs and resources. With the example of user data from nanoHUB, a virtual community for nanotechnology, we present novel optimization methods that directly connect users based on merits and interests rather than relying on fortunate circumstances to generate collaborations. By optimizing the collaborative potential of virtual organizations, this research aims to accelerate the global migration of resources.

2 - Artificial Neural Network Assisted Study for a Functional Oxide Thin Film Hetrostructure

Ghulam Uddin, guddin@coe.neu.edu, Hatem Abuhmid, Abe Zeid, Sagar Kamarthi

Nanoscale functional metal oxide thin film heterostructures research faces the challenge of control over discrete atomic level features like uniformity of crystalline structure and stoichiometry. A solution can found by utilizing the growth technique Molecular beam epitaxy (MBE) and an artificial neural networks as a process meta model assisting both the design of experiments and Monte Carlo experiments to model the growth mechanism. We present the results of analysis on experimental data of MBE of magnesium oxide (MgO) and iron oxide (FexOy) thin films in terms of growth rates and detailed stoichiometric growth dynamics. In addition to that we present the similarities in growth dynamics of both films in terms of the response of their equivalent stoichiometric performance indicators (Fe3+ bonding state for FexOy and Mg-O bonding state for MgO) to the similar control variables like metal source temperature, growth time, substrate temperature and quantity of chemical impurities on the starting surfaces.

3 - Analyzing Vertically Aligned Single Walled Carbon Nanotubes Growth Mechanism by a Hybrid Model

Hatem Abuhmid, Department of Mechanical and Industrial Engineering, Northeastern University, 360 Huntington Avenue, 334 SN, Boston, MA, 02115, abuhimd.h@neu.edu, Sagar Kamarthi, Ghulam Uddin, Abe Zeid

Chemical vapor deposition (CVD) formed vertically aligned single walled carbon nanotubes (VA-SWNTs) received much attention from academia due to their superior physical and chemical properties. We analyze the relation between the tubes Length and the CVD controllable inputs by an experimental design using a metamodel artificial neural network (ANN). The analysis shows that higher temperature and pressure will yield taller VA-SWNTs with great probability.

■ TA34

C - Room 218A

Hospital Operations Modeling

Sponsor: Health Applications

Sponsored Session

Chair: David Hutton, University of Michigan, Ann Arbor, MI, United States of America, dwhutton@umich.edu

1 - Policies for Managing Scheduled and Unscheduled Surgical Cases in Operating Rooms

Narges Hosseini, PhD Candidate, Industrial Engineering Department, Clemson University, 110-Freeman Hall, Clemson, SC, 29634, United States of America, nhossei@clemson.edu, Kevin Taaffe, Maria Mayorga

In order to manage the demand of surgeries in the hospital, some of the operating room (OR) managers dedicate ORs to specific type of surgeries (called scheduled and unscheduled surgeries). In such systems there are however shared resources (rooms) that could be used by all demand types. This research applies MDP to study the order in which surgeries may use the shared resources while the overall costs of patient's waiting time, room overtime, and the number of patients turned away is minimized.

2 - Education and Responses of Perioperative Staff to Simulation Modeling of Process Flow

Bryan Pearce, Clemson University, 103 Freeman Hall, Clemson, SC, 29634, United States of America, bpearce@clemson.edu, Kevin Taaffe, Lawrence Fredendall, Nathan Huynh

Communication practices within the perioperative environment are noted as key to improving process flow, teamwork climate, and patient safety. Cross-functional groups of staff interact with a simulation tool that models communications delays within and between departments. The researchers measure individual and group responses to simulation outcomes to evaluate if individuals developed a greater understanding of the overall system as well as responsiveness of staff to the simulation tool.

3 - Stochastic Arrival-Location Models and Patient Flow Optimization

Jonathan Helm, University of Michigan, Ann Arbor, MI, United States of America, jhelm@umich.edu, Mark Van Oyen

Dysfunctional admission policies in healthcare organizations drive highly variable workloads, negatively impacting safety, cost and access. We use a Poisson-arrival-location and a new deterministic-arrival-location model to analytically characterize patient flow for incorporation into math programs to, for the first time, optimize patient flow to control and smooth healthcare workloads. Rich managerial insight gained from this approach is demonstrated via case study of a partner hospital.

4 - Optimal Frequency of HIV Testing

Benjamin Armbruster, Northwestern University, 2145 Sheridan, Evanston, United States of America, armbruster@northwestern.edu

We build a stochastic model to determine the optimal frequency of HIV testing for different risk groups in the US. An approximation to the model has intriguing similarities to the EOQ model for inventory management with the test cost analogous to the reorder cost and the opportunity cost of late diagnosis analogous to the holding cost. The model suggests more frequent testing than currently recommended by the CDC.

■ TA35

C - Room 218B

Joint Session QSR/ENRE: Reliability and Optimization in Electric Power Systems

Sponsor: Quality, Statistics and Reliability/Energy, Natural Resources and the Environment

Sponsored Session

Chair: Eunshin Byon, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48105, United States of America, ebyon@umich.edu

1 - Optimization-based Approach to Select an Efficient Scenarios for Generation Expansion Planning

David Coit, Professor, Rutgers University, Department of Industrial & Systems Eng, Piscataway, NJ, 08844, United States of America, coit@rutgers.edu, Hatice Tekiner-Mogulkoc, Frank A. Felder

Electric generation planning problems are to determine when, where & which generations units are built for future demand. To get economic, reliable, environmental-friendly power grid, problem is modeled as multi-objective stochastic problem. Uncertainties are represented by scenarios. Uncertainty sources are component availability & user demand. There are numerous combinations of possible demand levels & failed components. Therefore, a methodology is developed to generate efficient scenarios.

2 - Hierarchical Simulation-based Optimization for Energy Management System Using Reinforcement Learning

Esfandyar Mazhari, Phd Candidate, University of Arizona, 1127 E James E Rogers, Room # 111, Tucson, AZ, 85721, United States of America, emazhari@email.arizona.edu, Young-Jun Son, Sadik Kucuksari

A hierarchical simulation is proposed for Energy Management System involving grid-connected photovoltaic system, battery and super capacitor for energy storage, and demand centers. The high level hybrid System Dynamics and Agent-based model concerns operational decision making. The low level circuit-level model concerns a control strategy of converters to maintain the required power quality. An optimization engine is constructed using reinforcement learning methods, integrated with both levels.

3 - On Finding Global Optimum of the Optimal Power Flow Problem

Rong Pan, Associate Professor, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85287, United States of America, Rong.Pan@asu.edu, Xiaotian Zhuang, Muhong Zhang, Joshua Lyon

The optimal power flow (OPF) problem aims to minimize the total cost of power generation while ensuring the electrical networks balance. It is in general a nonconvex nonlinear optimization problem. Many local optimal solutions have been developed over the years. In this talk, we discuss the formulation and the structure of this type of problem. We propose a simulation-based random search algorithm for finding global optimum.

4 - Estimating the Capacity Value of Concentrating Solar Power Plants

Ramteen Sioshansi, Assistant Professor, The Ohio State University, Integrated Systems Engineering, 240 Baker Systems, Columbus, OH, 443215, United States of America, sioshansi.1@osu.edu, Seyed Hossein Madaeni, Paul Denholm

We present and compare capacity value estimation techniques for concentrating solar power (CSP) plants. We demonstrate that methods based on the capacity factor of the plant can provide reasonable approximations of reliability-based estimation techniques. We also show that thermal energy storage can significantly increase the capacity value of CSP.

■ TA36

C - Room 219A

Advanced Planning and Scheduling in Healthcare

Sponsor: Health Applications

Sponsored Session

Chair: Bjorn Berg, North Carolina State University, Raleigh, NC, 27695, United States of America, bpberg@ncsu.edu

1 - Dynamic Sequencing and Scheduling of Appointment Based Service Systems

S. Ayca Erdogan, Stanford University, Stanford, CA, 94305, United States of America, serdogan@stanford.edu, Brian Denton, Alex Gose

We propose a stochastic mixed integer programming model for a single-server on-line appointment scheduling problem with uncertain service times. We describe solution methods that accelerate computational performance of the standard L-shaped method. Finally, we present results of numerical experiments that illustrate the optimal sequencing and arrival time decisions under the assumption of two patient classes (routine and urgent).

2 - Appointment Scheduling under Patient Cancellations and Choice Behavior

Nan Liu, Assistant Professor, Columbia University, 600 W 168th Street, 6th Floor, New York, NY, 10032, United States of America, nl2320@columbia.edu, Serhan Ziya, Huseyin Topaloglu

We study an appointment scheduling system where patients may cancel their appointments in advance or fail to show up. Patient choice of future appointment dates is modeled explicitly by a multinomial logit model. The objective of the clinic is to maximize the long run average net reward, and the decision to make is the set of days made available to patients for appointments. We consider both state-independent and -dependent scheduling policies and develop performance bounds for some of them.

3 - Clinic Scheduling: Balancing Arrival Certainty and Booking Flexibility

Jonathan Patrick, Telfer School of Management, University of Ottawa, 55 Laurier Avenue East, Ottawa, ON, K1N 6N5, Canada, Patrick@telfer.uottawa.ca

Open access is a scheduling policy designed to minimize the wasted capacity due to no-shows and provide timely access to care. The essence is "do today's demand today". We develop a Markov Decision model that demonstrates that a short booking window does significantly better than open access. We demonstrate that our MDP policy does as well as open access in terms of generating profit but significantly reduces variability in the daily workload and greatly reduces overtime and idle time.

4 - Scheduling Elective Surgeries in a Block-Booking System

Oleg Shylo, Department of Industrial Engineering, University of Pittsburgh, Pittsburgh, PA, United States of America, olegio@gmail.com, Andrew Schaefer, Oleg A. Prokopyev

Scheduling elective procedures in an operating suite is a formidable task due to competing performance metrics and uncertain surgery durations. In this paper, we present an optimization model of batch scheduling for a block-booking system and a solution approach that was developed in collaboration with the Veterans Affairs Pittsburgh Healthcare System (VAPHS) to maximize the utilization of operating room resources subject to a set of probabilistic capacity constraints.

■ TA37

C - Room 219B

Accelerated Testing Models and Experimental Design

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Haitao Liao, Assistant Professor, University of Tennessee, 211 Pasqua Building, Knoxville, TN, 37996, United States of America, hliao4@utk.edu

1 - Bayesian Planning of Step-Stress Accelerated Life Tests
Tao Yuan, Assistant Professor, Ohio University, 279 Stocker Center, Athens, OH, 45701, United States of America, yuan@ohio.edu, Xi Liu

This study proposes Bayesian methods for planning 2-level and 3-level step-stress accelerated life tests. The uncertainty in the planning values is described by a joint prior distribution of the model parameters. The optimization criterion is defined as minimization of the pre-posterior variance of the logarithm of a quantile life at the normal stress condition.

2 - A Tool for Evaluating Time-Varying-Stress ALT Plans with Log-Location-Scale Distributions
Yili Hong, Assistant Professor, Department of Statistics, Virginia Tech, 213 Hutcheson Hall, Blacksburg, VA, 24060, United States of America, yilihong@vt.edu, William Meeker, Haiming Ma

ALTs are often used to make assessments of lifetime distribution of materials and components. The goal of ALTs is to estimate a quantile of a log-location-scale distribution. Much of the previous work on planning ALTs has focused on deriving test-planning methods under a specific distribution. This paper presents a new approach for computing large-sample variances of maximum likelihood estimators of a quantile of a general log-location-scale distribution with censoring, and time-varying stress.

3 - Optimum Design of Stress Sequence Test Plans
Elsayed Elsayed, Professor, Rutgers University, CORE, Piscataway, United States of America, elsayed@rci.rutgers.edu, Michael Koskulics

In general, reliability models are insensitive to the order of stress sequence application. This implies that a low stress followed by a high stress is indistinguishable from a high stress followed by a low stress assuming equal exposures to each level. In this presentation we propose a design of a reliability test plan that incorporates the effect of the stress sequence while optimizing test objectives.

4 - Design of Statistically Precise and Energy Efficient Accelerated Tests
Haitao Liao, Assistant Professor, University of Tennessee, 211 Pasqua Building, Knoxville, TN, 37996, United States of America, hliao4@utk.edu, Dan Zhang, Belle Upadhyaya

Accelerated life testing (ALT) often consumes significant amount of energy because of the creation of harsher-than-normal operating conditions. A new experimental design methodology is developed in this research, which improves the reliability estimation precision of an ALT experiment while minimizing the experiment's total energy consumption. A collection of computational algorithms is developed to handle such complex experimental design problems.

■ TA38

H- Johnson Room - 4th Floor

New Directions in Location and Network Design

Sponsor: Location Analysis

Sponsored Session

Chair: Erhan Kutanoglu, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States of America, erhank@mail.utexas.edu

1 - Integrated Logistics Network Design and Inventory Problems with Service Levels for Low Demand Items
Erhan Kutanoglu, The University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712, United States of America, erhank@mail.utexas.edu

We present new results on solving the integrated logistics network design and inventory problem with customer based stochastic service level constraints. After addressing the modeling challenges for several versions of the problem, we develop methods that produce near-optimal solutions.

2 - Locating Recharge Stations on a Tree Network
Pitu Mirchandani, Professor, Arizona State University, Tempe, AZ, United States of America, pitu@asu.edu

This paper examines the locating stations for electric vehicles to exchange or recharge batteries for the special case when all the origins and destinations are on a tree network. When the optimization objective is non-decreasing concave with respect to the distance from last recharge, we show that even though appropriately defined "breakpoints" can form a set of non-dominated candidate locations, the problem however is still NP-Hard. A graph-theoretic heuristic is developed.

3 - Locating Capacitated Stations for Battery Recharge/Exchange Stations
Mingjun Xia, Student, Arizona State University, 1718 S. Jentilly Lane, APT204, Tempe, AZ, 85281, United States of America, mxia4@asu.edu, Pitu Mirchandani

To attract vehicles running on alternative fuels, it is important to design a network so that vehicles do not run out of charge/fuel on their trips. The paper reviews past work, where facilities are assumed uncapacitated, with special attention to the number of stops and amount of detouring. When other issues (costs of holding batteries and recharging docks) are included, both location and facility sizing decisions must be considered. We present this new problem and its preliminary results.

■ TA39

H - Morehead Boardroom -3rd Floor

Competition in Electronic Marketplace

Sponsor: E-Business

Sponsored Session

Chair: Byung Cho Kim, Assistant Professor, Virginia Tech, Business Information Technology, Pamplin 1007 (0235), Blacksburg, VA, 24061, United States of America, bck@vt.edu

1 - Pricing Game of Online Display Advertisement Publishers
Changhyun Kwon, Assistant Professor, University at Buffalo, SUNY, 400 Bell Hall, Buffalo, NY, 14260, United States of America, chkwon@buffalo.edu, Md. Tanveer Ahmed

We consider an online display advertisement publisher who maximizes the revenue by optimal pricing in an oligopoly setting. Each publisher interacts with others though setting cost-per-impression (CPM) that affects the demand for everyone. We study the best response of the publisher while her strategy space changes and the sensitivity of the publisher while other publishers change their CPM. We provide an algorithm for finding the equilibrium and illustrate by numerical examples.

2 - Sell through Priceline? Managing NYOP and Direct Channels Simultaneously in a Competitive Market
Xiao Huang, Assistant Professor, Concordia University, John Molson School of Business, 1455 de Maisonneuve Blvd West, Montreal, QC, Canada, xiaoh@jmsb.concordia.ca, Greys Sosic

Name-Your-Own-Price (NYOP) at Priceline.com combines opaque selling and customer-driven pricing. Consider two competing suppliers and one NYOP firm. Customers can NYOP at the intermediary firm or buy directly from the suppliers at preferred sequence. We find that high-valued customers may demonstrate low-valued behavior, and that the NYOP firm benefits from horizontally differentiated goods than vertical ones. Interestingly, competing suppliers do not benefit from the existence of the NYOP firm.

3 - Managing Product Variety in Online Retailing
Xiang Wan, Assistant Professor, Marquette University, College of Business Administration, Milwaukee, WI, 53201, United States of America, xiang.wan@marquette.edu

Retailers suffer various constraints to implement variety strategies for attracting customers. With the emergence of E-Business, many constraints of high product variety have been relaxed for online retailers. This paper proposes a framework to investigate the tradeoffs due to product variety faced by online retailers. The results indicate that product variety has a direct positive effect on customer satisfaction and a negative impact on logistics performance positively associated with sales.

4 - Complementary Online Services: How Firms Should Adjust Their Strategies Due to Network Effects

Hila Etzion, Assistant Professor, University of Michiga n, Ross School of Business, 701 Tappan St, Ann Arbor, MI, United States of America, etzionh@umich.edu, MIn-Seok Pang

We model the competition between two firms that sell a differentiated product when each firm can offer a complementary online service to its customers. Online services differ from traditional services because they often promote interactivity among the users and thus exhibit positive network effects. We examine how the market equilibrium changes when the service considered exhibits network effects, and determine how firms should adjust their strategies to account for such effects.

■ TA40

H - Walker Room - 4th Floor

Technological Resources: (Re)configuration and Forecasting

Sponsor: Technology Management

Sponsored Session

Chair: Juliana Hsuan, Associate Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-2000, Denmark, jh.om@cbs.dk

1 - A Multivariate Analysis of Sales Data

Eric Bentzen, Associate Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-2000, Denmark, bentzen@cbs.dk

In this paper we use multiple time series to forecast the future sales, and we apply multi-equation models as an extension of regression models and simultaneous equation systems. Because we use multi-equation models we can consider a larger system which includes moving-holiday (Easter), and Christmas.

2 - The Impact of Management Heuristics on the Selection and Allocation of Resources in an R&D Portfolio

Leonardo Santiago, Assistant Professor, Federal University of Minas Gerais, Av. Antônio Carlos, 6627 - Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br, Leonardo Tavares

We discuss the impact of heuristics commonly used by decision-makers during the process of forming an R&D portfolio. We consider simple ad hoc rules to select design alternatives and allocate resources during the development process of new technologies and compare their performance with respect to the overall portfolio value.

3 - Managing Modularity of Service Process Architecture

Thomas Frandsen, PhD Candidate, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-2000, Denmark, tfr.om@cbs.dk, Juliana Hsuan

Modularity has been suggested as a way to reduce complexity and enable re-configurability in the design of service systems. However modularity paradoxically also introduce new complexities requiring management attention. We use case research to study this paradox and apply the service modularity function to capture degrees of modularity in service process architecture. We show how managers in their design efforts use management technologies to address the dilemmas they face.

4 - The Third Capability: Asset Reconfiguration, Renewal and Learning from Stakeholders

Stefan Hafliger, ETH Zurich, Kreuzplatz 5, Zurich, 8032, Switzerland, shaefliger@ethz.ch, Fotini Pachidou, Georg von Krogh

With fundamental discoveries becoming rare in mature industries, the need to reconfigure existing assets receives more attention. The third dynamic capability focuses on the reconfiguration and renewal of existing assets and describes how such a reconfiguration may contribute to sustaining the performance of tangible and intangible assets. The market for mature drugs offers variance in the success of asset renewal activity and we study the treatment of Alzheimer's disease.

■ TA41

H - Waring Room - 4th Floor

Empirical Work in New Product Development, Innovation and R&D Management

Cluster: New Product Development

Invited Session

Chair: Bilal Gokpinar, Assistant Professor, University College London, Management Science and Innovation, London, United Kingdom, b.gokpinar@ucl.ac.uk

1 - Risk Management in Complex Information Technology (IT) Programs: The Role of Process Maturity

Anant Mishra, George Mason University, 4400 University Drive, VA, 22030, United States of America, amishra6@gmu.edu, James Murray, Sidhartha Das

Organization-wide IT initiatives are frequently organized in the form of complex IT programs that involve multiple projects spanning diverse knowledge bases and a number of partners. Managing risks in such programs is a matter of serious concern for managers. Using time series panel data collected from 75 IT programs within a global high technology firm, this study identifies a set of program completion risks and examines the role of process maturity (SEI-CMMI) level in mitigating such risks.

2 - Knowledge Diversity, Turnover and Team Performance: An Empirical Analysis

Sriram Narayanan, Assistant Professor, Michigan State University, Eli Broad College of Business, N370 North Business Complex, East Lansing, MI, 48824-1122, United States of America, sriram@msu.edu, Jayashankar Swaminathan, Srinivas Talluri

We examine the role of diversity as separation and diversity as variety in determining team level productivity in the context of software maintenance. Our analysis focuses on two key diversity metrics: diversity as separation and diversity as variety. In addition to examining the impact of diversity on team productivity, we seek to better understand the interplay between diversity measures and show how different attributes of diversity assist/ deter team level productivity when turnover occurs.

3 - The Effects of Feedback and Organizational Learning on Product Design and Development

Bilal Gokpinar, Assistant Professor, University College London, Management Science and Innovation, London, United Kingdom, b.gokpinar@ucl.ac.uk

The iterative process of product design and development does not come to an end once the product reaches the market. Instead, companies learn a great deal about their products from their customers, distributors and regulatory bodies after their products are on the market. In this study, by combining two unique data sets, we examine the role of these different feedback mechanisms on organizational learning and their effects on subsequent design and development efforts.

4 - Unsolicited Customer Input (UCI) and New Service Development (NSD)

Amitkumar Kakkad, PhD Student, London Business School, Sussex Place, Regent's Park, London, W12 0UB, United Kingdom, akakkad.phd2005@london.edu

This paper examines the role of Unsolicited Customer Input (UCI) in NSD & Service Innovation (SI). Extant literature has mostly explored Solicited Customer Input (SCI) in the context of NSD, whereas UCI has largely been studied only in the context of service recovery. This paper analyzes the role that UCI can play in NSD and SI through multiple case studies and a large-scale survey of service firms. Results strongly support the model proposed and lead to many promising ideas for future research.

■ TA42

H - Gwynn Room - 4th Floor

Contracts, Incentives and Sourcing

Sponsor: Information Systems Society

Sponsored Session

Chair: Anjana Susarla, Carnegie Mellon, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, anjanas@andrew.cmu.edu

1 - Network Structure and Competitive Dynamics in IT Outsourcing

Kiron Ravindran, IE Business School, Marìa de Molina, 11. 28006 Madrid, Spain, kiron.ravindran@ie.edu, Yingda Lu, Anjana Susarla

We consider a network based logic to understand competitive positioning and market segmentation strategies in IT outsourcing by examining the dynamics of tie formation in the overall buyer supplier network.

2 - Pricing, Contract Structure and Quality Outcomes in Offshore Outsourcing

Ravi Aron, Assistant Professor, Johns Hopkins Carey Business School, 100 International Drive, Room 1331, Baltimore, MD, 21202, United States of America, raviaron@jhu.edu, Praveen Pathak

We study how the pricing structure of offshore outsourcing of services impacts on outcomes such as a quality of output and customer satisfaction. We study pricing schemes such as time and materials (cost plus), fixed fee, transaction pricing, outcome-based pricing and hybrid pricing – a combination of the four – impact on outcomes such as quality of output, customer satisfactions and growth in the size of the contract.

3 - Optimal Software Outsourcing Contracts with Non-Verifiable Quality

David Zeng, University of California Irvine, Irvine, CA, United States of America, qzeng04@exchange.uci.edu, Shivendu Shivendu

We model a software application outsourcing relationship wherein a client offers contracts for software development and support. Quality of delivered software is impacted by intrinsic capability and effort, but is not contractible. We show that the client uses free maintenance support period as a screening device and first-best is achieved under certain conditions even in the presence of adverse selection, moral hazard and non-verifiability.

4 - Offshore Delivery of Healthcare Services: Effectiveness of E-Channels of Information

Praveen Pathak, Univesity of Florida, 8325 SW 16th Pl, Gainesville, FL, 32607, United States of America, praveen.pathak@warrington.ufl.edu, Deepa Mani

The offshore delivery of healthcare services to globally located patients is a vast and growing business segment. Consumers of healthcare world over shop for services from providers located in countries such as Singapore, India, Thailand and Mexico. We study how consumers process information from offshore healthcare service providers from different channels available to them. In particular we compare and contrast the effectiveness of information delivery of electronic and manual channels.

■ TA43

H - Suite 402 - 4th Floor

Modeling Natural Gas Markets with OR Techniques

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Olivier Massol, Assistant Professor, IFP School, Center for Economics & Management, 228-232 avenue Napoleon Bonaparte, Rueil-Malmaison, 92852, France, olivier.massol@ifpen.fr

1 - A Generalized Nash Model for the European Gas Market with a Fuel Substitution Demand: GaMMES

Ibrahim Abada, EDF R&D, 1 Avenue Général de Gaulle, Clamart, 92140, France, ibrahim.abada@ifpen.fr, Vincent Briat, Steven Gabriel, Olivier Massol

We present a Generalized Nash-Cournot model of the gas markets. The major gas chain players are depicted. We consider market power and the demand representation captures the fuel substitution. Long-term contracts are endogenous. The model is a Generalized Nash Equilibrium problem. It has been applied to represent the European gas market and forecast consumption, prices, production and foreign dependence. We studied the evolution of the natural gas price as compared to the coal and oil prices.

2 - Two-stage Risk Hedging Capacity Allocation and Equilibrium in the Natural Gas Future Market Network

Parviz Darvish, PhD Candidate, ESSEC Business School, Avenue Bernard Hirsch, BP 50105 Cergy,, Cergy-Pontoise Cedex, Cergy, 95021, France, parviz.darvish@essec.edu, Fernando Oliveira

We address the problem of the risk spreading in the natural gas future market. In this work, we aim at finding the optimal network capacities at the future market regarding interactions between different network participants and Nash equilibrium in the existence of the randomness in the demand side. In a two-stage replicated procedure, we achieve the optimal flows and prices based on the MCP programming and the optimal capacities for mitigating the diffused risk into this network.

3 - A New Method for EPECs and MPECs with an Application to Natural Gas Markets

Steven Gabriel, University of Maryland, 1143 Martin Hall, Department of Civil & Env. Eng., College Park, MD, 20742, United States of America, sgabriel@umd.edu, Sauleh Siddiqui

We present a new method based on Schur's decomposition and SOS1 variables that can solve both MPECs and EPECs. We provide the methodology, why it works and an application to natural gas markets.

4 - Export Diversification and Resource-based Industrialization: The Case of Natural Gas

Olivier Massol, Assistant Professor, IFP School, Center for Economics & Management, 228-232 avenue Napoleon Bonaparte, Rueil-Malmaison, 92852, France, olivier.massol@ifpen.fr, Albert Banal-Estanol

For a small economy, the ownership of natural gas resources is usually described as a blessing, but past performances reveal a curse caused by the large variability of export revenues. A modified mean-variance portfolio model is thus proposed to design a diversification strategy centered on resource-based industries. Using a time-series model of commodity prices, this model is put at work to: analyze the efficient frontier, and evaluate the policies implemented in nine economies.

■ TA44

H - Suite 406 - 4th Floor

Managing Supply Chain Disruptions

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Kash Barker, University of Oklahoma, School of Industrial Engineering, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, kashbarker@ou.edu

1 - Quantifying the Interdependent Effects of Supply Chain Disruptions and Mitigation Strategies

Cameron MacKenzie, PhD Candidate, University of Oklahoma, School of Industrial Engineering, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, cmackenzie@ou.edu, Kash Barker

We deploy a risk-based interdependency model to analyze the broader impacts of supply chain disruptions. Potential industry strategies for coping with these disruptions include maintaining inventory, buying from multiple suppliers, and substituting one input for another. We find the equilibrium points as determined by the disruption and a company's optimal strategy and explore the dynamics of moving between equilibria. A input-output model quantifies the impacts of this dynamic production model.

2 - A Bi-criteria Measure to Assess Supply Chain Network Performance for Critical Needs

Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts - Amherst, Eugene M. Isenberg School of Management, Amherst, MA, 01003, United States of America, nagurney@gbfin.umass.edu, Patrick Qiang

We develop a supply chain/logistics network model for critical needs in the case of disruptions. The objective is to minimize the total network costs, which are generalized costs that may include the monetary, risk, time, and social costs. The model assumes that disruptions may have an impact on both the network link capacities and on the product demands. Two different cases of disruption scenarios are considered.

3 - Managing Disruptions in Decentralized Supply Chains with Endogenous Supply Reliability

Sammi Tang, Assistant Professor, University of Miami, Department of Management, 5250 University Drive, Coral Gables, FL, 33146, United States of America, ytang@bus.miami.edu, Haresh Gurnani, Diwakar Gupta

We study how decentralized firms can utilize proactive risk management techniques to reduce supply disruption risk. Supplier reliability is assumed to be endogenous and the buyer may provide an incentive to the supplier to invest in process investment effort. We study the effectiveness of different incentives, and compare the incentive strategy with the diversification strategy.

■ TA45

H - Suite 407 - 4th Floor

Auctions and Trading Agents

Cluster: Auctions

Invited Session

Chair: Wolf Ketter, Assistant Professor, Rotterdam School of Management, Burgemeester Oudlaan 50, T9-07, Rotterdam, 3062PA, Netherlands, WKetter@rsm.nl

1 - Autonomous Trading in Simulated Dutch Flower Auctions

Eric Sodomka, PhD Student, Brown University, 115 Waterman ST, 4th Floor, Providence, RI, 02912, United States of America, sodomka@cs.brown.edu, Wolf Ketter, Jordan Berg, Amy Greenwald, Yixin Lu, Eric van Heck

The Dutch flower auction (DFA) network is the largest in the world, accounting for nearly two-thirds of the global flower trade. Bidding in these simultaneous, sequential, multi-unit auctions is non-trivial, and testing various bidding strategies can be costly. We develop a simulation of the DFA in which trading is autonomous and evaluate bidding strategies in this domain.

2 - A Structural Estimation of Bidding Behavior in overlapping Online Auctions

Lin Hao, University of Washington Seattle, Foster School of Business, Seattle, WA, United States of America, linhao@uw.edu, Arvind Tripathi, Yong Tan

This research explores bidding behavior in overlapping online auctions of identical items where auctioneers can vary the amount of overlap between successive auctions. We investigate how the information about upcoming auctions affects bidding behavior in the current auction. We develop a structural model and estimate it with the online auction data. Our results reveal that how auction-level and bidder-level covariates affect bidding behavior in overlapping auctions.

3 - Exploring Bidder Heterogeneity in B2B Auctions: Evidence from the Dutch Flower Auctions

Yixin Lu, PhD Student, Rotterdam School of Management, Burgemeester Oudlaan 50, T9-16, Rotterdam, 3062PA, Netherlands, ylu@rsm.nl, Alok Gupta, Wolf Ketter, Eric van Heck

We study the expert bidding behavior in a dynamic, complex B2B environment. Using bidding data from different auction access, we develop a stable taxonomy of bidder behavior containing four types of bidding strategies. Bidders pursue different bidding strategies that, in aggregate, realize different surplus. We demonstrate how the taxonomy of bidder behavior can be used to enhance the design of real-time decision support systems for auctioneers and bidders.

4 - Electric Vehicle Charging Coordination via a Time-dependent Tariff

Clemens van Dinther, Karlsruhe Institute of Technology, Kaiserstr. 12, Karlsruhe, D-76128, Germany, Clemens.vanDinther@kit.edu, Wolf Ketter, Jörn C. Richstein, Alexander Schuller

The market share of electric vehicles will increase until 2020. In order to avoid peaks and distribution system instability, charging of EVs has to be coordinated. Sustainability is only ensured if a high share of renewable energy is used for charging. We present a broker agent offering a special tariff considering renewable energy infeed, charging decisions by EV owners and empirical driving profiles. The agent's objective is to minimize cost while ensuring a maximum supply of renewable energy.

■ TA46

H - Suite 403 - 4th Floor

Teaching OR More Analytically

Sponsor: INFORM-ED

Sponsored Session

Chair: Peter Bell, University of Western Ontario, Richard Ivey School of Business, London, ON, N6A 3K7, Canada, pbell@ivey.uwo.ca

1 - Special Session: Teaching OR More "Analytically"

Peter Bell, University of Western Ontario, Richard Ivey School of Business, London, ON, N6A 3K7, Canada, pbell@ivey.uwo.ca
Mehmet Begen, Assistant Professor, Ivey School of Business - University of Western Ontario, 1151 Richmond St., London, ON, N6A3K7, Canada, mbegen@ivey.uwo.ca

The interest from INFORMS in addressing the Business Analytics audience suggests that we investigate ways we can include more Business Analytics in our teaching of OR. This workshop will examine a framework for linking OR into Business Analytics and suggest some easy steps that OR instructors can take to include more Business Analytics materials into the basic OR course.

■ TA47

H - Dunn Room - 3rd Floor

Maritime Logistics

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Dimitri Papageorgiou, Ph.D. Candidate, Georgia Tech, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, djpapag@gatech.edu

1 - Solving Massive-Scale Maritime Inventory Routing Problems

Dimitri Papageorgiou, Ph.D. Candidate, Georgia Tech, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, djpapag@gatech.edu, George Nemhauser, Joel Sokol, Ahmet Keha

We describe aggregation and decomposition techniques for solving massive-scale deterministic maritime inventory routing problems. "Standard" mixed-integer programming formulations of these problems involve tens of millions of binary decision variables and tens of millions of constraints and lead to LP relaxations that require hours to solve, assuming they can be loaded into memory. Approaches for obtaining good feasible solutions and useful bounds are presented.

2 - Practical Methods for LNG Inventory Routing

Samid Hoda, ExxonMobil, 3120 Buffalo Speedway, Houston, TX, 77098, United States of America, samid.hoda@exxonmobil.com, Yufen Shao, Vikas Goel, Kevin Furman

We introduce a practical problem for simultaneous optimization of ship routing and inventory management of LNG. Even though this ship inventory routing problem and the conventional Inventory Routing Problem have similar structures, differences arise in the application specifically to the LNG industry. We develop a discrete time optimization model and heuristic algorithms for solving annual delivery plans. Computational results comparing various algorithmic approaches are presented.

3 - A Comparative Study of the Crude Oil Scheduling Models

Chen Xuan, Tsinghua University, Tsinghua University, Beijing, China, chenxuanhanhao@gmail.com, Ignacio Grossmann

This work presents a comparative analysis of different representations and formulations for the crude oil scheduling problem. We focus on the unit-specific continuous time model and the multiple operations sequence model, which are the most effective two formulations reported in the literature. We extend the models to incorporate more complex practical logistics constraints. Pros and cons of different models are highlighted based on extensive experiments and analysis.

4 - Valuing Flexibility in the Operation of Assets in the LNG Value Chain

Peter Schütz, SINTEF Applied Economics, P.O. Box 4760 Sluppen, Trondheim, 7465, Norway, peter.schutz@sintef.no, Ruud Egging

We present a multi-stage stochastic programming model for planning the operations of a Liquefied Natural Gas value chain. The goal is to examine the effect and monetary value of having flexibility in the system (e.g. in storage capacity or routing of vessels). We study a value chain consisting of 2 liquefiers and 3 regasifiers over a planning horizon of 3 months. We include capacity constraints and other operational characteristics combined with uncertainty in LNG and local spot market prices.

■ TA48

H - Graham Room - 3rd Floor

Advances in Traffic Signal Control

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Nathan H. Gartner, Professor, University of Massachusetts Lowell, Department of Civil and Environmental Eng., One University Avenue, Lowell, MA, 01854, United States of America, Nathan_Gartner@uml.edu

1 - A Dynamic Programming Approach for Arterial Signal Optimization with Link Dependent-Performance Functions

Nathan H. Gartner, Professor, University of Massachusetts Lowell, Department of Civil and Environmental Eng., One University Avenue, Lowell, MA, 01854, United States of America, Nathan_Gartner@uml.edu, Rahul Deshpande

Traffic signals reduce delays and provide smooth flow conditions. We present a model that considers flow interactions among successive links and applies it in a dynamic programming procedure to determine optimal signal settings. The procedure is applicable to both arterial streets and arterial networks. Computational effort is proportional to the max node cut-set of the network. Performance is compared with existing signal optimization programs.

2 - A Bilevel Model of Traffic Signal Control with an Embedded Cell Transmission Model

Adbul Aziz, PhD Student, Purdue University, 150 Arnold Dr., Apt #15, West Lafayette, IN, 47906, United States of America, haziz@purdue.edu, Satish Ukkusuri, Kien Doan

A bilevel mathematical program is proposed accounting for the interdependency of signal control and dynamic traffic assignment in the context of transportation planning. An enhanced cell transmission model (as a mixed integer program) without the holding back problem considering multiple origins and destinations is adapted as the embedded traffic flow model. Proposed signal control schemes show better performance when compared to fixed timing plans.

3 - Robust Control for Traffic Networks: The Near Bayes Near Minimax Strategy

Nathan H. Gartner, Professor, University of Massachusetts Lowell, Department of Civil and Environmental Eng., One University Avenue, Lowell, MA, 01854, United States of America, Nathan_Gartner@uml.edu, Lee Jones, Rahul Deshpande, Chronis Stamatiadis, Fei Zou

This paper addresses the problem of determining robust signal controls in a traffic network which (a) consider the interdependency of signal controls and flow patterns and (b) account for the variability or uncertainty in the origin-destination demands. The approach taken is to consider the uncertainty in the origin-destination demands concurrently with the design changes to produce a "best" control strategy that readily accounts for this uncertainty.

4 - Vehicle Queue Location Estimation of Signalized Intersections Using Sample Travel Times from Mobile Sensors

Hao Peng, Rensselaer Polytechnic Institute, 110 Eighth Street, Troy, NY, 12180, United States of America, haop@rpi.edu, Jeff Ban

We discuss how sample intersection travel times can be used to estimate the location of a (queued) vehicle in the queue of a traffic signal. The method focuses on the queue discharging process when the signal turns green and thus does not impose any assumption on the vehicle arrival process at the intersection.

5 - Microscopic Traffic State Estimation Based on a Stochastic Three-detector Approach

Wen Deng, Visiting Student, University of Utah, 110 Central Campus Dr, Salt Lake City, UT, 84112, United States of America, winddengwen@gmail.com, Xuesong Zhou

We extend Newell¤s deterministic three-detector model to a stochastic case through a novel use of Clark¤s approximation method for Probit functions. Linear measurement equations are constructed to estimate evolution of cell-based microscopic traffic states by using data sources from point, AVI and mobile probe sensors.

■ TA49

H - Graves Room - 3rd Floor

Simulation Meets the Multi-Armed Bandit

Sponsor: Simulation

Sponsored Session

Chair: Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

1 - Optimal Strategies for Discrete Optimization with Noisy Evaluations

Sebastien Bubeck, Princeton University, Department of Operations Research and Financial Engineering, Sherrerd Hall, Charlton Street, Princeton, NJ, United States of America, sebastien.bubeck@gmail.com

In this talk we investigate the problem of discrete optimization with a finite number of noisy evaluations. While at first, one may think that simple repeated sampling can overcome the difficulty introduced by noisy evaluations, it is far from being an optimal strategy. Indeed, to make the best use of the evaluations, one may want to estimate more precisely the seemingly best options, while for bad options a rough estimate might be enough. This reasoning leads to non-trivial algorithms.

2 - May The Best Man Win: Simulation Optimization for Match-making in E-sports

Ilya Ryzhov, Princeton University, Princeton, NJ, United States of America, iryzhov@Princeton.edu, Warren Powell, Awais Tariq

We consider the problem of automated match-making in a competitive online gaming service. Existing mathematical models for this problem assume that each player has a skill level that is unknown to the game master. As more games are played, the game master's belief about player skills evolves according to a Bayesian learning model. We propose a new decision-making policy in this setting, based on the knowledge gradient concept from the literature on optimal learning.

3 - Sequential Bayes-optimal Policies for Multiple Comparisons with a Control

Jing Xie, Cornell University, 232 Rhodes Hall, Ithaca, NY, United States of America, jx66@cornell.edu, Peter Frazier

We consider the problem of efficiently allocating simulation effort to support multiple comparisons with a standard. Using a Bayesian formulation, we show that the optimal fully sequential policy is the solution to a dynamic program. We show that this dynamic program can be solved efficiently, and the Bayes-optimal allocation policy is found, using techniques from optimal stopping and multi-armed bandits. We apply the resulting policy to an application in ambulance positioning.

■ TA50

H - Ardrey Room - 3rd Floor

Behavioral Analyses of Human Planners

Sponsor: Behavioral Operations Management

Sponsored Session

Chair: Jan C. Fransoo, Professor, Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, Pav F4, Eindhoven, 5600 MB, Netherlands, j.c.fransoo@tue.nl

1 - Planning for the Planning Fallacy

Yael Grushka-Cockayne, University of Virginia, Darden School of Business, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, GrushkaY@darden.virginia.edu, Bert De Reyck, Daniel Read

The media are full of stories in which projects underperform; cost too much, take too long, and deliver too little. Studies on representative samples of projects, both public and private, show that the average project underperforms; this general tendency is called the planning fallacy. Using data from a wide range of past projects, we explore the reasons for the planning fallacy, in effort to support project managers and planners in overcoming the fallacy and better estimating project outcomes.

2 - Leveraging Supply Chain Control Towers: Matching Scheduling Jobs to Schedulers

Jose A. Larco Martinelli, Eindhoven University of Technology, School of Industrial Engineering, Eindhoven, Netherlands, j.a.larco.martinelli@tue.nl, Vincent Wiers, Eva Demerouti, Jan C. Fransoo

We present a field study at a supply chain control tower where schedulers are collocated in one facility. Economies of scope that can be obtained in control towers include higher learning rates and the possibility of using job redundancy for coping with leave days. Assigning scheduling jobs to schedulers is then critical for obtaining such economies of scale. We then propose ways to characterize heterogeneous scheduling jobs and schedulers for scheduler allocation decisions.

3 - Overcoming Barriers to the Scalability of Supply Chain and Production Analytics in Multiunit Firms

Hüseyin Tanriverdi, Associate Professor, The University of Texas at Austin, IROM Department CBA 5.202 B6500, 1 University Station, Austin, TX, 78712, United States of America, huseyin.tanriverdi@mccombs.utexas.edu

Firms face barriers in scaling up IT-enabled analytics across their supply chains and production plants. We present case study evidence from Fortune100 firms to explain how successful firms: 1) architect their supply chain and production analytics for scalability, 2) deploy them across multiple supply chains and production plants, 3) upgrade skill and expertise profiles of planners, 4) monitor quality of decisions, and 5) compare business outcomes of the decisions with and without the analytics.

4 - Meta-analysis of the Relation between Worker-oriented and Operational Lean Practices and Performance

Jan Riezebos, Associate Professor of Operations, Program Ddirector of Technology Management, University of Groningen, P.O. Box 800, Groningen, 9700AV, Netherlands, j.riezebos@rug.nl, Dirk Pieter van Donk, Nick Ziengs

Lean practices and worker behavior are both important determinants of operational performance in production systems. Nevertheless, they are frequently implemented separately. Based on a meta-analysis of earlier empirical work in the fields of JIT, TQM and TPM we show the strength of the relations between these practices and performance. The results suggest that worker-oriented practices should not solely be considered as antecedents of operational practices.

■ TA51

H - Caldwell Room - 3rd Floor

Network Evacuation and Dynamic Modeling

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Tao Yao, Assistant Professor, The Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu

1 - An Agent Based Modeling Approach Integrating Household Level Behavior with Traffic Simulation

Samiul Hasan, PhD Student, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, hasan1@purdue.edu, Satish Ukkusuri, Kien Doan, Rodrigo Mesa Arango

Current transportation evacuation models largely overlook the complexity of household decision making behavior and as a result, fail to model the complex interactions in evacuation decision making. In this work an agent-based simulation model is developed incorporating the behavior of individual household vehicle (agent) decision and its interaction with the environment during a hurricane.

2 - Robust and Dynamic Models for Evacuation

Tao Yao, Assistant Professor, The Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Byung Do Chung, Bo Zhang, Andreas Thorsen

In this talk, we discuss the difficulties of mathematical programming due to the inherent uncertain nature of disaster and propose a computationally tractable robust optimization approach based on dynamic traffic assignment (DTA) model. Computational results demonstrate the advantage of the proposed approach compared to the deterministic or stochastic method.

3 - Congested Network Flows over Time for Evacuation Planning

Douglas Bish, Assistant Professor, Virginia Tech, Department of ISE, 250 Durham Hall, Blacksburg, VA, 24061-0118, United States of America, drb1@vt.edu, Edward Chamberlayne, Hussein Tarhini

Optimal planning for automobile-based regional evacuations can be developed using network flows over time. This methodology allows for the exploration of various strategies (e.g., staging or staggering evacuee flows, routing flows, and contra-flow planning). These are difficult problems, especially as models that adequately describe traffic flow often have non-convex feasible regions. In this presentation we examine appropriate network models for this problem and discuss modeling issues.

4 - Spatial Risk Assessment and Its Implications in Demand Management for Evacuation Operations

Yu-Ting Hsu, Purdue University, Nextrans Center, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, yhsu@purdue.edu, Srinivas Peeta

We propose a systematic approach to determine an Evacuation Risk Zone (ERZ), which encloses the population sustaining the highest risk under evacuation operations. The ERZ is derived based on the assessment of risk which spatially varies over the affected region, depending on disaster, demand pattern, and network structure. A stage-based operational framework of ERZ deployment is designed to account for network dynamics. Its effectiveness is illustrated and discussed using numerical experiments.

■ TA52

H - North Carolina - 3rd Floor

Facility Logistics I

Sponsor: Transportation Science and Logistics/Facility Logistics

Sponsored Session

Chair: Sadan Kulturel-Konak, Associate Professor of MIS, Pennsylvania State University, Tulpehocken Road, P.O. Box 7009, Reading, PA, 19610, United States of America, sadan@psu.edu

1 - Reducing Extended Versions of the Facility Layout Model to the Standard Form

Stein W. Wallace, Professor, Lancaster University, Department of Management Science, Lancaster, LA1 4YX, United Kingdom, Stein.w.wallace@lancaster.ac.uk, Yifei Zhao

The standard facility layout model leads to the classical quadratic assignment problem - QAP. The QAP is very hard to solve, but also comes with very strong assumptions. We add several jobs, random demand, and multiple copies of each machine type, but are still able to reduce the model to the classical QAP, leading to very strong (but not optimal) solutions. So good solutions can be found to the extended versions whenever good or optimal solutions can be found for the classical QAP.

2 - Unequal Area Facility Layout with a New Flexible Bay Representation

Sadan Kulturel-Konak, Associate Professor of MIS, Pennsylvania State University, Tulpehocken Road, P.O. Box 7009, Reading, PA, 19610, United States of America, sadan@psu.edu, Abdullah Konak

In this paper, a hybrid particle swarm optimization (PSO) and local search approach is proposed to solve the facility layout problem (FLP) with unequal area departments. The flexible bay structure (FBS), which is a very common layout in manufacturing and retail facilities, is used and it is relaxed by allowing empty spaces in bays. The comparative results show that the hybrid PSO approach is very efficient in finding the previously known-optimal solutions and some new best solutions.

3 - An Optimization-based Planning Tool for the Selection of Piece-level Order-fulfillment Technologies

Jennifer Pazour, Assistant Professor, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, United States of America, jpazour@uark.edu, Russell Meller

We develop a mathematical-programming model that jointly determines the best combination of piece-level order-fulfillment technologies and the assignment of SKUs to these technologies. We validate our methodology with industry data and show that our model provides technology recommendations and SKU assignments that are consistent with successful implementations. We also provide insights into the application of different order-fulfillment technology strategies.

4 - A Two-stage Model for Supply Chain Risk Analysis
Edward Huang, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, edwardhuang@gatech.edu, Marc Goetschalckx

We consider the efficiency and risk of a supply chain configuration in the two-stage supply chain network design problem. We compare three alternative definitions of risk that are based on the standard deviation, downside risk, and maximum regret, respectively. The goal is to identify all Pareto-optimal configurations of the supply chain. We propose an efficient algorithm for this design problem.

■ TA53

H - South Carolina - 3rd Floor

Joint Session DM/HAS: Quality and Statistical Decision Making in Health Care Applications I

Sponsor: Data Mining/Health Applications

Sponsored Session

Chair: Shuai Huang, Research Assistant, Arizona State University, 2343 West Main Street, Mesa, AZ, 85201, United States of America, shuang31@asu.edu

1 - Healthcare Physician Performance Assessment and Composite Quality Index Development
Kaibo Liu, Research Assistant, Gerogia Institute of Technology, H. Milton Stewart School of Industrial and Systems Engineering, 765 Ferst Drive, Room 331, Atlanta, GA, 30332, United States of America, kbliu@gatech.edu, Shabnam Jain, Jianjun Shi

Physician performance assessment is an important task for the purpose of cost reduction and quality improvement. In this study, we propose a generic approach to develop a single composite, severity-adjusted metric for physician performance assessment by using nonnegative principal component analysis. A new algorithm, named iterative quadratic programming, is developed to solve the numerical issue. Case studies are conducted to demonstrate the performance of the method based on a real dataset.

2 - Pharmaceutical Inventory Management under Demand and Supply Uncertainty
Samira Saedi, PhD Candidate, University of Houston, E206 Engineering Bldg. 2, Houston, TX, 77204-4008, United States of America, ssaedi@uh.edu, Erhun Kundakcioglu, Andrea Henry

The US pharmaceutical market is valued at 306 billion in 2009. However, 10% to 25% of public procurement spending is lost due to corrupt practices. Failures in pharmaceutical supply chain pose a direct threat to the quality of care and cause serious monetary implications. In this study, an inventory model is proposed that considers demand uncertainty as well as supply disruptions. Simulation results show that the proposed par levels alleviate drug shortages and reduce costs significantly.

3 - Brain Effective Connectivity Modeling for Alzheimer's Disease by Sparse Gaussian Bayesian Network
Shuai Huang, Research Assistant, Arizona State University, 2343 West Main Street, Mesa, AZ, 85201, United States of America, shuang31@asu.edu, Jing Li

This paper proposes an efficient large-scale Bayesian network structure learning algorithm to model the effective brain connectivity of both AD patients and normal aging subjects. The developed algorithm is applied to PET data collected when subjects are at their resting state. Results are consistent with previous findings in the AD literature. Some new aspects are also revealed with added value to the current connectivity research, and are worthy of further investigation.

■ TA55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS: INFORMS and the Analytics Movement: Where We've Been, Where We Are, and Where We Are Going

Sponsor: Analytics/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Michael Gorman, Professor, University of Dayton, School of Business, 2130, 300 College Park, Dayton, OH, 45469, United States of America, Michael.gorman@udayton.edu

1 - INFORMS and the Analytics Movement: Where We've Been, Where We Are, and Where We Are Going
Jack Levis, Director of Process Management, UPS, 2311 York Rd., Timonium, MD, 21093, United States of America, jlevis@ups.com

Businesses have learned that data and Analytics can be a competitive advantage. This is leading to an explosion in the use of Analytics in organizations, and a need for professionals. INFORMS needs to adjust its product offerings to become the premiere organization for Advanced Analytics professionals. We will discuss the current status and future direction for these important initiatives.

2 - Perspectives on Analytics Within INFORMS and in Industry
Matthew Liberatore, Professor, Villanova University, 800 Lancaster Avenue, Villanova, PA, 19085, United States of America, matthew.liberatore@villanova.edu, Wenhong Luo

The movement toward the increased use of analytics in organizations has generated much discussion by academics and professionals about the impacts and opportunities that analytics offers. We discuss current trends in the use of analytics with organizations and the results of a survey of INFORMS members and Analytics magazine readers on knowledge and interest in analytics and its relationship with operations research.

3 - Analytics Section and INFORMS: Where We are Going
Michael Gorman, Professor, University of Dayton, School of Business, 2130, 300 College Park, Dayton, OH, 45469, United States of America, Michael.gorman@udayton.edu

In this presentation I will discuss the Analytics Section's future plans for expanding the role of INFORMS in the Analytics space. I will discuss: 1) Analytics Section activities, 2) INFORMS objectives and opportunities in the Analytics space, and 3) How the two mesh for existing and potential INFORMS members.

■ TA56

H - Biltmore Boardroom - 2nd Floor

Healthcare Topics

Contributed Session

Chair: Xin Zhao, Xi'an Jiaotong University, School of Management, No28, Xianning West Road, Xi'an, 710049, China, zhaoxin_zzz@163.com

1 - Fourier Analysis and Its Applications to Forecast the Demand of Staff
shuping zhang, Ph.D Candidate, The University of Tennessee, Knoxville, 329 Stokely Management Center, 916 Volunteer Blvd., knoxville, tn, 37996, United States of America, szhang12@utk.edu

Fourier analysis has been used in virtually all areas of science and engineering. This research project proposes a new approach using Fourier analysis to forecast the demand for staff. We evaluate not only the frequencies but also the amplitudes of the data in the model. We also compare the results using our method with the results of simulation.

2 - Moderating Effect of Achievement Goal Orientation in Work Stress: An Interesting Finding
Xin Zhao, Xi'an Jiaotong University, School of Management, No28, Xianning West Road, Xi'an, 710049, China, zhaoxin_zzz@163.com, Xiping Zhao, Mi Zhou

Through Lazarus' cognitive appraisal lens, this article tests the moderating effect of achievement goal orientation in the mechanism by which work stress is generated, using data from 357 Chinese nurses. Results demonstrate that performance orientation and the combination of mastery orientation and performance orientation moderate the relationship between job demands and work stress. Interestingly, whether mastery orientation does work depends on performance orientation in work stress process.

3 - Optimal Placement of Screenings for Preclinical Cancer with Logconcave Disease-free Times

Ang Li, Graduate Student, Texas A&M University, 241 Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843, United States of America, isela@tamu.edu

Certain cancers have a pre-clinical period in which treatments are available that can completely cure the disease. In this study, we take the cancer-free period as logconcave, and take the disease-free period as any uniform distribution. Our objective is to place N screening times to maximize the probability of capturing the cancer during the disease-free period. We show that a unique optimal sequence of screening times exisits, and we find it by a simple binary search algorithm.

■ TA57

W - Providence I- Lobby Level

Simulation and Analysis of the Air Transportation System

Sponsor: Aviation Applications

Sponsored Session

Chair: Akira Kondo, Senior Research Analyst, Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC, 20591, United States of America, akira.kondo@faa.gov

1 - A Simulation Model for Analyzing Promptness in Arrivals and Departures in LAN Airlines

Pedro Gazmuri, Depto. de Ingeniería Industrial y de Sistemas, Pontificia Universidad Católica de Chile, Chile, pgazmuri@ing.puc.cl, Rodolfo Cuevas

We present a stochastic simulation model for analyzing promptness in arrivals and departures of all commercial flights of LAN airlines. The model considers a collection of possible causes of disruptions and delays. The main output of the model is the number of flights that depart and land on time. Our model is been used routinely by the company for building robust schedules of flight.

2 - Airport Departure Process Modeling Using Colored Stochastic Petri Nets

Poornima Balakrishna, Research Engineer, Sensis Corporation, 11111 Sunset Hills Road, Ste 130, Reston, VA, United States of America, pbalakri@sensis.com, Tony Diana, Akira Kondo, Ray Young

We model the airport departure process using colored stochastic Petri nets and airport surveillance data. We analyze this formal specification of the probabilistic airport system through simulation. The use of surveillance data in the model enables identification of bottlenecks on the airport surface, such as gate area holds and runway queues. We present a case-study of JFK airport and report on airport performance through analysis of queue lengths, delays and resource utilization.

3 - Delay Propagation on Network vs. Point-to-Point Carrier Operations

Akira Kondo, Senior Research Analyst, Federal Aviation Administration, 800 Independence Avenue, SW, Washington, DC, 20591, United States of America, akira.kondo@faa.gov

In a sequence of flights operated by the same tail-numbered aircraft, delays are likely to accumulate and have ripple effects on others downstream. Propagated delays are stochastic, making it difficult for airlines to build a reliable and robust schedule. This paper examines propagated delays in terms of a root delay in flight sequences and low-cost carriers and shows that the point-to-point carrier under investigation propagates more delays than the legacy carrier that operates a network.

■ TA58

W - Providence II - Lobby Level

Logistics and Supply Chain Modeling & Simulation

Sponsor: Military Applications Society

Sponsored Session

Chair: Susan Laird, Sr. Operations Research Analyst, Naval Air Systems Command, 47060 McLeod Road, Patuxent River, MD, 20670, United States of America, susan.laird@navy.mil

1 - Using M&S to Develop Buffered Supply Chains and Redefine Spares Management

Susan Laird, Sr. Operations Research Analyst, Naval Air Systems Command, 47060 McLeod Road, Patuxent River, MD, 20670, United States of America, susan.laird@navy.mil, David Solomon

The development of a library of simulation components that will allow planners to rapidly develop high candidate spares requirements based upon expected utilization, readiness and sortie generation goals, readily available equipment, footprint, and expected transportation assets. This presentation will discuss the origin of this requirement, its development which is in work, and the challenges associated with the development of these simulations.

2 - An Approximate Approach for the Joint Problem of Level of Repair Analysis and Spare Arts Stocking

Marco Schutten, University of Twente, Fac. Management and Governance, P.O. Box 217, Enschede, 7500 AE, Netherlands, m.schutten@utwente.nl, Erhan Kutanoglu, Rob Basten, Matthieu van der Heijden

There has been a lot of attention for the spare parts stocking problem: given a product design, a repair network, and a target availability, which amount of spare parts to stock at which locations? The level of repair analysis (lora) problem is about which components to repair upon failure and where to perform them. We propose to solve the joint problem of lora and spare parts stocking iteratively. We show that our approach is close to optimal and may provide large cost savings in practice.

3 - A Multi-Criteria Approach to Performance Based Contract for a Variable System Fleet

Tongdan Jin, Assistant Professor, Texas State University, 601 University Drive, San Marcos, TX, 78666, United States of America, tj17@txstate.edu, Chen-Han Sung

We propose a multi-criteria decision model to optimize reliability and spare parts stocking with the goal of minimizing lifecycle cost and improving system availability. We consider the situation where the installed base or the system fleet size randomly increases over the contractual period, resulting in a non-stationary parts demand stream. A multi-phase inventory policy is proposed to adaptively replenish the base stock to meet the time-varying demand.

■ TA59

W - Providence III - Lobby Level

Energy Service and Sustainability

Sponsor: Service Science

Sponsored Session

Chair: Ajay Deshpande, IBM T J Watson Research Center, 19 Skyline Drive, Hawthorne, NY, 10532, United States of America, ajayd@us.ibm.com

1 - Smarter Energy Service: Residential Energy Conservation through Active User Engagement

Ajay Deshpande, IBM T J Watson Research Center, 19 Skyline Drive, Hawthorne, NY, 10532, United States of America, ajayd@us.ibm.com, Younghun Kim, Ming Li, Jing Dai, Sambit Sahu, Milind Naphade

We have designed and implemented a Smarter Energy Service that provides residents multi-resolution views of their energy usage, deep insights and customized energy saving activities. The service collects 15 min resolution usage data from smart meters, employs sophisticated data analytics, and offers a dynamic web portal to visualize the data and engage users. We have deployed the service to 850+ households in Dubuque, IA. We present features of the service and interim energy saving results.

2 - Portfolio Management in Spot and Bilateral Electricity Markets
Reinaldo Garcia, Associate Professor, University of Brasilia - UnB, Faculty of Technology, Brasilia, 70910-900, Brazil, rcgarcia@unb.br, Javier Contreras, Virginia Gonzalez

We propose a model to optimally allocate the energy between spot and bilateral contract markets using modern portfolio theory. An optimal risky portfolio is obtained and risk management is performed based on a GARCH prediction model that is able to predict prices and volatilities in a dynamic fashion.

3 - Intelligent Weakness Detection in Power Distribution Network for Electricity User Service Enhancement
Feng Gao, Research Staff Memeber, IBM Research, Building 19A, Zhongguancun Software Park, Haidian District, Bejing, 100193, China, gfgao@cn.ibm.com, Xinjie Lv, Tianzhi Zhao, Jinyan Shao, Hairong Lv, Jin Dong

Intelligent weakness detection automatically detects weakness of power distribution network to ensure its safe, reliable and stable operation. Thereafter high power quality service requirement from electricity end users can be satisfied. Intelligent weakness detection performs fault/defect analysis, operation status analysis, etc. based on network analysis, index evaluation and expert system.

■ TA60

W - College Room - 2nd Floor

Aspects of Semidefinite and Quadratic Optimization

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Miguel Anjos, Ecole Polytechnique de Montreal, Mathematics & Industrial Engineering, Montreal, QC, Canada, :miguel-f.anjos@polymtl.ca

1 - Bad Semidefinite Programs: They All Look the Same
Gabor Pataki, University of North Carolina at Chapel Hill, Hanes Hall, 307, Chapel Hill, United States of America, gabor@unc.edu

Motivated by the curious similarity of known, pathological SDP instances (with nonattainment, or duality gaps), we find an exact, combinatorial characterization of semidefinite systems, which are badly behaved from the viewpoint of duality. We also prove an "exluded minor" type result, i.e. that — surprisingly — all badly behaved semidefinite systems can be reduced (in a well defined sense) to a minimal such system with just one variable, and two by two matrices.

2 - A Dynamic Learning Algorithm for Online Quadratic Problem
Rui Yang, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Avenue, Urbana, IL, 61801, United States of America, ruiyang1@illinois.edu, Jiming Peng

We consider a generic quadratic programming model under online setting. The model covers applications like incremental support vector machine, online portfolio selection and online continuous quadratic knapsack problem. Under the distribution-free permutation model and some mild assumptions, we propose a near optimal dynamic learning algorithm for this online problem. The results can be used to make better decisions when facing online problems with quadratic objective function.

3 - Direct Representation of the Resolution Rule Via Semidefinite Programming
Miguel Anjos, Ecole Polytechnique de Montreal, Mathematics & Industrial Engineering, Montreal, QC, Canada, miguel-f.anjos@polymtl.ca, Manuel Vieira

We use the language of semidefinite optimization relaxations to describe the resolution rule process for determining whether a logical formula in conjunctive normal form is satisfiable. More specifically, we represent one step of resolution using semidefinite optimization. We also comment on how this will likely lead to new insights on the relationships between semidefinite relaxations and satisfiability.

■ TA61

W - Sharon Room - 2nd Floor

Maritime Transportation

Contributed Session

Chair: Yueqiong Zhao, Student, Florida Atlantic University, 638 nw13th street, apt26, Boca Raton, FL, 33486, United States of America, zhaoyueqiong@gmail.com

1 - Strategic Fleet Renewal in Shipping – Considering Uncertainty
Rikard Bakkehaug, Norwegian University of Science and Technology, Ole Aasvedsveg 35, Trondheim, 7048, Norway, rikard.bakkehaug@gmail.com, Kjetil Fagerholt, Eirik Eidem, Lars Magnus Vattum

When planning the future fleet composition maritime shipping companies have to deal with a lot of uncertainty. In this paper we implement a stochastic programming model to take this uncertainty into account. The model is used to determine what ship types to buy when, and when to sell them. Results from multiple simulations are used to compare the deterministic and the stochastic model and draw conclusions.

2 - A Simulation Study of Berthing Policies and Yard Allocation Rules in Container Terminals
Matthew Petering, Associate Professor, The Kuehne Logistics University, Brooktorkai 20, Hamburg, 20457, Germany, matthew.petering@the-klu.org, Frank Meisel

Minimizing the port stay time of container vessels requires short waiting times before berthing and high quay crane handling rates. Waiting times are minimized by berthing vessels at the earliest opportunity whereas high crane productivity is achieved if a vessel waits for the berth closest to the yard area where its containers are stored. We present a simulation study that jointly evaluates berthing policies and yard allocation rules to identify the strategies that minimize vessels' port stays.

3 - Modeling and Simulation on the Yard Trailers Deployment in a Maritime Container Terminal
Yueqiong Zhao, Student, Florida Atlantic University, 638 nw13th street, apt26, Boca Raton, FL, 33486, United States of America, zhaoyueqiong@gmail.com, Evangelos I. Kaisar

In order to increase the efficiency of operations in container terminals, a mathematical model is developed to simulate the Dynamic Yard Trailers operations. The objective is to evaluate the solutions to find the proper number of Yard Trailers with the minimal cost. The Monte Carlo method and Brute-Force Search are employed to find the best feasible solution. The numerical test results suggest that this method is good for use in conjunction with simulation of container terminal operations.

■ TA62

W - Independence Room - 2nd Floor

Biofuels and Renewable Sources

Contributed Session

Chair: Michael Hilliard, Research Staff, Oak Ridge National Laboratory, One Bethel Valley Road, P.O. Box 2008, MS-6054, Oak Ridge, TN, 37831-6054, United States of America, hilliardmr@ornl.gov

1 - A Simulation of Early Cellulosic Biofuel Infrastructure in the US
Nathan Parker, Postdoctoral Scholar, University of California - Davis, Institute of Transportation Studies, One Shields Avenue, Davis, CA, 95616, United States of America, ncparker@ucdavis.edu, Jie Zheng

Introduction of cellulosic biofuels face a number of obstacles related to early market entry – unproven and expensive technology, undeveloped feedstock supply markets and competition with low cost incumbent technologies (gasoline and corn ethanol). A limited foresight simulation model of the industry at high spatial resolution is proposed and initial analysis of early infrastructure build out will be presented with a focus on the subsidy required to overcome the early market barriers.

2 - Biomass Location for Optimal Sustainability Model (BLOSM)– Balancing Profit and Water Quality

Michael Hilliard, Research Staff, Oak Ridge National Laboratory, One Bethel Valley Road, P.O. Box 2008, MS-6054, Oak Ridge, TN, 37831-6054, United States of America, hilliardmr@ornl.gov, Latha Baskaran, Alexandre Sorokine, Patrick Mulholland, Esther Parish, Virginia Dale, Natalie Griffiths, Neil Thomas, Richard Middleton, Mark Downing

Using data from the watershed surrounding a pilot cellulosic ethanol refinery in Tennessee, a multi-objective LP-based model paired with results from a water quality model run on a large parallel computer demonstrates that planting switchgrass in the right locations can improve nitrogen, phosphorus and sediment levels in the watershed with a moderate impact on revenue. A web-based interface communicates the results to the public.

■ TA63

W - Tryon North - 2nd Floor

Evolutionary Multi-Objective Optimization 4

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Kalyanmoy Deb, Professor, Indian Institute of Technology Kanpur, Department of Mechanical Engineering, Kanpur, 208016, India, deb@iitk.ac.in

1 - Discovery of Design Principles Using Evolutionary Multi-Criterion Optimization

Kalyanmoy Deb, Professor, Indian Institute of Technology Kanpur, Department of Mechanical Engineering, Kanpur, 208016, India, deb@iitk.ac.in, Sunith Bandaru

Multi-objective optimization has received a face-lift with the possibility of finding multiple trade-off solutions in a single simulation by using evolutionary optimization algorithms. In this abstract, we shall discuss a post-optimality study of multiple trade-off solutions and demonstrate how they can be exploited to discover salient problem knowledge that can be useful to designers and practitioners.

2 - Evolutionary Optimization in Industry: State-of-the-art and Future Directions

Santosh Tiwari, R&D Engineer, Vanderplaats Research & Development, Inc., 41700 Gardenbrook, Suite 115, Novi, MI, 48375, United States of America, stiwari@vrand.com

In this talk, an industry perspective on the application of evolutionary algorithms (EAs) to solve engineering optimization problems is presented. The benefits and the challenges that EAs present, the lessons learned from using EAs, and the best practices are also discussed. A discussion on the associated computational cost to perform optimization is also presented. Finally, the talk concludes with desired/needed advancements in EAs that may benefit the optimization practitioners in industry.

3 - A MOCC Strategy for Greenhouse Environment Energy-Saving Control Based on EMOO

Lihong Xu, Professor, Michigan State University/Tongji Univ., 6010 Gibson Avenue, East Lansing, MI, 48823, United States of America, xulihong@egr.msu.edu, Erik Goodman, Haigen Hu

A modified Multi-Objective Compatible Control (MOCC) strategy based on EMOO and an extant greenhouse model has been proposed in this paper. A series of simulation experiments through various comparative studies are presented to validate the feasibility of the proposed algorithm. The results state clearly that it may achieve high control precision and low energy cost for real-world engineering application in greenhouse production.

■ TA64

W - Queens Room - 2nd Floor

Joint Session SPPSN/LA/Minority: Community-Based Operations Research I

Sponsor: Public Programs, Service and Needs/Location Analysis/Minority Issues

Sponsored Session

Chair: Michael Johnson, Associate Professor, University of Massachusetts Boston, 100 Morrissey Boulevard, McCormack Hall, Room 3-428A, Boston, MA, 02125-3393, United States of America, Michael.Johnson@umb.edu

1 - Fair Fare Policies: Pricing Policies that Benefit Transit-dependent Riders

Kendra Taylor, Senior Consultant, CH2MHill, Northpark 400, 1000 Abernathy Road Suite 1600, Atlanta, GA, 30328, United States of America, Kendra.Taylor@ch2m.com, Erick Jones

Given that the top 20 U.S. agencies, representing 83% of transit trips, either already have or plan to implement a smart card fare collection system and are looking to increase farebox revenue, we propose introducing a 'Best Fare' alongside the next fare increase. This policy supports transit-dependent riders for whom pre-payment for multiple trips to receive the associated discount may present a financial hardship.

2 - Stochastic Multicriteria Models for Long-term Investment in Foreclosed HoUsing Acquisition

Senay Solak, Assistant Professor, University of Massachusetts Amherst, Isenberg School of Management, Department of Finance & Operations Mgmt, Amherst, MA, 01003, United States of America, solak@som.umass.edu, Armagan Bayram, Michael Johnson, David Turcotte

Community Development Corporations (CDCs) are non-profit organizations with an important role in preventing negative impacts of mortgage foreclosures in the U.S. by acquiring and redeveloping foreclosed properties. We describe a multi period stochastic optimization problem aimed at identifying optimal long term investment strategies for CDCs. We seek general insights for optimal policies by considering multiple criteria and uncertainties in local market conditions.

3 - Social Impacts of Foreclosed Housing Acquisition and Redevelopment

Michael Johnson, Associate Professor, University of Massachusetts Boston, 100 Morrissey Boulevard, McCormack Hall, Room 3-428A, Boston, MA, 02125-3393, United States of America, Michael.Johnson@umb.edu, Jeff Keisler, David Turcotte, Rachel Drew

Decision models for foreclosed housing investments by community based organizations (CBOs) rely on multiple measures of social impacts. We estimate: (1) the value of averted property value losses (2) a measure of strategic importance to CBOs and (3) the impacts on community cohesion and health, associated with foreclosed housing acquisition and redevelopment strategies. We show that our measures reflect real-world CBO concerns and are robust to alternative values of structural parameters.

4 - Allocating Targeted Police Resources to Reduce Homicides and Shootings

Thomas Darling, Associate Professor, University of Baltimore, School of Public and International Affai, 1420 N. Charles St., Baltimore, MD, 21201, United States of America, tdarling@ubalt.edu, Autumn Linderborn

Logistic regression and tree-based algorithms using up-to-date crime and 911 call data are developed to predict the likelihood of homicide and shooting incidents within designated violent crime zones. Various variable reduction techniques to improve predictive accuracy are compared. An allocation model (based on signal detection theory's receiver operating curve) allowing weekly redeployment of targeted policing resources is demonstrated.

■ TA65

W - Kings Room - 2nd Floor

Panel Discussion: Enhancing Adolescents' Lives through Decision-Making

Sponsor: Service Science

Sponsored Session

Chair: Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 South Matthews Avenue, Urbana, IL, 61801, United States of America, aliabbas@illinois.edu

1 - Enhancing Adolescents' Lives through Decision-Making

Moderator: Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 South Matthews Avenue, Urbana, IL, 61801, United States of America, aliabbas@illinois.edu, Panelsits: Carl Spetzler, Nadine Oeser

Can good decision-making be trained? We discuss our learning and experience teaching decision skills to youth. This work has involved working with high school students, high school math teachers, residents at the Juvenile Detention Centers, and other venues.

■ TA66

W - Park Room - 2nd Floor

Management of Dynamic Work-Sharing

Cluster: Workforce Engineering and Management

Invited Session

Chair: Yun Fong Lim, Assistant Professor, Singapore Management University, 50 Stamford Road, #04-01, Singapore, SG, Singapore, yflim@smu.edu.sg

1 - Dynamics and throughput of Cellular Bucket Brigades on U-Lines

Yun Fong Lim, Assistant Professor, Singapore Management University, 50 Stamford Road, #04-01, Singapore, SG, Singapore, yflim@smu.edu.sg, Yue Wu

We propose cellular bucket brigade rules to coordinate two workers on a U-line so that they can dynamically share work without too much travel in practice. Under these rules, we show that the system always converges to a fixed point or a period-2 orbit. Numerical simulations based on random work velocities suggest that our approach is significantly more productive than static allocation when variability of work velocities is large.

2 - Fixed Task Zone Chaining: An Inexpensive Approach to Improve CONWIP Line throughput

Hoda Parvin, University of Michigan, Ann Arbor, MI, United States of America, hoda@umich.edu, Mark Van Oyen, Dimitrios Pandelis

We analyze a canonical model of worker cross-training, the Fixed Task Zone Chain, for environments where extensive cross-training is prohibitive. We develop effective dynamic control policies for a given zone structure. A Zone Assignment algorithm creates a zone structure that yields high throughput with very low WIP and few skills.

3 - Dynamics of a Two-worker Bucket Brigade with Location Dependent Hand-off Costs

Erika Murguia Blumenkranz, Consultant, TIS Consulting Group, Hermosillo, Sonora, Hermosillo, Mexico, erika.murguia@gmail.com, Esma Gel, Dieter Armbruster

We consider bucket brigade systems where hand-offs incur positive negotiation time when performed in the middle of stations while hand-offs at the end or beginning of stations can be performed instantaneously. We append the traditional bucket brigade rules by defining non-negotiation zones in each station to obtain improved throughput performance.

4 - A Reset Policy for Bucket Brigades that Creates Chaos

John Nguyen, Arizona State University, Temple, AZ, United States of America, jknguye1@asu.edu, Dieter Armbruster

The normative bucket brigade model of Bartholdi and Eisenstein is considered with a change in one feature: Workers are allowed to overtake but handovers still occur only with one designated predecessor for each worker. For worker orders that do not follow the slowest to fastest arrangement this overtake and reset policy creates chaos. The mathematical paths into this chaotic behavior are studied. The resulting chaotic attractors are characterized by their invariant densities.

■ TA67

W - Grand A - 2nd Floor

Business Intelligence

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Gautam Pant, The University of Iowa, Henry B. Tippie College of Business, Iowa City, IA, 52242, United States of America, gautam-pant@uiowa.edu

1 - Applying Process Control and Machine Learning to Develop Effective Dynamic Decision Strategies

Georg Meyer, University of Minnesota, 321 19th Avenue South, CSOM 3-365, Minneapolis, MN, 55455, United States of America, meye1131@umn.edu, William Rush, Gediminas Adomavicius, Paul Johnson, Mohamed Elidrisi, Patrick O'Connor, JoAnn Sperl-Hillen

Dynamic decision making (DDM) requires an agent to make a series of path-dependent, time-critical decisions in environments that change as a result of the agent's actions as well as autonomously. We model DDM as a process control problem using a general-purpose "measure-intervene-iterate" framework and propose a machine learning approach to improving decision strategies. We present results from applying the technique in a simulation of an important healthcare DDM problem, namely diabetes care.

2 - Manipulation in "Top N" News Recommender Systems

Balaji Padmanabhan, Anderson Professor of Global Management, University of South Florida, Tampa, FL, United States of America, bp@usf.edu, Shankar Prawesh

There is some concern that news recommendations are being manipulated online for various reasons. The motivation for our work is to build manipulation resistant news recommenders. We focus on a common method of recommending the N most read articles. We show (through simulation and analytical results) that whereas recommendation of the N most read articles is easily susceptible to manipulation, a simple probabilistic variant is more robust to common manipulation strategies.

3 - Managing Crowdsourcing Workers

Jing Wang, PhD Student, New York University, 44 West 4th Street, 8-186, New York, NY, 10012, United States of America, jwang5@stern.nyu.edu, Panagiotis Ipeirotis, Foster Provost

In online crowdsourcing services, the requesters are exposed to quality risks due to high verification cost and unstable employment relationship. In this paper, we present an algorithm for assessing the worker quality, which can easily separate the true error rates from the biases. Next, we bring up an active testing approach to decide when and how to test workers using an expected utility framework. Finally, we present experimental results to demonstrate the performance of our algorithm.

4 - Collaborative Information Acquisition for Top Expected Revenues

Danxia Kong, University of Texas - Austin, Austin, TX, United States of America, danxia.kong@phd.mccombs.utexas.edu, Maytal Saar-Tsechansky

This study addresses the problem of actively acquiring information for improving the identification of top-ranked instances (customers or firms) based on their expected revenue estimates. The policy we propose prefers acquisitions that can improve expected revenue estimates that are (1) likely to be incorrect, and (2) are likely to have higher values. Using two real world data sets, we show the new policy is effective as compared to alternatives.

5 - Predicting Audience Demographics of Web Sites Using Local Cues

Iljoo Kim, The University of Utah, 1645 East Campus Center Drive, Salt Lake City, UT, 84112, United States of America, iljoo.kim@business.utah.edu, Gautam Pant

A critical piece of information for producers/publishers of content as well as advertisers in web space is the demographics of the consumers who are likely to visit a given web site. In this paper we explore predictive models that attempt to deduce the audience demographics of a web site using cues embedded in the design or the content of its homepage. We find that it is possible to effectively predict different types of demographics of web site consumers based on the suggested approach.

■ TA68

W - Grand B - 2nd Floor

Academic Job Search

Cluster: Job Placement Services

Invited Session

Chair: Bala Shetty, Professor, Texas A & M University, College Station, TX, 77845, United States of America, B-shetty@tamu.edu

1 - Panel Discussion: Academic Search

Moderator: Bala Shetty, Professor, Texas A & M University, College Station, TX, 77845, United States of America, B-shetty@tamu.edu, Panelists: Agha Iqbal Ali, Neil Geismar

The panel will discuss the academic interview process and do's and don'ts associated with the job search. In addition to comments by current and former search chairs, time will be provided for questions and answers.

■ TA69

W - Grand D - 2nd Floor

Environmental Issues in Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Gokce Esenduran, The Ohio State University, 2100 Neil Avenue, Columbus, OH, United States of America, esenduran_1@fisher.osu.edu

1 - Process Innovation and Competition in an Industrial Symbiotic System

Yunxia Zhu, Ph.D. Candidate, The University of Texas at Dallas, School of Management, 800 W. Campbell Rd, Richardson, TX, 75080, United States of America, yunxia.zhu@utdallas.edu, Milind Dawande, Srinagesh Gavirneni, Vaidy Jayaraman

Inspired by a real-world example of a paper-sugar symbiotic complex, we study the impact on a firm's operational decisions from implementing an industrial symbiotic system. Our models capture both supply- and demand-side influences of implementation. We characterize the firm's optimal/equilibrium decisions, both in the presence and absence of the system, under monopoly as well as under Cournot competition. Our focus is on understanding the firm's "willingness" to implement the symbiotic system.

2 - Engaging Supply Chains in Climate Change: Supplier Responses to Buyer Demands

Chonnikarn Fern Jira, Harvard Business School, 8 Whittier Place #17A, Boston, MA, 02114, United States of America, cjira@hbs.edu, Michael Toffel

A growing number of organizations are asking their suppliers to share information about their GHG emissions levels and reduction strategies. Our paper theorizes and empirically identifies circumstances that encourage or deter suppliers from sharing such information with their buyers. We examine characteristics of the supplier's institutional context and factors related to the buyer-supplier relationship. We test our hypotheses using data from the Carbon Disclosure Project's Supply Chain Project.

3 - Regulating Markets for Valuable Waste: Cherry Pickers vs. Scavengers

Gokce Esenduran, The Ohio State University, 2100 Neil Avenue, Columbus, OH, United States of America, esenduran_1@fisher.osu.edu, Atalay Atasu, Luk Van Wassenhove

Take-back legislation mandates minimum recovery rates for waste products. If product take-back is costly then there would be no recovery in the absence of legislation. This is not true for products with valuable material content. The recoverable value in waste products may create competition between producer and scavenger and divert them from landfills even under no legislation. We identify the conditions where legislator should not distort an efficient waste market by imposing recovery targets.

4 - Managing Engineering Design for Competitive Sourcing in Closed-Loop Supply Chains

Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Eugene, 97403, United States of America, tolga@uoregon.edu, Nagesh Murthy

Using a game theoretical framework, we study the joint design and procurement decisions of a manufacturer who chooses between integral or partitioned design alternatives, and the pricing decisions made by its suppliers. The integral design requires more raw materials per pound of final product and prevents yield loss due to final joining. However, the partitioned design is simpler, resulting in a more competitive supplier base and allows the suppliers to rely less on reverse material flows.

1 - Stochastic Programming Framework for Decentralized Inventory with Transshipment

Moshe Dror, The University of Arizona, MIS Department, 1130 E. Helen St., Tucson, AZ, 85721, United States of America, mdror@eller.arizona.edu, Nichalin Summerfield

This paper discusses a family of two-stage decentralized inventory problems using a unifying taxonomy depicted as a multilevel graph. The taxonomy allows us to model and link different problems of retailers who independently procure inventory in response to uncertain demand and anticipated inventory decisions of other competing retailers. In the ex-post stage, the retailers exercise recourse actions to coordinate transshipment in response to the realized demand and competitors' inventory levels.

2 - with or without Forecast Sharing: Credibility and Competition under Information Asymmetry

Mehmet Gumus, Assistant Professor, McGill University, 1001 Sherbrooke West, Montreal, QC, H3A 1G5, Canada, mehmet.gumus@mcgill.ca

Forecast sharing among trading partners lies at the heart of many collaborative SCM efforts, and has been praised in academic and practitioner circles for its critical role in increasing demand visibility for supply chains exposed to high supply-demand mismatch risk. That said, there is concern in the same circles that the implementation of a forecast-sharing system may induce collusive behaviour. In this paper, we develop a supply chain model in order to explore whether such a fear is grounded.

3 - Can Reciprocity in a Supply Chain Be Signaled?

Ruth Beer, University of Michigan, Ross School of Business, 701 Tappan Avenue, Ann Arbor, MI, 48109, United States of America, ruthbeer@umich.edu, Hyun-Soo Ahn, Stephen Leider

We often see in supply chains acts of reciprocity that are hard to explain through standard incentives. Some suppliers make costly buyer-specific investments without a long-term contract. Similarly many buyers offer generous contract terms to a supplier even in one-time transactions. We propose reciprocal motivations as a potential explanation. Generous acts can serve as a signal of reciprocity to the other party. We develop a model that characterizes an equilibrium with reciprocity.

4 - Product Upgradability and Channel Management

Canan Savaskan, Southern Methodist University, Cox School of Business, Dallas, TX, United States of America, csavaskan@cox.smu.edu, Sreekumar Bhaskaran

For a bilateral monopoly, this paper, we investigate the strategic implications of product upgradability on channel relations in a retail environment. More specifically, we investigate how the ability of a retailer to upgrade overstock units would affect a manufacturer's pricing as well as product design decisions.

Tuesday, 11:00am - 12:30am

■ TB01

C - Room 201A

Contracting and Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Eda Kemahlioglu Ziya, Assistant Professor, University of North Carolina-Chapel Hill, Kenan- Flagler Business School, McColl 4707, Chapel Hill, NC, United States of America, Eda_KemahliogluZiya@unc.edu

■ TB02

C - Room 201B

Optimization in Finance VI

Cluster: Optimization in Finance

Invited Session

Chair: Gautam Mitra, Professor, Brunel University, Kingston Lane, Uxbridge, London, UB83PH, United Kingdom, gautam.mitra@brunel.ac.uk

1 - Financial Algebra: Some Applications of Constructive Algebra in Financial Optimization Problems

Bernard Hanzon, Professor of Mathematics, School of Mathematical Sciences, University College Cork, Western Gateway Building, Western Road, Cork City, Ireland, b.hanzon@ucc.ie, Edwin OShea, Andrei Mustata

We report on progress in applications of algebra to some optimization problems arising in finance. One application is concerned with investigating whether currency exchange markets with bid-ask spread with a number of currencies allow for static arbitrage opportunities. The methods make use of max-plus algebra/tropical algebra techniques. If time permits we will also report on usage of polynomial algebra techniques for optimization problems in finance.

2 - Generating Arbitrage-Free Scenario Trees

Michael Hanke, Professor, University of Liechtenstein, Fürst-Franz-Josef-Str., Vaduz, 9490, Liechtenstein, michael.hanke@uni.li, Alex Weissensteiner, Alois Geyer

We present an approach to generate scenario trees which excludes arbitrage opportunities by construction. Our approach is embedded in the setting of arbitrage pricing theory (APT). We establish necessary conditions for the number of scenarios to be generated and derive bounds for expected returns to exclude arbitrage at the outset. Trees constructed in this way can be smaller compared to trees generated by moment matching with almost no loss in accuracy regarding the optimal solution.

3 - A Possibilistic Approach for Selecting Portfolios with Higher Moments

Enriqueta Vercher, Professor, University of Valencia, C/ Dr Moliner 50, Burjassot, 46100, Spain, vercher@uv.es, Jose D. Berm´dez, Jose V. Segura

We present new possibilistic models for the portfolio selection problem. The uncertainty of the future returns is modeled using LR-fuzzy numbers. Since the joint possibility distribution of the returns on the assets is unknown, we directly consider the returns on a given portfolio as the historical data set. We state certain multi-objective optimization problems using higher interval-valued possibilistic moments and apply a meta-heuristic procedure for generating efficient portfolios.

4 - Optimal Securitization with Heterogeneous Investors

Huaxia Rui, The University of Texas at Austin, 1 University Station B6500, Austin, TX, 78712, United States of America, ruihuaxia@gmail.com, Huaxia Rui, Semyon Malamud, Andrew Whinston

We solve the problem of optimal securitization for an issuer facing heterogeneous investors with arbitrary time and risk preferences. The optimal securitization is characterized by multiple nonlinear tranches, and each investor gets a portfolio of these tranches. When all agents have CARA utility functions, the linear tranching is optimal. We show that the boundaries of the tranches can be efficiently calculated through a fixed point of a contraction mapping.

5 - Computational Experience of Solving Two-stage Stochastic Integer Programming Problems

Gautam Mitra, Professor, Brunel University, Kingston Lane, Uxbridge, London, UB83PH, United Kingdom, gautam.mitra@brunel.ac.uk, Victor Zverovich, Jasmina Lazic

We present a computational study of two-stage stochastic integer programming (SIP) solution algorithms for a set of benchmark problems. We describe an application of variable neighborhood decomposition search (VNDS) to the solution of SIP problems and compare heuristic methods based on it to the application of MIP methods to deterministic equivalent problems and to the integer L-shaped method. The scale-up properties of the algorithms and the performance profiles are presented.

■ TB03

C - Room 202A

Open Source Solvers and Modeling Languages

Sponsor: Computing Society/ Open Source Software (Joint Cluster Optimization)

Sponsored Session

Chair: Kipp Martin, University of Chicago, Booth School of Business, 5807 South Woodlawn, Chicago, IL, 60637, United States of America, kmartin@chicagobooth.edu

1 - Optimization Services: Communicating Solver Options and Solver Results

Horand Gassmann, Dalhousie University, School of Business Administration, 6100 University Avenue, Halifax, NS, B3H 3L5, Canada, Horand.Gassmann@Dal.Ca, Kipp Martin, Jun Ma

Optimization Services (OS) is a web-aware framework linking algebraic modeling languages and solvers. Communication takes place in standardized XML formats. After a brief overview of the system design I will describe the option and result formats in more detail. Unlike the instance description, there are choices here to allow for both flexibility to cater to the varying design choices of solver developers, and rigidity to allow one AML to talk to multiple solvers without changing the interface.

2 - CMPL (Coliop/COIN Mathematical Programming Language)

Mike Steglich, Technical University Wildau, Bahnhofstrasse, Wildau, 15745, Germany, mike.steglich@berlin.de

CMPL is a mathematical programming language and a system for modelling, solving and analysing linear programming (LP) problems and mixed integer programming (MIP) problems.

3 - The New OSI: Lighter, Thinner, Stronger, More Dynamic

Matthew Saltzman, Clemson University, Department of Mathematical Sciences, Martin Hall, Box 340975, Clemson, SC, 29631, United States of America, mjs@clemson.edu, Lou Hafer

Over the 10 years of its existence, the original OSI interface has grown–unlike most of its users–from 'just a little pudgy' to 'seriously overweight'. OSI2 is a return to something a bit more lean and mean, with outsourcing. In this talk we will discuss the implementation of an interface layer whose primary function is to act as a broker, managing modules provided by underlying solvers to implement defined APIs.

■ TB04

C - Room 202B

Surrogate and Derivative Free Optimization II

Sponsor: Computing Society/Optimization: Surrogate and Derivative-free Optimization(Joint Clusters)

Sponsored Session

Chair: Christine Shoemaker, Ripley Professor, Cornell University, Civil & Environmental Engr, Operations Res.and Information Engr., Ithaca, NY, 14850, United States of America, cas12@cornell.edu

1 - Nonintrusive Termination of Noisy Derivative-free Optimization

Jeffrey Larson, University of Colorado Denver, 1250 14th Street, Denver, CO, 80217, United States of America, Jeffrey.Larson@ucdenver.edu, Stefan Wild

Significant savings can be gained from terminating the optimization of a computationally expensive function before traditional criteria are satisfied. Such early termination is especially desirable for noisy functions. In this talk we propose parameterized termination tests that can be used in conjunction with any solver's built-in termination criteria, compare their performance on a collection of noisy benchmark problems, and provide recommendations for practical use of these tests.

2 - EAGLS: A Hybrid Global-local Optimizer for MINLPs

Genetha Gray, Sandia National Laboratories, P.O. Box 969, MS 9159, Livermore, CA, 94551-0969, United States of America, gagray@sandia.gov, Shawn Matott, Josh Griffin

In this talk, we will describe EAGLS (Evolutionary Algorithm Guiding Local Search) and its applicability to mixed-integer, nonlinear, black box optimization problems. EAGLS extends the capabilities of a parallel implementation of the generating set search (GSS) method, and utilizes a genetic algorithm (GA) to handle the integer variables. We will demonstrate the performance of EAGLS on a series of pump-and-treat problems and examine how the problem formulation can influence the optimizer performance.

3 - Surrogate Global Optimization Enhanced with Sensitivity Analysis

Christine Shoemaker, Ripley Professor, Cornell University, Civil & Environmental Engr, Operations Res.and Information Engr., Ithaca, NY, 14850, United States of America, cas12@cornell.edu, Yilun Wang

This paper discusses the use of sensitivity analysis on a surrogate response surface to enhance the efficiency of a global optimization algorithm for computationally expensive simulation models, for which we can only afford a very limited number of simulations. The method does not require derivatives of the expensive simulation model. The method is especially effective for high dimensional decision vectors.

4 - A Comparison of Software Implementations of Derivative-free Optimization Algorithms

Nick Sahinidis, Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, United States of America, sahinidis@cmu.edu, Luis Miguel Rios

We present results from a systematic comparison of 22 derivative-free algorithm implementations using a test set of 502 problems. The test bed includes convex and nonconvex problems, smooth as well as nonsmooth problems. The algorithms were compared under several criteria, including their ability to find near-global solutions to nonconvex problems, improve a given starting point, and refine a near-optimal solution. Over 100,000 problem instances were solved in the course of these experiments.

■ TB05

C - Room 203A

Innovation and Entrepreneurship: A Process Framework

Cluster: Tutorials

Invited Session

Chair: Stefanos Zenios, Stanford University, Graduate School of Business, Stanford, CA, United States of America, stefzen@GSB.Stanford.Edu

1 - Innovation and Entrepreneurship: A Process Framework

Stefanos Zenios, Stanford University, Graduate School of Business, Stanford, CA, United States of America, stefzen@GSB.Stanford.Edu

Innovation and entrepreneurship courses are rarely taught by OR faculty. In this tutorial we will argue that this should not be the case because innovation and entrepreneurship is not an event but a process, and OR scholars are well positioned to teach courses on processes. We will describe the (29-step) innovation process we are no teaching at Stanford in the context of health care innovation and explain how the process can be expanded to other industry verticals.

■ TB06

C - Room 203B

ICS Prize Winners

Sponsor: Computing Society

Sponsored Session

Chair: Shabbir Ahmed, Georgia Tech, 765 Ferst Dr NW, Atlanta, GA, 30318, United States of America, sahmed@isye.gatech.edu

1 - ICS Prize Session

The winners of the 2011 ICS Prize and the 2011 ICS Student Paper Award present their award-winning work.

■ TB07

C - Room 204

Applied Propability

Contributed Session

Chair: Xiaowei Zhang, Hong Kong University of Science and Technology, Kowloon, Hong Kong - PRC, xiaoweiz@ust.hk

1 - Computational Applications in Probability

Lawrence Leemis, Professor, Department of Mathematics, The College of William & Mary, P.O. Box 8795, Williamsburg, VA, 23187, United States of America, leemis@math.wm.edu

Several applications of computing in probability using the Maple-based APPL language are surveyed, including bootstrapping, goodness-of-fit, reliability, probability distribution selection, stochastic activity networks and transient queueing analysis.

2 - Modeling Evolution of Conditional Covariance between Demands with Application to Production Planning

Amirhosein Norouzi, NCSU, 6900 Crescent Moon Ct Apt 306, Raleigh, 27606, United States of America, anorouz@ncsu.edu, Reha Uzsoy

We propose a stochastic framework for modeling the evolution of conditional covariance between demands, which takes into account demand information updates by using the martingale model. In order to analyze the effects of this model, we integrate it with a multi-period production model with chance constraints. Computational results demonstrate the benefit of considering the conditional demand covariances in production planning.

3 - Strongly Efficient Rare Event Simulation for Heavy-tailed Recurrence Equations

Kevin Leder, Harvard School of Public Health, 25 Shattuck St, Harvard, MA, 02115, United States of America, leder@jimmy.harvard.edu

Importance sampling in the setting of heavy tailed random variables has generally focused on models with additive noise terms. In this work we extend this concept by considering importance sampling for the estimation of rare events in Markov chains of the form $$ X_{n+1} = A_{n+1}X_n+B_{n+1},\quad X_0=0, $$ where the B_n's and A_n's are independent sequences of independent and identically distributed (iid) random variables and the B_n 's are regularly varying and the A_n's are suitably light tailed relative to B_n. We focus on efficient estimation of the rare event probability $P(X_n > b)$ as $b\to\infty$. In particular we present a strongly efficient importance sampling algorithm for estimating these probabilities, and present several numerical examples showcasing the strong efficiency.

4 - Shipment Consolidation When Demand is Brownian Motion with Drift

Bo Wei, student, Texas A&M University, 241 Zachry, TAMU 3131, College Station, TX, 77843, United States of America, feixianxing@neo.tamu.edu, Sila Cetinkaya

We consider a shipper implementing a quantity-based consolidation policy with parameter Q and considering the alternative of dispatching the consolidated load at an independent random time T later than it takes to accumulate Q. We call the former Q-policy and the latter (Q+T)-policy. We develop conditions such that the (Q+T)-policy is better than the Q-policy. Also, we obtain results about the jointly optimal (Q+T)-policy in the single- and the multi-item cases.

5 - On the Ergodicity of Affine Jump-diffusion Processes

Xiaowei Zhang, Hong Kong University of Science and Technology, Kowloon, Hong Kong - PRC, xiaoweiz@ust.hk, Peter Glynn

Affine jump-diffusion (AJD) processes are widely used in finance and econometrics due to their computational tractability and modleing flexibility. The ergodicity often plays an essential role for parameter estimation based on large-time asymptotics. We prove various ergodicity results for AJD under mild conditions. We further show that the tail-fatness of the equilibrium distribution of AJD is determined by that of the jump distribution, giving us a feasible approach to incorporate fat tails.

■ TB08

C - Room 205

Hybrid Methods IV: CP/IP Combinations

Sponsor: Computing Society/ Constraint Programming and Integrated Methods

Sponsored Session

Chair: John Hooker, Carnegie Mellon University, Tepper School of Buisness, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu

1 - Valid Inequalities for the Cumulative Constraint and the Cumulative Job Shop Scheduling Problem

Tallys Yunes, Assistant Professor, University of Miami, Department of Management Science, Coral Gables, FL, 33124-8237, United States of America, tallys@miami.edu, Dimitris Magos, Ioannis Mourtos

The cumulative global constraint describes a machine that can process multiple jobs at a time. We study the convex hull of feasible solutions to cumulative when (i) jobs are identical, and (ii) jobs differ in their resource utilization rates. In (i) we revisit some previous work from the literature; in (ii) we propose a new family of facet-defining inequalities. We also present computational results with a branch-and-cut algorithm for a cumulative version of the job shop scheduling problem.

2 - Graph Coloring Facets from a Constrant Programming Formulation

John Hooker, Carnegie Mellon University, Tepper School of Buisness, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu, David Bergman

We obtain facets for vertex coloring by formulating the problem with multiple all-different constraints and analyzing the polyhedron that results. We then map the facets into 0-1 space to obtain valid cuts for the traditional formulation. Computational tests show that they reduce the integrality gap substantially more than previously known facets.

3 - An Efficient Generic Network Flow Constraint

Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, vanhoeve@andrew.cmu.edu, Robin Steiger, Radoslaw Szymanek

We present a generic global constraint that can be applied to model a wide range of network flow problems using constraint programming. We utilize a network simplex algorithm to design a highly efficient, and incremental, domain filtering algorithm. Our generic constraint can be applied to automatically derive domain filtering algorithms for ad-hoc networks, but also for existing (soft) global constraints that rely on a network structure, many of which are not yet supported by CP systems.

4 - A New Exact Algorithm for the Elementary Shortest Path Problem with Resource Constraints

Andrés L. Medaglia, Associate Professor, Universidad de los Andes, Departamento de Ingeniería Industrial, COPA, Bogotà, Colombia, amedagli@uniandes.edu.co, Leonardo Lozano

The Elementary Shortest Path Problem with Resource Constraint (ESPPRC) is an NP-Hard problem that arises in the context of vehicle routing. We propose an exact method for the ESPPRC that combines implicit enumeration with dynamic programming. Our algorithm performs well on instances derived from Solomon's testbed for the vehicle routing problem with time windows.

■ TB09

C - Room 206A

Revenue Management and Pricing Challenges in Practice

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Tugrul Sanli, Director, R&D, SAS Institute Inc., SAS Campus Dr, Cary, NC, United States of America, Tugrul.Sanli@sas.com

1 - Pricing High-Tech Products

Utku Yildirim, Principal, Prorize, 3399 Lenox RD NE, Atlanta, United States of America, uyildirim@prorize.com, Ahmet Kuyumcu

Pricing in high-tech industries is difficult due to high rates of technological innovations, intense competition, and shifting consumer expectations. In this presentation, we illustrate forecasting and pricing challenges using real life data and discuss several approaches used to tackle them.

2 - Applying Revenue Management and Pricing in Golf Industry: Key Challenges

Ronald Menich, Chief Scientist, JDA Software Group, 1090 Northchase Pkwy, Suite 300, Marietta, GA, 30067, United States of America, ronald.menich@jda.com, Emrah Uyar, Pelin Pekgun

Revenue Management (RM) principles have proven to be a key success factor in airlines and hotels. Considering the common characteristics of these traditional industries with fixed capacity, RM practices have started to extend to new frontiers, one of which is the golf industry. Tee-times are perishable inventory with a high potential for differential pricing by peak vs. off-peak periods. In this talk, we discuss key challenges in forecasting and pricing golf demand and solution approaches.

3 - Next Generation of Revenue Management and Price Optimization System for the Hotel Industry

Xiaodong Yao, Analytical Solution Manager, SAS Institute Inc., SAS Campus Drive, Cary, NC, 27519, United States of America, Xiaodong.Yao@sas.com, Tugrul Sanli

A few challenges in the development of next generation of revenue management and price optimization are discussed, along with our solutions. For example, how to incorporate into optimization models multiple resource types (e.g., different room categories/types) with pre-defined upgrade path? How to handle different types of demands at the same time in the system, e.g. price elastic demands, price independent demands, and best available rates linked demands?

4 - Prices, Bid Prices and Their Analytics

Darius Walczak, PROS, 3100 Main Street, Suite 900, Houston, TX, 77002, United States of America, dwalczak@prospricing.com, Tom Gorin

Bid Price is a fundamental concept in the newer generation of revenue management system, and one of the main drivers of the optimal pricing in capacity constrained industries. We review an array of bid price properties, expected trends and probabilities of certain events. We show the interplay between the bid price and the optimal price in price-sensitive demand models. We present a set of analytics that help with explaining bid price control revenue models to real-life revenue managers.

■ TB10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - Frontline Systems, Inc. - Integrated Data Mining, Simulation and Optimization in Microsoft Excel

Daniel H. Fylstra, President, Frontline Systems, Inc., P.O. Box 4288, Incline Village, NV, 89450, United States of America, info@solver.com

We'll explain how one integrated toolset in Microsoft Excel can meet your needs for forecasting and sophisticated data mining, Monte Carlo simulation and risk analysis, and conventional and stochastic optimization. We'll show you the fastest way to build your models, build your own analytic expertise, and get real business results.

2 - Gurobi Optimization - Solving Large Scale Math Programming Models with the Gurobi Optimizer

Zonghau Gu, CTO, Gurobi Optimization, Inc., 3733-1 Westheimer Road, Houston, TX, 77027, United States of America, gu@gurobi.com

We will examine recent trends in the types and sizes of models that are being solved, focusing on models with up to hundreds of millions of variables or constraints. We will examine several instances that are pushing the envelope on size and difficulty, and talk about technologies and tuning approaches for obtaining good solutions.

■ TB11

C - Room 207A

Queues in Service Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Cathy Xia, Associate Professor, Ohio State University, 210 Baker Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, xia.52@osu.edu

1 - understanding the Marginal Impact of Customer Flexibility

Osman Akgun, PhD Student, University Of California Berkeley, 4141 Etcheverry Hall, Berkeley, CA, 94720, United States of America, akguno@ieor.berkeley.edu, Rhonda Righter, Ronald Wolff

We consider a queuing system with two parallel servers, in which a proportion of customers are flexible and can go to either server, while the remainder require service at a particular server. We show that the stationary expected waiting time is decreasing and convex in the proportion of flexible customers. We also show, for a modified model in which servers are never idle and can build up inventory, that convexity holds in a strong sample-path sense.

2 - Optimization of Call Centers with Service Level Objectives

Ger Koole, Professor, VU University Amsterdam, De Boelelaan 1081a, Amsterdam, Netherlands, koole@cs.vu.nl, Thomas Nielsen, Bo Nielsen

Most models of call centers are based on Markov chains that have the number of waiting calls as state. For this reason it is difficult to study objectives based on waiting times in all but the simplest models. In this talk we present results on optimization models with the waiting times of the first in line as state variable.

3 - Gaussian-Skewness Approximations for Dynamic Rate Multi-server Queues

William Massey, Professor, Princeton University, Princeton, NJ, United States of America, wmassey@princeton.edu, Jamol Pender

The scaling of multi-server queues with abandonment leads to dynamical systems and diffusions as limiting processes. This leads to Gaussian approximations of the transient queue length distribution that do not work as well when the mean number in the system is close to the number of servers. We introduce a new, simple algorithm called the Gaussian-skewness approximation that produces a more accurate, non-Gaussian estimate of the queueing dynamics.

4 - Decentralized Control Policies for Large-scale Vehicle Sharing Systems
David George, PhD Candidate, The Ohio State University, Columbus, OH, 43201, United States of America, george.385@osu.edu, Cathy Xia

With the increasing scale and complexity of today's vehicle sharing systems, centralized approaches for their management tend to be impractical. In this research, we present a decentralized approach based on a closed queueing network model for addressing the operational decisions of vehicle repositioning and customer admission. Our resulting policy has a simple, agent-based structure and is thus easily implemented in practice.

■ TB12

C - Room 207BC

Stochastic Optimization in Networks

Sponsor: Computing Society/ Computational Stochastic Optimization

Sponsored Session

Chair: Ozlem Ergun, Georgia Institute of Technology, Atlanta, GA, United States of America, oergun@isye.gatech.edu

1 - Dynamic Network Deployment Problems Accommodating Uncertain Transmission Range
Kangyuan Zhu, Software Researcher, CSSI, INC, 8201 Corporate Drive, Sutie 750, Hyattsville, MD, 20785, United States of America, kz3y@virginia.edu, Stephen Patek

This paper explores physical layer models for estimating dynamic node connectivity in wireless ad hoc networks, taking into consideration the stochastic characteristic of signal strength. With the models, we propose a heuristics for deployment problems, in which we alternatively construct a network tree and determine locations for deploying network nodes, inspired from the dynamic programming approach. Numerical examples are provided to illustrate the application of the proposed heuristics.

2 - Online/Stochastic Network Expansion Type Problem in the Context of Debris Clearance After a Disaster
Melih Celik, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30339, United States of America, melihcelik@gatech.edu, Ozlem Ergun, Pinar Keskinocak

In this study, we consider the multi-period debris clearance problem on a network with supply and demand nodes, as well as debris-blocked arcs, whose debris amounts are partially known in advance, and clear arcs. The objective is to minimize the total penalty due to unsatisfied demand over the planning horizon. For this end, we employ a POMDP-based model involving different information updating approaches, and give results on different graph types.

3 - Revenue Management in Resource Exchange Carrier Alliances
So Yeon Chun, PhD Candidate, Georgia Institute of Technology, Atlanta, GA, United States of America, schun@isye.gatech.edu, Anton Kleywegt, Alexander Shapiro

We present a stochastic optimization model with equilibrium constraints (SMPEC) for the design of a resource-exchange alliance which takes into account the effect of the resource exchange on the competition among the alliance members. Our model determines the optimal amount of resource exchange for the alliance and the equilibrium prices of alliance members. The SMPEC is well-posed and good results can be obtained with a reasonable amount of computational effort.

■ TB13

C – Room 207D

Price Optimization on Social Networks

Sponsor: Revenue Management and Pricing Section

Sponsored

Chair: Costis Maglaras, Columbia University, 3022 Broadway, New York, NY, United States of America, c.maglaras@gsb.columbia.edu

1 - Near-optimal Pricing for Products with Social Learning Effects
Ilan Lobel, New York University, New York, NY, United States of America, ilobel@stern.nyu.edu, Nicole Immorlica, Sham Kakade

We consider the problem of optimal pricing of a common-value good in the presence of social learning effects, that is, agents learn rationally from the purchasing decisions of their peers. We find an upper bound on the total revenue of the firm and construct a pricing policy that maximizes the rate of extracted revenue.

2 - Word of Mouth and Percolation in Social Networks
Arthur Cambell, Assistant Professor of Economics, Yale University, School of Management, Yale University, New Haven, CT, United States of America, Arthur.Campbell@yale.edu

I construct a framework in which to study the optimal pricing strategies of a monopolist selling a good to consumers who are connected by a social network and engage in word-of-mouth communication (WOM). In the baseline model WOM demand is more elastic and prices are lower relative to a model without WOM. I consider the effect of changes to homophily, clustering, correlation between valuations and number of friends and the distribution of friendships.

3 - Network Topology and Rate of Social Learning
Alireza Tahbaz-Salehi, Columbia Business School, 3022 Broadway, Uris Hall 418, New York, NY 10027, United States of America, alirezat@columbia.edu, Ali Jadbabaie, Pooya Molavi

In this paper, we study the rate of convergence in a model of non-Bayesian social learning. We show how the structure of the social network and the informativeness of individuals' private signals determine the rate at which agents learn the truth.

4 - Monopoly Pricing in the Presence of Social Learning
Bar Ifrach, Columbia University, New York, NY, United States of America, bifrach14@gsb.columbia.edu, Costis Maglaras, Marco Scarsini

We study the revenue maximization problem of a monopolist seller in a market with heterogeneous customers that learn the quality of the offered product by observing the reviews of customers that purchased the product earlier in time. We explore how this social learning aspect affects the seller's pricing decision, which, in turn, controls the revenue rate and the customers' learning speed.

■ TB14

C - Room 208A

Long Term Energy System Planning

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Sarah Ryan, Iowa State University, 3004 Black Engineering Bldg, Ames, IA, 50011-2164, United States of America, smryan@iastate.edu

1 - Assuring Competitiveness in a Carbon-Constrained World
Emrah Cimren, The Ohio State University, Integrated Systems Engineering, 210 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43202, United States of America, cimren.1@osu.edu, Joseph Fiksel, Andrea Bassi

We develop a simulation model to analyze the net economic and environmental impacts of climate policy options and green house gas emission reduction scenarios such as renewable portfolio standards, energy efficiency, feed-in-tariff, carbon capture and sequestration, and smart grid. We used the model to investigate the possible policies for the State of Ohio.

2 - Long Term Coordinated Planning of Natural Gas and Electric Power Infrastructures
Cong Liu, Argonne National Laboratory, 9700 South Cass Avenue, B221 C244, Argonne, IL, United States of America, liuc@anl.gov, Jianhui Wang

We propose a bi-level programming model to simulate coordinated decision making of coupled electric power and natural gas systems. Using this modeling approach, the natural gas planning problem will be nested into the electric power system planning problem as a constraint. We will study and apply appropriate algorithms and decomposition techniques to solve the problem.

3 - An Electricity Generation Planning Model for Evaluation of Energy Policy Options
Dong Gu Choi, Graduate Student, Georgia Tech, 765 Ferst Drive, NW, Atlanta, GA, 30329, United States of America, doonggus@gatech.edu

A deterministic mixed-integer linear programming optimization model is developed to analyze electricity capacity expansion planning. The model includes some characteristics of new energy policies, and their implications are evaluated, with emphasis on renewable energy, clean energy, and greenhouse gas reduction policies. This analysis incorporates demand response to price change, which plays a crucial role in long term planning.

4 - A Trilevel Transmission and Multi-GenCo Expansion Planning Model with Electricity Market

Shan Jin, Iowa State University, 3024 Black Engineering, Ames, IA, United States of America, shanjin@iastate.edu, Sarah Ryan

We formulate a trilevel programming problem that includes transmission and generation expansion for an electricity market. At the first level, the system operator expands transmission to maximize the total social welfare less expansion cost. Multiple GenCos at the second level expand capacity to maximize the profits from production less the expansion cost. In each GenCo problem, a market clearing problem is considered as the third level. Computational results are presented for a small system.

■ TB15

C - Room 208B

Joint Session DAS/MAS: Game Theoretic and Decision Analytic Methods for Terrorist Risk Analysis

Sponsor: Decision Analysis/Military Applications Society

Sponsored Session

Chair: Seth Guikema, Assistant Professor, Johns Hopkins University, 3400 N. Charles St., Ames Hall, Baltimore, MD, 21218, United States of America, sguikema@jhu.edu

1 - A Comparative Analysis of PRA and Intelligent Adversary Methods for Counter-terrorism Risk Management

Gregory Parnell, Distinguished Visiting Professor, United Stat es Air Force Academy, Department of Management, 2354 Fairchild Drive, Suite 6H130, USAF Academy, CO, 80840, United States of America, greg.parnell@gmail.com, Jason Merrick

In counter-terrorism risk management decisions, the analyst can choose to represent terrorist decisions as uncertainties or as decisions. We perform a comparative analysis of PRA, decision analysis, game theory, and combined methods on the same problem. For each technique, we compare the assumptions, probability assessment requirements, risk levels, and potential insights for risk managers.

2 - Terrorist Least Risk Attack Planning

Ric Blacksten, Principal Analyst, Innovative Decisions, Inc., 1945 Old Gallows Road, Suite 207, Vienna, VA, 22182, United States of America, hblacksten@innovativedecisions.com

A Terrorist Least Risk Attack Planning (TLRAP) analysis approach and Excel/VBA tool seek to determine how a terrorist group might maximize its probability of attack success by using its resources (time, money) to buy down attack plan risk. This can be used in an iterative Red-Blue intelligent adversary analysis cycle to formulate a min-max defensive posture to prevent a worst case outcome. TLRAP is appropriate when confident estimates of terrorist group action preferences are unavailable.

3 - The Team Effect in Terrorist Risk Analysis

Seth Guikema, Assistant Professor, Johns Hopkins University, 3400 N. Charles St., Ames Hall, Baltimore, MD, 21218, United States of America, sguikema@jhu.edu, Andrew Samuel

The federal government's allocation of resources for defense against attacks involves depending on a multi-tiered organization. This can lead to mis-aligned objectives and the possibility of agencies gaming the system. Attacker-Defender models have generally ignored this agency affect. We present an Attacker-Defender model that explicitly accounts for agency affects and show that ignoring agency effects leads to a sub-optimal allocation of resources.

4 - Robust Adversarial Risk Analysis: A Level-k Approach

Laura McLay, Assistant Professor, Virginia Commonwealth University, Richmond, VA, 23284, United States of America, lamclay@vcu.edu, Casey Rothschild, Seth Guikema

Adversarial risk analysis is an active and important area of decision analytic research. This paper proposes, formulates, and illustrates the application of robust optimization methodologies to a level-k defender-attacker game theory model for adversarial risk analysis. Our approach thus combines level-k and robust optimization insights to provide a computationally tractable model of boundedly rational players who are faced with significant and difficult to quantify uncertainties.

■ TB16

C - Room 209A

Economics, Supply Chain and Logistics Analysis of Biofuels II

Sponsor: Energy, Natural Resources and the Environment/ Environment and Sustainability

Sponsored Session

Chair: Sandra Eksioglu, Mississippi State University, Department of Industrial and Systems Eng, Mississippi State, MS, 39762, United States of America, sde47@ise.msstate.edu

1 - Logistics Cost and Optimal Size of a Bio-fuel Refinery

Aisyah Larasati, Oklahoma State University, Stillwater, OK, United States of America, Aisyah.Larasati@okstate.edu, Francis Epplin, Austin Buchanan, Tieming Liu

We identify the optimal size of a bio-fuel refinery by analyzing the trade-off between the switchgrass transportation cost and the economic scale of cellulosic ethanol production. The results indicate that for the refinery capacities considered the effect of the economic scale of cellulosic ethanol production dominates the increase in transportation cost and the cost per gallon decreases as the refinery capacity increases.

2 - Biofuel Supply Chain Systems Design under Seasonality and Uncertainty

Yongxi Huang, University of California Davis, Davis, CA, United States of America, yxhuang@ucdavis.edu, Yueyue Fan

A biofuel supply chain consists of various interdependent components. We aim to improve the reliability of biofuel infrastructure systems against seasonal variations and uncertainties of feedstock supply in an integrative manner. We develop a stochastic MIP model that minimizes the total expected cost of the entire supply chain under feedstock seasonality, geographical distribution, and uncertainty, and present a case study considering California corn stover and forest residues.

3 - Biofuel Supply Chain Design under Competitive Feedstock Supply and Market Equilibrium

Yun Bai, University of Illinois Urbana at Champaign, Department of Civil Environmental Engineering, Urbana, IL, United States of America, yunbai1@illinois.edu, Jong-Shi Pang, Yanfeng Ouyang

This study proposed game-theoretic models that incorporate farmers' decisions on land use and market choice into the biofuel manufacturers' supply chain design problem. A Stackelberg leader-follower game model, a cooperative game model and corresponding solution approaches are developed to address possible business partnership scenarios between feedstock suppliers and biofuel manufacturers.

4 - Supply Chain Designs and Management for Biocrude Production Via Wastewater Treatment

Sandra Eksioglu, Mississippi State University, Department of Industrial and Systems Eng, Mississippi State, MS, 39762, United States of America, sde47@ise.msstate.edu, Mohammad Marufuzzaman

The objective of this study is to design and evaluate the performance of the supply chain for biocrude production from activated sewage sludge in waste water treatment facilities. We initially assess the cost of transporting sludge using pipeline and truck. We derive transportation costs as a function of volume and distance traveled. These functions are then used on a mixed integer program that helps to identify facility locations and assignments that minimizes total supply chain related costs.

■ TB17

C - Room 209B

Advances in Probabilistic Modeling

Sponsor: Decision Analysis

Sponsored Session

Chair: Luis Montiel, PhD, University of Texas at Austin, Austin, TX, 78703, United States of America, lvmontiel@gmail.com

1 - Formulating Decision Circuits with the Assessed Probability Model

Debarun Bhattacharjya, IBM T. J. Watson Research Center, Ossining, NY, United States of America, debarunb@us.ibm.com, Ross Shachter

Decision trees and influence diagrams are both popular in decision analysis. A decision circuit is a graphical representation that is syntactic, i.e. depicts summation, multiplication and maximization operations required to solve a decision problem, incorporating coalescence at the structural level. In this talk, I will show how the analyst can build a circuit directly, using the assessed form probability model, highlighting how decision circuits generalize decision trees and influence diagrams.

2 - Simulating Discrete Joint Probability Distributions Subject to Partial Information

Luis Montiel, PhD, University of Texas at Austin, Austin, TX, 78703, United States of America, lvmontiel@gmail.com, Eric Bickel

We present a methodology for simulating discrete joint probability distributions given partial information. Our approach begins with the construction of a polytope using linear constraints. We then implement a Monte Carlo procedure to sample joint distributions uniformly from the polytope. The simulated distributions can be used to solve decision models under different uncertainty scenarios.

3 - Making Decisions with Partial Information: Eagle Airlines Example

Eric Bickel, Operations Research / Industrial Engineering Center for International Energy and Environmental Policy, The University of Texas at Austin, Austin, TX, 78712, United States of America, ebickel@mail.utexas.edu, Luis Montiel

We propose a new approach to analyzing decisions with partial information. We use a new simulation procedure to create a collection of joint distributions that match the given information. The collection of distributions is then used to analyze sensitivity to the dependence structure in a decision. We demonstrate this methodology with the Eagle Airlines example.

■ TB18

C - Room 210A

Scheduling and Its Integration with Other Operational Decisions

Cluster: Scheduling and Project Management

Invited Session

Chair: Zhixin Liu, Assistant Professor, University of Michigan - Dearborn, 19000 Hubbard Drive, Dearborn, MI, 48126, United States of America, zhixin@umd.umich.edu

1 - Order Scheduling on Parallel Machines to Minimize Maximum Lateness

Guohua Wan, Professor of Management Science, College of Econommics and Management,, Shanghai Jiao Tong University, Shanghai, 200052, China, ghwan@sjtu.edu.cn

We consider an order scheduling problem on parallel machines to minimize maximum lateness for orders. Due to NP-hardness of the problem, we develop four heuristic algorithms with worst case bounds to solve the problem, namely, EDD-LS, EDD-LPT, EDD-BIN and EDD-MF. We obtain tight bound for the heuristic algorithm EDD-LS. We provide numerical results to demonstrate the performance of the algorithms as well.

2 - A Game Theory Approach on Supply Chain Scheduling in the Steel Industry

Lixin Tang, Professor, Northeastern University, The Logistics Institute, Liaoning Key Lab of Mfg Sys & Logistics, Shenyang, 110004, China, lixintang@mail.neu.edu.cn, Feng Li

This talk studies three problems as follows. 1) Two-stage non-cooperative game based supply chain scheduling with batching in steelmaking plant and hot rolling plant. 2) Hybrid non-cooperative and cooperative game based supply chain scheduling with batching in hot rolling and cold rolling plant. 3) Cooperative game based supply chain scheduling with batching for serial production units within a cold rolling plant.

3 - Production Scheduling and Its Coordination with Price Quotation

Zhixin Liu, Assistant Professor, University of Michigan - Dearborn, 19000 Hubbard Drive, Dearborn, MI, 48126, United States of America, zhixin@umd.umich.edu, Liang Lu, Xiangtong Qi

We study a joint price quotation and production scheduling problem for a manufacturing firm. We develop efficient algorithms to calculate the expected production cost, measured by the completion time of all firm orders, under a given set of quoted prices, and then design dynamic programming algorithms to find the optimal price quotations. Our models and algorithms are validated by computational experiments.

4 - Optimal Pricing Strategy to Reduce Fuel Consumption in Electricity Generation with Regulated Demand

Zhongsheng Hua, Professor and Vice Dean of School of Management at University of Science and Technology of China, (USTC), Hefei, Anhui P.R., China, zshua@ustc.edu.cn, Ping He, Ye Lu, Meng Meng Yuan

We divide electricity demand cycle into two periods, peak and off-peak periods. There is an upper bound on demand in peak period, and demand overrun the bound will be changed at a higher price. When fuel consumption is a strictly increasing convex function, we use a two-price strategy to shift demand from peak to off-peak period, and show how this strategy can help reduce fuel consumption. We also study how the bound and the prices can be jointly optimized to reduce fuel consumption.

■ TB19

C - Room 210B

Contagion and Portfolio Modeling

Sponsor: Financial Services Section

Sponsored Session

Chair: Wendy Roth, PhD Candidate, UTK, University of Tennessee, Chattanooga, United States of America, Wendy-Roth@utc.edu

1 - Analysis of the Impact of Contagion Flow on High Yield Bond Portfolio

Wendy Roth, PhD Candidate, UTK, University of Tennessee, Chattanooga, United States of America, Wendy-Roth@utc.edu, Chanaka Edirisinghe, Aparna Gupta

Portfolios are constructed to increase returns and manage risk. An unanticipated event impacting securities of one firm can contagiously affect other firms through a contagion flow process. A model is developed for flow of contagion between firms. This model is then used to assess the impact of a network structure underlying contagion flow on the optimization of a portfolio of high-yield debt instruments.

2 - A Discrete Transformation Survival Model with Application to Default Probability Prediction

Shaonan Tian, PhD Candidate, University of Cincinnati, P.O. Box 210130, College of Business, Cincinnati, OH, 45221, United States of America, tiansn@mail.uc.edu, A. Adam Ding, Yan Yu, Hui Guo

In this work, we propose to apply a discrete transformation family of survival analysis to corporate default risk predictions. We show that a transformation parameter different from the popular Shumway's model and Cox proportional hazards model is needed for default prediction. Due to some distinct features of bankruptcy application, the proposed discrete transformation survival model is fundamentally different from the continuous survival models in the literature.

3 - Integer Programming Approach to the Portfolio Selection Problem with Spillover Risk Aversion

Hwayong Choi, KAIST, Department of Industrial & System Engineering, 373-1 Guseong-dong, Yuseong-gu, Daejeon, 305-701, Korea, Republic of, ganarisg@kaist.ac.kr, Chungmok Lee, Sungsoo Park

We propose a new optimization approach for a variant of the mean-variance portfolio model concerning the spillover effects at the market distress situation. CoVaR is suggested as a measure for the spillover risk. Based on the framework of mean-variance model, we additionally guarantee that the candidate stocks constructing the portfolio have limited spillover effects. The model is solved by using the column generation. The results of the computational experiments are presented.

■ TB20

C - Room 211A

Convex Optimization Tools in Nonlinear Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Agustin Bompadre, Postdoctoral Fellow, California Institute of Technology, 1200 E. California Boulevard, Pasadena, CA, 91125, United States of America, abompadr@gmail.com

1 - SDP Relaxations for Concave Cost Transportation Problems

Tomohiko Mizutani, Kanagawa University, 3-27-1 Rokkakubashi, Kanagawa, Yokohama, 221-8686, Japan, mizutani@is.kanagawa-u.ac.jp, Makoto Yamashita

We present hierarchical SDP relaxations for concave cost transportation problems with p supply nodes and q demand nodes, based on the convergence theory by Lasserre. One of the features is that that the size of matrix variables at each relaxation level only depends on min{p, q}, and the key idea to derive such relaxations is change of variables to the problems. We show by numerical experiments that the relaxation methods give good approximation solutions.

2 - Convex Methods in Sparse Image Reconstruction

Roummel Marcia, Assistant Professor, University of California, Merced, 5200 N. Lake Road, Merced, CA, 95343, United States of America, rmarcia@ucmerced.edu, Zachary Harmany, Rebecca Willett

In this talk, we discuss current convex approaches for solving nonlinear optimization problems arising in sparse image reconstruction. In addition, we use a priori signal information to improve our ability to recover the true image from noisy measurements.

3 - Lagrangean Approach for a Class of Large Scale Newsboy Problem with Supplier Discounts

Guoqing Zhang, Professor, University of Windsor, Department of Industrial Engineering, 401 Sunset Avenue, Windsor, ON, N9B3P4, Canada, gzhang@uwindsor.ca

We developed Lagrangian heuristic to solve a class of large scale newboy problem with supplier discount, which is formulated as MINLP. The computation results with comparisons to GAMS are reported.

4 - Mixed-integer Programming Approach to Multi-piece Mold Design

Stephen Stoyan, Starbucks Coffee Company, 2401 Utah Avenue S., Seattle, WA, 98134, United States of America, stoyan@usc.edu

Multi-piece polymer molds involve a technology that consists mold pieces being assembled/dissembled like 3D puzzles. Compared to traditional methods, parts with complex geometries can be made; however, there are numerous challenges in designing such multi-piece molds. Previous work that addresses this problem are based on heuristics. We present a multi-piece mold model using a mixed-integer programming approach. Optimal multi-piece mold designs are made that can be generated for any CAD model.

■ TB21

C - Room 211B

Stochastic Optimization with Application to Search and Detection I

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Johannes Royset, Associate Professor, Naval Postgraduate School, Monterey, CA, United States of America, joroyset@nps.edu

1 - Bayesian Search, Tracking, Localization and Mapping – A Unified Strategy for Multi-task Mission

Tomonari Furukawa, Professor, Virginia Tech, IALR, 150 Slayton Avenue, Danville, VA, 24540, United States of America, tomonari@vt.edu, Gamini Dissanayake, Lin Chi Mak, Kunjin Ryu, Xianqiao Tong

The talk will present cooperative Bayesian search, tracking, localization and mapping (STLAM), which allows multiple autonomous vehicles to cooperatively search for, track and localize targets while self-localizing and constructing a map of environments in a unified theoretical framework. STLAM are essentially the four major tasks of field robots. The authors formulated and implemented them within a Bayesian framework such that the tasks can be efficiently, robustly and seamlessly performed.

2 - Implementation of CVaR-based Support Vector Machine with Portfolio Safeguard

Peter Tsyurmasto, PHD Student, University of Florid a, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32608, United States of America, peter.tsyurmasto@gmail.com, Stan Uryasev

CVaR-based Support Vector Machine (SVM) was implemented with Portfolio Safeguard (PSG) and tested on six available classification data sets. As it was shown earlier, CVaR-based SVM is equivalent to nu-SVM. It can be reduced to minimization of quadratic and CVaR-risk function. Both functions have already been pre coded in PSG. It allows user to call them without going into details of their realization.

3 - Dynamic Vehicle Routing over a Sparse Sensor Network

Joao Hespanha, Professor, UCSB, 4157 HFH, UCSB, Santa Barbara, CA, 93106-9560, United States of America, hespanha@ece.ucsb.edu, Jason Isaacs, Shaunak Bopardikar

We consider a dynamic vehicle routing problem in which a service vehicle visits several unattended ground sensors (UGS) to localize randomly occurring events. The UGS can detect events occurring within a known range and the service vehicle must visit multiple sensors to localize the event. The goal is to minimize the expected time between when an event occurs and when it has been localized. Multiple policies are provided for the service vehicle as well as criteria for switching between.

4 - Optimization of Risk-averse Searchers under Incomplete Information Using Regression Models

Sofia Miranda, Naval Postgraduate School, Monterey, CA, United States of America, smiranda@nps.edu, Johannes Royset

We consider a discrete time-and-space search optimization problem where the objective function is defined by an averse and coherent risk measure of a random function, with unknown probability distribution. We approximate the random function by a linear combination of known factors. Using a nonstandard regression model, we ensure the difference between the random function and its approximation is minimized. Thus, the random function is replaced by the best possible approximation in some sense.

■ TB22

C - Room 212A

Quadratic Optimization and its Applications in Computer Vision

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Jiming Peng, University of Illinois at Urbana-Champaign, 104 S Mathews Avenue, Urbana, IL, 61801, United States of America, pengj@illinois.edu

1 - Scale Invariant Cosegmentation for Image Groups

Vikas Singh, Assistant Professor, University of Wisconsin, 5795 MSC, 1300 University Av, Madison, WI, 53706, United States of America, vsingh@biostat.wisc.edu, Lopamudra Mukherjee, Jiming Peng

Our interest is in concurrent image segmentation of common foreground regions from many images. We want our algorithm to offer scale invariance (foregrounds have arbitrary sizes in different images) and the runtime to be small. We present an easy to implement algorithm which performs well, and satisfies all requirements listed above (scale invariance, low runtime, and viability for the multiple image setting). We present qualitative and technical analysis of the properties of this framework.

2 - Some Results on Sparse Solutions to Quadratic Programming Problems

Jiming Peng, University of Illinois at Urbana-Champaign, 104 S Mathews Avenue, Urbana, IL, 61801, United States of America, pengj@illinois.edu

In the talk, we present some recent results on sparse solutions to quadratic programming problems including the standard QP, and the mean-variance model for portfolio selection. For the StQP, we show that if the input data is from a certain distribution, then with a high probability, the corresponding QP has a very sparse solution. Fot the MV model, we show that with a high probability, there exists a sparse approximation solution.

3 - Discrete Convexity and Optimization of a Set of Discrete Variable Functions in Z^n,n=1

Emre Tokgoz, Ph D student, University of Oklahoma, 601 Elm Avenue, Norman, OK, 73019, United States of America, Emre.Tokgoz-1@ou.edu, Sara Nourazari, Hillel Kumin

In this work, we generalize the integer convexity definition of Fox (1966) to functions with domain Z^n,n=1, by defining the condense discrete convexity (CDCx) with the corresponding Hessian matrix. In addition, optimization results are proven for C^1 CDCx functions assuming that the given CDCx function is C^1 and Rosenbrock's function is shown to be a CDCx function.

■ TB23

C - Room 212B

Managing the Environmental Impacts of Aviation

Sponsor: Aviation Applications

Sponsored Session

Chair: Karen Marais, Assistant Professor, Purdue University, 701 W Stadium Avenue, School of Aeronautics and Astronautics, West Lafayette, IN, 47907, United States of America, kmarais@purdue.edu

1 - Demonstration of Reduced Airport Congestion through Pushback Rate Control

Hamsa Balakrishnan, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, hamsa@mit.edu, Ioannis Simaiakis, Tom Reynolds, John Hansman, Harshad Khadilkar

In this talk, we present the field tests of an airport congestion control strategy at Boston Logan International Airport. The approach determines a suggested rate at which to meter pushbacks from the gate, thereby preventing the airport surface from entering congested states, and reducing the time that flights spend with engines on while taxiing to the runway. The field trials demonstrated the potential for significant benefits: in 8 test periods of 4 hours each, over 16 tons of fuel was saved.

2 - Environmental Benefits of Optimized Surface and Terminal Area Operations

John-Paul Clarke, Associate Professor, Georgia Institute of Technology, Aerospace Engineering, Atlanta, GA, 30332-0150, United States of America, johnpaul@gatech.edu, Bosung Kim, Evan McClain, Gustaf Sölveling

Operations at and around major airports are characterized by congestion and delay both on the ground and in the air. This is the result of both overly aggressive scheduling and poor coordination. We present a set of linked algorithms for jointly optimizing operations on the surface and in the terminal area, and provide estimates of the economic and environmental benefits via numerical studies.

3 - Economic and Environmental Comparison of Select Alternative Jet Fuel Options

James Hileman, Associate Director, Massachusetts Institute of Technology Partner, 77 Massachusetts Ave., 33-115, Cambridge, MA, 02139, United States of America, hileman@mit.edu, Michael Bredehoeft

In response to growing interest in alternative jet fuels, this empirical study derives a predictive instrument for fuel production costs from the experience of Fischer-Tropsch project developers and a bottoms-up analysis of hydroprocessing facilities. Fuel cost estimates from this tool were compared to greenhouse gas emissions estimates to understand the relative performance of conventional petroleum-based fuels, hydroprocessed renewable oils, and F-T fuels from biomass, coal, and natural gas.

4 - Environmental Benefits of Improved Airport Surveillance

Eric Feron, Professor, Georgia Institute of Technology, School of Aerospace, 270 Ferst Drive, Atlanta, GA, 30332-0150, United States of America, feron@gatech.edu

This presentation quantifies the benefits yielded by ramp clearance strategies that rely on enhanced ground surveillance at Seattle-Tacoma International airport. Controlling spot clearances from three ramp areas, using ASDE-X surface surveillance, reduces the number of taxiing aircraft, and therefore emissions, by 6 percent when compared with a state-of-the-art threshold policy. This reduction occurs with no change of airport take-off rate.

5 - Environmental Benefits of End-around Taxiway Operations

Payuna Uday, Graduate Student, Purdue University, 400 N. River Rd, Apt 732, West Lafayette, IN, 47906, United States of America, puday@purdue.edu, Karen Marais

Primarily motivated by safety concerns, the adoption of end-around taxiways at high-traffic airports with parallel runways has the potential to reduce runway incursions, increase runway throughput, and reduce fuel burn and surface emissions. This study presents an explicit evaluation of the environmental implications of these taxiways at one airport.

■ TB24

C - Room 213A

Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Gabor Pataki, University of North Carolina at Chapel Hill, Hanes Hall, 307, Chapel Hill, United States of America, gabor@unc.edu

1 - Optimizing Convex Functions over Non-convex Domains

Daniel Bienstock, Columbia University, 342 S. W. Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States of America, dano@columbia.edu, Alex Michalka

We describe continuing work primarily focused on minimizing strictly convex quadratics over the complement of convex sets, especially the union of ellipsoids.

2 - Lower Bounds for the Chvátal-Gomory Closure in the 0/1 Cube

Sebastian Pokutta, FAU, Am Weichselgarten 9, Erlangen, Germany, sebastian.pokutta@math.uni-erlangen.de, Gautier Stauffer

We will present a simplified method to establish lower bounds on the Chvátal-Gomory rank. We show the power and applicability of this method on classical examples and provide new families of polytopes with high rank. Furthermore, we provide a deterministic/constructive family of polytopes achieving a Chvátal-Gomory rank of at least (1+1/e)n - 1 and we show how to obtain a lower bound on the rank from solely examining the integrality gap.

3 - A Unifying View of Lenstra's Algorithm, Kannan's Algorithm, and Lattice Based Reformulation Methods

Gabor Pataki, University of North Carolina at Chapel Hill, Hanes Hall, 307, Chapel Hill, United States of America, gabor@unc.edu, Mustafa Tural

Lenstra's and Kannan's classic algorithms for the Integer Programming (IP) feasibility problem run in polynomial time when the dimension is fixed. Suppose we reformulate IP problems using basis reduction. A more recent, and somewhat surprising result shows that applying regular branch-and-bound on reformulated IP problems solves almost all instances after enumerating just one node. We give a simple, and unifying derivation of these results.

4 - Non-recursive Cut Generation in Mixed Integer Programming

Egon Balas, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, eb17@andrew.cmu.edu, Francois Margot, Selvaprabu Nadarajah

We explore computational aspects of the new cut generation paradigm proposed by Balas and Margot (2010), which can be used to obtain in a non-recursive fashion deep cutting planes that would require several iterations of a standard cut generating procedure.

■ TB25

C - Room 213BC

Empirical Research in Inventory Management and Retail Operations

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 417, New York, NY, 10027, United States of America, molivares@columbia.edu

1 - Firm-Level Inventory Performance and 10-K Inventory Risk Factors During the Financial Meltdown

Ying-Ju Chen, University of California- Berkeley, 4121 Etcheverry Hall, Berkeley, CA, 94720, United States of America, chen@ieor.berkeley.edu, Ke-Wei Huang

This paper empirically examines the inventory performance of US publicly listed companies from 2006 to 2010. We use computational text classification algorithms to automatically identify firms that reported 4 types of inventory related risk factors in their annual reports. The financial crisis period provides us a natural experiment setting to examine the inventory performance of firms when significant inventory risk actually realizes.

2 - Systematic Risk and the Bullwhip Effect in Supply Chains
Vishal Gaur, Cornell University, The Johnson School, 321 Sage Hall, Ithaca, NY, 14853, United States of America, vg77@cornell.edu, Nikolay Osadchiy, Sridhar Seshadri

The variance of demand has two components, a systematic risk component due to economic factors, and an idiosyncratic noise. We investigate the degree of systematic risk in supply chains and its causes using industry-level data for manufacturers, wholesalers, and retailers in the U.S. economy. Our findings have implications for the type of operational and financial hedging strategy that a firm should choose.

3 - Bullwhip Effect Measurement and its Implications
Li Chen, Assistant Professor, Duke University, 100 Fuqua Drive, Durham, NC, 27708, United States of America, Lc91@duke.edu, Hau Lee

The bullwhip effect has been a subject of both theoretical and empirical studies in the operations management literature. In this paper, we propose a general theoretical framework to explain various empirical observations. We then discuss the linkage between the bullwhip measure and the supply chain cost performance. We also show that data aggregation tends to mask the bullwhip effect.

4 - Demand Estimation with Inventory Endogeneity
Santiago Gallino, Doctoral Student, The Wharton School, 500 Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104, United States of America, sgallino@wharton.upenn.edu, Gerard Cachon, Marcelo Olivares

Our work is concerned with the relationship between inventory and demand. We make two important contributions to the stream of literature on the relationship between inventory and demand. First, through the use of instrumental variables, we incorporate inventory endogeneity into the estimation of demand. Our second contribution is that we develop a methodology to uncover the mechanism by which inventory affects sales, decomposing it into stock-out, billboard and scarcity effects.

■ TB26

C - Room 213D

Customer Queuing Behaviors and Their Implications for M&SOM

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Mirko Kremer, Pennsylvania State University, 460 Business Building, University Park, PA, 16802, United States of America, Mirko.Kremer@psu.edu

1 - Impact of Price Fluctuations on Consumer Purchasing Behavior
Margaret Pierson, Harvard Business School, Harvard, CT, United States of America, mpierson@hbs.edu

How do customers consider changing retail prices when making consumption decisions around basic goods and services?

2 - Bounded Rationality in Service Systems
Gad Allon, Northwestern University, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Tingliang Huang, Achal Bassamboo

The traditional economics and queueing literature typically assume that customers are fully rational. In contrast, in this paper, we study canonical service models with boundedly rational customers. We capture bounded rationality using a framework in which better decisions are made more often, while the best decision needs not always be made.

3 - Joining (and Leaving) Observable and Unobservable Queues – An Experimental Investigation
Mirko Kremer, Pennsylvania State University, 460 Business Building, University Park, PA, 16802, United States of America, Mirko.Kremer@psu.edu, Laurens Debo

We report results from a set of laboratory experiments designed to test queuing game theory predictions about human queue joining behavior. Specifically, we test how customers form expectations about waiting times based on past experience, when the current congestion level is (not) observable upon arrival to the service facility. We discuss implications for models queue joining behavior with boundedly rational consumers.

4 - Follow-the-Crowd Queue Joining Behavior – An Experimental Investigation
Laurens Debo, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, United States of America, Laurens.Debo@chicagobooth.edu, Mirko Kremer

When there is doubt about the service quality in some consumers' minds, the less informed consumers may be attracted by the long lines in front of a service facility, despite the longer waiting times. Naor (1969) predicts that subjects will only join queues that are not too long. We report results from a set of laboratory experiments designed to understand how the presence of more informed consumers leads to follow-the-crowd queue joining behavior of the less informed consumers.

■ TB27

C - Room 214

Maintenance Management for Advanced Technical Systems

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Geert-Jan van Houtum, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, g.j.v.houtum@tue.nl

1 - Spare Parts Management: Anticipated Rationing Policy and Dual Sourcing
Sean Zhou, Chinese University of Hong Kong, Hong Kong - PRC, zhoux@se.cuhk.edu.hk, Shenghao Zhang, Yi Wang

We study a firm managing an inventory system with two service-differentiated demand classes. The firm can order each period from two supply sources: regular supply and expedited supply. Unsatisfied demands are backlogged and high-priority demand incurs a higher backlog cost. We adopt a base-stock type of inventory policy and propose a new demand rationing policy. An exact analytical procedure is provided for evaluating the expected long run average cost under such policies.

2 - Modeling Airstation Performance and Asset Optimization to Maximize Mission Execution at USCG
Vinayak Deshpande, Purdue University, West Lafayette, IN, United States of America, vinayak@purdue.edu, Ananth Iyer

Based on a project with the US Coast Guard, we address the following question: what mix of aircraft and availability should be assigned to air stations to maximize the overall performance of the USCG? We addressed this problem by (a) building a simulation model of each air station, parameterized by detailed tactical level data, and (b) constructing a math programming model that generated the optimal air station asset mix and repair capability configuration that maximized system performance.

3 - Real-time Demand Allocation in Spare Parts Networks
Geert-Jan van Houtum, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, g.j.v.houtum@tue.nl, Moritz Fleischmann, Eleni Pratsini, Harold Tiemessen

Motivated by the practice of the spare parts service operations of a high-tech manufacturer, we study the allocation of a demand to one of the stockpoints that can deliver the requested part within the required time limit. The allocation is based on the actual on-hand stock levels. This dynamic allocation outperforms static allocation. We show by how much and how this depends on network characteristics.

■ TB28

C - Room 215

Novel Directions in Operations Management Research

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Serguei Netessine, Professor, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, serguei.netessine@insead.edu

1 - A Study of a Novel Electric Vehicle Business Model
Buket Avci, Phd Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, buket.avci@insead.edu, Serguei Netessine, Karan Girotra

We analyze a novel business model for the deployment of electric vehicles. In contrast with the traditional automobile sales and maintenance, the customer is charged for the "service" of miles driven, as opposed to the ownership of the vehicle. We compare this new service model to the traditional EV sales model in terms of market adoption and environmental impact. We also investigate how

the advances in battery technology influence the adoption and environmental impact of the new model.

2 - When Does the Devil Make Work? An Empirical Study of the Impact of Workload on Server's Performance

Tom Tan, PhD student, Wharton Business School, University of Pennsylvania, 500 Jon Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104, United States of America, fangyun@wharton.upenn.edu, Serguei Netessine

We use a detailed operational data from a restaurant chain to understand how workload affects meal duration, sales and guest satisfaction, taking endogeneity and heterogeneity into consideration. Therefore our study is one of the early attempts to link Operations Management, Human Resource Management and Restaurant Revenue Management. We also provide insights that can help restaurants better understand how to manage their labor capacity.

3 - Supply Chain Structure: Centralization or Anarchy?

Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, karan@girotra.com, Elena Belavina

We revisit a classic result in supply chain design- the purported superiority of centralized supply chains. We consider the myopic and continuing incentives of firms in a supply chain and show that a longer supply chain, one with more self-interested acting tiers can outperform a more centralized supply chain! While the myopic incentives considered in the past literature, indeed favor centralization; the continuing benefits incent firms to behave more cohesively in longer supply chains.

4 - Information, Supply Chains and Price Dispersion: Evidence from a Natural Experiment in India

Chris Parker, PhD Candidate, London Business School, Regent's Park, London, NW14SA, United Kingdom, cparker.phd2007@london.edu, Nicos Savva, Kamalini Ramdas

In 2007, Reuters introduced a service providing information about local prices of 200+ agricultural products to farmers in rural India via daily text messages. Utilizing an exogenous 12-day ban on text messages as a natural experiment, we investigate the impact of this service on geographic price dispersion. We find a significant increase in price dispersion during the ban period and we investigate the product and supply chain mechanisms through which information decreases price dispersion.

■ TB29

C - Room 216A

Financial Engineering: Models and Computation

Cluster: Quantitative Finance

Invited Session

Chair: Steve Kou, Professor, Columbia University, 312, Mudd Building, Columbia University, New York, NY, 10027, United States of America, sk75@columbia.edu

1 - Blind Auctions and Information Obfuscation

Gerry Tsoukalas, Stanford University, Huang 170, Stanford, CA, United States of America, gts@stanford.edu

Blind auctions are often used as a mechanism to exchange a good while maintaining some level of anonymity around its true state. We study this trade-off for a risk-sensitive seller, through a game-theoretic signaling framework and characterize the optimal amount of information dissemination to the market. As an example, we show results for the blind portfolio auction problem in which the seller's desire to obfuscate originates from the potential threat of predatory traders lurking in the market.

2 - Transmission of Risk in a Supply Chain

Stathis Tompaidis, University of Texas at Austin, McCombs School Of Business, Austin, TX, 78712, United States of America, Stathis.Tompaidis@mccombs.utexas.edu, Hamed Ghoddusi, Sheridan Titman

We present an equilibrium model for the transmission of shocks in a supply chain. Starting with the supply of the input and the demand for the output, we construct the equilibrium process for the input and output prices, the spread between them, and the value of the capital asset that transforms the input into the output. We calibrate our model for the case of crude oil, gasoline, and oil refineries and provide comparative statistics and empirical evidence supporting our model's predictions.

3 - Location, Location, Location: Asset Pricing Models with Spatial Interaction

Haowen Zhong, Columbia University, 313A, Mudd Building, Columbia University, New York, NY, 10027, United States of America, hz2193@columbia.edu, Xianhua Peng, Steve Kou

Spatial interaction is important in the real estate market, as housing prices are significantly affected by the prices of neighbors. Besides providing theoretical foundation connecting classical asset pricing models with spatial statistics, we derive estimators and test statistics needed to implement the models. Empirical tests using the Case-Shiller U.S. regional real estate indices are also given.

4 - Finding Optimal Credit Portfolios

John Birge, Professor, University of Chicago, Booth School of Business, Chicago, IL, United States of America, john.birge@chicagobooth.edu

The potential for default introduces difficult non-linearity into the construction of optimal credit portfolios. With large numbers of assets, these complications can be overwhelming. This talk will describe various approximations for the returns of credit instruments that enable efficient computation.

■ TB30

C - Room 216B

Emerging Topics in OM/Finance Interface

Sponsor: Manufacturing & Service Oper Mgmt/ iFORM SIG

Sponsored Session

Chair: Sridhar Seshadri, Professor, University of Texas at Austin, McCombs School of Business, Austin, TX, United States of America, Sridhar.Seshadri@mccombs.utexas.edu

Co-Chair: Nikolay Osadchiy, Assistant Professor, Emory University, Atlanta, GA, United States of America, nikolay.osadchiy@emory.edu

1 - Resource Flexibility and Capital Structure

Jiri Chod, Boston College, 140 Commonwealth Avenue, Fulton Hall, Chestnut Hill, MA, 02467, United States of America, jiri.chod@bc.edu, Jianer Zhou

We examine how investment in a portfolio of flexible and nonflexible capacity is affected by capital structure and, vice versa, how resource flexibility affects capital structure. Taking debt level as given, financial leverage leads to underinvestment and substitution of flexible capacity with nonflexible capacity. However, when the firm chooses capital structure optimally, trading off the tax benefit and the agency cost of debt, the relation between flexibility and leverage is reversed.

2 - Improving Operational Competitiveness through Bankruptcy

Song Alex Yang, Assistant Professor, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, sayang@london.edu, Rodney Parker, John Birge

Using a dynamic model, we study the influence of formal bankruptcy procedure, especially the existence of bankruptcy reorganization, on a distressed firm's operational competitiveness before and after bankruptcy, the operational decision of his non-distressed competitor, as well as his supplier and creditors. We find that the distressed firm reduces his marginal cost through reorganization, and competes more aggressively under distress.

3 - Sales Forecasting with Financial Indicators and Experts' Input

Nikolay Osadchiy, Assistant Professor, Emory University, Atlanta, GA, United States of America, nikolay.osadchiy@emory.edu, Vishal Gaur, Sridhar Seshadri

We investigate whether retail sales forecasts can be improved with incorporating publicly available market information. The empirical analysis shows that a significant part of analysts' forecast errors can be explained by the broad market index return. We present a method of augmenting the sales forecasts with market returns and improving their accuracy. The accuracy improvement can exceed 15% in the out-of-sample tests, substantially decreasing the cost of supply-demand mismatch.

4 - Industrial Service Pricing Based on Customer Perceived Value: An Empirical Study

Jie Ning, University of Michigan, Industrial & Operations Engineering, Ann Arbor, MI, United States of America, jien@umich.edu, Jussi Keppo, Volodymyr Babich

We study optimal industrial service pricing based on customer perceived value of the service. We model customer perceived value using indifference pricing theory and test it over more than 600 Xerox managed print service contracts. The model has a significant correlation with the realized contract prices.

■ TB31

C - Room 217A

Modelling and Evaluation of Health Systems

Sponsor: Health Applications

Sponsored Session

Chair: Mehmet Ayvaci, University of Wisconsin - Madison, 3233-1533 University Avenue, Madison, WI, 53706, United States of America, ayvaci@wisc.edu

1 - Using Agent-Based Simulation to Improve Clostridium Difficile Infection Control in a Hospital

James Codella, University of Wisconsin-Madison, 3239 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, codella@wisc.edu, Nasia Safdar, Oguzhan Alagoz

Clostridium difficile infection (CDI) affects 500,000 Americans every year, and causes nearly 20,000 deaths annually. Although there are guidelines to control CDI outbreaks in a hospital, there is a strong need to develop rigorous methods to assess the efficacy of these strategies. We propose an agent-based simulation to model the effects of infection control strategies to minimize disease transmission, length of stay, and deaths. We use real data to evaluate the performance of these strategies.

2 - Design of Optimal Surveillance Protocols for Bladder Cancer Patients

Yuan Zhang, NC State University, 3201 Warwick Dr., Raleigh, NC, 27606, United States of America, yzhang13@ncsu.edu, Brian Denton, Matthew Nielsen

We discuss a partially observable Markov decision process (POMDP) to investigate the optimal design of surveillance strategies for bladder cancer patients using a combination of biomarkers tests and cystoscopy. We discuss the special structure of the POMDP and a new methods designed to accelerate incremental pruning to solve this POMDP. The optimal protocol is compared to existing guidelines to measure the benefits of using biomarker tests.

3 - Reducing Wait Times and Improving Treatment Planning Process for Radiation Therapy

Vusal Babasov, University of Western Ontario, Epidemiology & Biostatistics, 1151 Richmond Street, London, ON, Canada, vbabasho@uwo.ca, Greg Zaric, Inge Aivas, Mehmet Begen, Michael Lock

Abstract: Recent statistics show that London Regional Cancer Program (LCRP) consults 45% and treats 85% of patients within Cancer Care Ontario's (CCO) wait time targets. We develop a simulation model to determine bottlenecks and reduce wait times at LRCP. The ultimate goal is to perform scenario and sensitivity analysis and recommend alternate policies on process changes and improvements, staffing levels, and schedules of resources that most efficiently achieve COO's target wait times.

4 - Modeling a Pay-for-Performance Risk Sharing Agreement

Fredrik Odegaard,Assistant Professor, University of Western Ontario, Ivey School of Business, London ON, Canada, fodegaard@ivey.uwo.ca, Reza Mahjoub, Greg Zaric

Some new drugs such as cancer drugs are costly and their effectiveness outside of clinical trial conditions may be unproven. A risk sharing agreement is a contract between the drug manufacturer and a healthcare payer to manage uncertainties regarding the cost and effectiveness of those drugs. We model a risk sharing scheme where the rebate is a percentage of the total sales until an evaluation time. Our model explicitly considers disease progression.

■ TB32

C - Room 217BC

Advances in OR/MS for Passenger Railways

Sponsor: Railway Applications

Sponsored Session

Chair: David Hunt, Senior Specialist, Oliver Wyman, One University Square, Suite 100, Princeton, NJ, 08540, United States of America, David.Hunt@oliverwyman.com

1 - An Exploratory Study of Revenue Management System (RMS) for a Railway in South East Asia

Goutam Dutta, Indian Institute of Management Ahmedabad, Vastrapur,, Ahmedabad, Gu, 380015, India, goutam@iimahd.ernet.in, Priyanko Ghosh

We conduct an exploratory study of a RMS for a railway in South East Asia. We employ a multi-period network revenue optimization model, a series of forecasting models, simulation of passenger demand and EMSR to test the validity of RMS system. We evaluate variations of revenue opportunities in different conditions.

2 - Software Tools to Optimize Crew Schedules for the New Hours of Service Rules

John Dezio, Southeastern Pennsylvania Transportation Authority (SEPTA), Philadelphia, PA, United States of America, JDezio@septa.org

The US Federal Rail Safety Improvement Act of 2008 (H.R. 2095) stipulated new hours of service (HOS) regulations, impacting commuter rail starting October 2011. The new regulations restrict total hours spent operating trains, and implement fatigue management factors in determining legal shifts. This paper explores modeling techniques to optimize the creation of crew jobs to meet the HOS regulations, while creating a set of crew schedules that cover the operating timetable for the lowest cost.

3 - Capacity Planning for Shared Use Corridors

Chip Kraft, TEMS, Frederick, MD, United States of America, ckraft@temsinc.com

This presentation will explore capacity planning models for freight and passenger shared use railway corridors.

4 - An Equipment Optimization Model for SEPTA

Marc Meketon, Vice President, Oliver Wyman, One University Square, Suite 100, Princeton, NJ, 08540, United States of America, marc.meketon@oliverwyman.com

The Southeastern Pennsylvania Transportation Authority (SEPTA) operates one of the largest commuter rail systems in the USA. In this presentation, we will describe a new equipment optimization model for SEPTA that focuses on equipment repositioning, and matching seat capacity to demand.

■ TB33

C - Room 217D

Nanomanufacturing and Nanoinformatics V: Synthesis and Characterization

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Chiwoo Park, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, chiwoo.park@tamu.edu

1 - High-bandwidth Nanopositioning for High-yield Nano-Manufacturing and Metrology

Jingyan Dong, Assistant Professor, North Carolina State University, Edward P. Fitts Department of Ind. & Sys. Eng., Raleigh, NC, 27695, United States of America, jdong@ncsu.edu

High bandwidth is a critical requirement for nanopositioners in high-throughput nanomanufacturing, nano-metrology and high-speed AFM imaging. This paper presents the development and control of a high-bandwidth nanopositioning stage that are capable of 2 Khz closed-loop bandwidth. The stage is used in fast imaging and tip-based nanomanufacturing applications.

2 - Modeling Dynamic Change of Nanoparticle Morphology

Chiwoo Park, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, chiwoo.park@tamu.edu

Analyzing the changes of particle morphology during the synthesis process helps understand how nanoparticles grow during the synthesis, and this understanding in turn helps find control factors in the synthesis process. In this presentation, a statistical method to extract and analyze the dynamic morphology change from a time-series data of particle morphology is proposed.

3 - Problems in Statistical Characterization of Nanomaterials and Their Manufacturing Process Modeling

Ravi Shankar, Assistant Professor, University of Pittsburgh, 1034 Benedum Hall, Pittsburgh, United States of America, ravishm@pitt.edu

Materials composed of nano-scale constituents have attracted significant research interest due to their enhanced property combinations. Their novelty emerges from the effect of organization of atoms and interfaces at the nanoscale on physical, mechanical and biological properties. Using our studies on bulk nanomaterials, we will contextualize current challenges in the statistical characterization of nanomaterials and in elucidating the process-structure relationships via designed experiments.

4 - Fast Filtration Synthesis Method for Buckypaper Using Highly Concentrated Carbon Nanotube Slurry

Chuck Zhang, High-Performance Materials Institute, Florida State University, 2005 Levy Avenue, Tallahassee, FL, 32310, United States of America, chzhang@eng.fsu.edu, Kan Wang, Zhiyong Liang, Ben Wang

Buckypapers (BPs) were synthesized from highly concentrated multi-walled carbon nanotube slurry, using poly(vinyl alcohol) as binder. Scanning electron microscopy characterization was used to investigate the nanostructure of the BPs. Their Young's moduli and electrical conductivities are measured by dynamic mechanical analysis and four-point Kelvin tests, respectively. This new process has a great potential in the scalability of production by significantly reducing the manufacturing time.

■ TB34

C - Room 218A

Stochastic Models in Healthcare

Sponsor: Health Applications

Sponsored Session

Chair: Turgay Ayer, Assistant Professor, Georgia Institute of Technology, School of Industrial and Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332, United States of America, ayer@isye.gatech.edu

1 - Determining the Best Vaccine Vial Size: An Stochastic Approach

Ruben Proano, Asistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, KGCOE 09-1593, Rochester, NY, 14623, United States of America, rpmeie@rit.edu, Aswin Dhamodharan

The choice of a vaccine vial size can highly impact the cost and wastage of immunization campaigns. Large vial sizes not only result in lower purchase and storage costs per dose, but also in higher levels of vaccine wastage than single dose vials. Considering vaccine vials as stochastic inventory systems, this study determines the optimal vial size and the reorder point that minimize the total cost and wastage incurred by an immunization campaign.

2 - Capacity and Staffing Decisions in the Presence of Limited Resource Flexibility - A Hospital Setting

Jan Schoenfelder, Indiana University, Operations & Decision Technologies Department, Kelley School of Business, Bloomington, IN, 47405, United States of America, janschoe@indiana.edu, Edwin Coe, H. Sebastian Heese, Kurt Bretthauer

Based on our collaboration with a US hospital, we model the problem of making capacity and staffing decisions in two hospital units with limited resource flexibility. We apply our model to derive insights for the specific hospital setting that motivated our research.

3 - Adaptive Vaccine Allocation in an Influenza Pandemic

Anna Teytelman, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, teytanna@mit.edu, Richard Larson

The 2009-10 H1N1 flu outbreak spread from the Southeastern US states to the North and West. 'Early-flu' states did not receive H1N1 vaccines until the major wave had passed; their vaccines were ineffective and mostly unused. 'Late-flu' states vaccinated a significant portion of their population. We propose an improved adaptive vaccine distribution strategy (AVDS). AVDS would allow a central body to utilize states' near real-time flu wave data to distribute vaccines in a more effective manner.

4 - Optimal Discharge Timing for Traumatic Brain Injury (TBI) Inpatient Rehabilitation

Nan Kong, Purdue University, School of Biomedical Engineering, West Lafayette, IN, United States of America, nkong@purdue.edu, Pratik Parikh

TBI accounts for one third of all injury-related deaths in the US. Concerns have been raised about balancing the short- and long-term TBI care costs in the context of inpatient rehabilitation discharge planning. In this talk, we focus on the optimal discharge timing issue. We present a POMDP model that maximizes the total care cost. We use readmission risk as a partially observable surrogate state descriptor, which is related to the patient's length of stay in the inpatient rehab facility.

■ TB35

C- Room 218B

Capacity and Contracts in Electricity Markets II

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Golbon Zakeri, Dr, University of Auckland, #70 Symonds Street, Auckland, New Zealand, g.zakeri@auckland.ac.nz

1 - Valuing Water in Contracts

Golbon Zakeri,Dr, University of Auckland, #70 Symonds Street, Auckland, New Zealand, g.zakeri@auckland.ac.nz

In jurisdictions such as Scandinavia and New Zealand water plays a major role in electricity production. However this is not the only role that water plays. It is also frequently used for agricultural irrigation. Through this talk we will explore the value of water through agriculture related uses visavis an electricity market.

2 - Interannual Variability in Electricicy-sector Capacity-expansion Model

Patrick Sullivan, National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden CO, United States of America, Patrick.Sullivan@nrel.gov, Kelly Eurek, Walter Short

Renewable energy resources tend to be variable, not only on short timescales like minutes, hours, and days (specifically wind and solar), but also interannually (all of wind, solar, hydropower, and biomass). The amount of energy generated by a renewable generating plant over the course of a single season or year can vary dramatically from the long-term expected average. This variation can adversely impact the value of the installation and requires the system operator to be flexible with regard to supplies of other electricity sources. The project to be discussed here adds a stochastic component to the Regional Energy Deployment System (ReEDS) model and uses the augmented model to investigate how interannual variability of renewable resources affects the economics of investing in renewable power.

3 - Studying Variability and Uncertainty of Variable Generation Power Systems using an Integrated Scheduling Model

Erik Ela, National Renewable Energy Laboratory, 1617 Cole Boulevard, Golden, CO 80401, United States of America, Erik.Ela@nrel.gov, Mark O'Malley

This presentation will discuss a new way of studying the integration of variable generation on power systems. Recent models used to study the integration of variable generation are typically at one single time resolution without possibility of modeling the impacts that occur from the errors of variable generation production forecasts. The model integrates security constrained unit commitment, security constrained economic dispatch, and automatic generation control together using MILP, LP, and rule-based algorithms, respectively. Each sub-model is synchronized so that proper feedback between them is achieved for realistic results with the flexibility of the study user to test different market designs to see how the impacts change. Results from the test cases will be presented.

■ TB36

C - Room 219A

Simulation in Healthcare

Sponsor: Health Applications

Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mech. & Ind. Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, mike.carter@utoronto.ca

1 - Optimizing Patient Flow at General Site Orthopedic Clinic Using Discrete Event Simulation

Ivan Yuen, St. Joseph's Health Centre, 30 The Queensway, Toronto, ON, M6R1B5, Canada, ivan.yuen@utoronto.ca

Numerous DES models have been developed in the past as a tool for allocating resources to improve patient flow in health care. However, there is a challenge in ensuring the results are applied. This initiative has been a successful implementation in reducing patient cycle time at an Orthopedic Clinic in Hamilton, ON. 10 scenarios that varied appointment schedule and clinic resources were developed and tested using the model. The recommended optimal scenario has reduced patient cycle time by 8%.

2 - A Generalized Simulation-based Tactical Perioperative Decision Support Tool for Hospitals

Daphne Sniekers, PhD Student, Mechanical and Industrial Engineering, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, daphne.sniekers@utoronto.ca, Michael Carter

In 2005 the Surgical Process Analysis Improvement Expert Panel recommended the development of a perioperative simulation system accessible to all Ontario hospitals. A generalized simulation model has been created to inform tactical level decisions such as the OR block schedule, scheduling rules, resource capacities, etc. on patient flow. The generalized model has been successfully used at six hospitals. This presentation will demonstrate results, lessons learned, limitations and future work.

3 - A Generic Bed Planning Model

Tian Mu Liu, University of Toronto, Mech. & Ind. Engineering, Mississauga, Canada, tianmu.liu@utoronto.ca, Michael Carter

Hospitals want to allocate their resources to maximize the efficient use of acute care beds. We introduce a generic bed planning model that allows any hospital to estimate the number of beds that are required during a typical busy week in order to provide a given level of service.

■ TB37

C - Room 219B

Multivariate Analysis for System Quality and Reliability Improvement

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Jian Liu, Assistant Professor, The University of Arizona, Rm 268 ENGR Building, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, jianliu@email.arizona.edu

1 - Feature Selection for Unlabeled Data with Complex Structures for Quality Improvement

Kai Yang, Professor, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States of America, kai.yang@wayne.edu, Adel Alaeddini, Sara Shirinakm

Feature subset selection of multivariate data sets is used to identify key variables affecting the underline quality of a process. Very few methods can handle unlabeled data sets with complex structures in real manufacturing practices. In this research, based on the concept of statistical learning, graph theory, and multivariate statistics we develop an automated method of feature selection. This method can also uncover the hidden clusters in datasets that can be used to quality diagnosis.

2 - Hypergraph-based Gaussian Process Models with Both Qualitative and Quantitative Inputs

Shuai Huang, Research Assistant, Arizona State University, 2343 West Main Street, Mesa, AZ, 85201, United States of America, shuang31@asu.edu, Jing Li

A handful of novel Gaussian process models have been developed for computer experiments with both qualitative and quantitative factors. Due to the complicated nature of their correlation functions, a lot of parameters are employed and intense computational efforts are needed. We develop a new Hypergraph-based Gaussian process model, which is parsimonious on parameters, easy to implement, cheap on computation, and more stable in terms of statistical estimation.

3 - A Method for Machining Tool Wear Prediction

Zhigang Tian, Assistant Professor, Concordia University, Institute for Information Systems Engine, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca

Machining tool condition monitoring plays an important role, since excessive tool wear will result in losses in surface finish and accuracy of the part and possible damage to the work piece and the machine. In this work, we investigate a data-driven method for tool wear prediction. Data collected from a milling machine is used to demonstrate the method.

4 - Control Charts with Supplementary Runs Rule for Small Mean Shifts Detection

Jinho Kim, Rutgers University, CORE, Piscataway, United States of America, jinhokim@eden.rutgers.edu, Elsayed Elsayed, A.M.S. Hammuda, Khalifa Al-Khalifa, Minjae Park, Myong K (MK) Jeong

In this paper, we develop a new consecutive runs rule that incorporates with the CUSUM chart to improve the performance in detecting small mean shifts. The ARL performance of the proposed method is compared with EWMA and some variants of CUSUM charts including ACUSUM.

■ TB38

H- Johnson Room - 4th Floor

Location Analysis

Sponsor: Location Analysis

Sponsored Session

Chair: Zvi Drezner, Professor, California State University, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu

1 - An Approximation Algorithm for a Continuous Facility Location Problem

Fan Jia, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, fanjia@ie.umn.edu, John Carlsson

We consider a continuous facility location problem in which the objective is to minimize emissions. The two sources of emissions are transportation between facilities and the transportation from facilities to customers. Solving this problem to the exact solution is computationally infeasible when the number of facilities is large. Thus, we give a constant factor approximation algorithm for the problem.

2 - Integrated Redistricting and Allocation for overload Minimization by Intra-district Service Transfer

Ehsan Nazarian, PhD Student, University of Nebraska-Lincoln, W348 Nebraska Hall, Lincoln, NE, 68588, United States of America, enazarian@unlnotes.unl.edu, Jeonghan Ko

Service demand overload problem often involves overload disparity resulting from improper planning not reflecting up-to-date spatial demand distributions. This paper focuses on overload disparity in the service planning with strict district boundaries such as public legal service planning. Redistricting the current service districts is integrated with transferring services between service providing locations to enable efficient utilization of the geographically distributed service capacity.

3 - Hub and Spoke Network Design with Single-assignment, Capacity Decisions and Balancing Requirements

Stefan Nickel, Karlsruhe Institute of Technology (KIT), Kaiserstrasse 12, Karlsruhe, 76131, Germany, stefan.nickel@kit.edu, Francisco Saldanha da Gama, Isabel Correia

An extension of the capacitated single-allocation hub location problem is considered in which not only the capacity of the hubs is part of the decision making process but also balancing requirements are imposed on the network. The decisions involve i) the selection of the hubs, ii) the allocation of the spoke nodes to the hubs, iii) the flow distribution through the sub network defined by the hubs and iv) the capacity level at which each hub should operate.

4 - Responsive Supply Chain Design Problem for a Network of Make to Order Facilities

Robert Aboolian, California State University San Marcos, 333 S. Twin Oaks Valley Rd, San Marcos, CA, 92096, United States of America, raboolia@csusm.edu

In this problem we seek to locate a set of MTO facilities, allocate customers to these facilities and assign enough capacity for the customer demand to each of these facilities to minimize facilities overall cost while maintaining a certain level of responsiveness. An extension of this problem allows violation in responsiveness level at a cost. Both problems are formulated as nonlinear MIPs for a network of M/M/1 queues. We analyze these problems and present exact approaches for them.

■ TB39

H - Morehead Boardroom -3rd Floor

E-business & Economics of IS

Sponsor: E-Business

Sponsored Session

Chair: Hyoduk Shin, Assistant Professor, Northwestern University, Kellogg School of Management, Evanston, IL, 60201, United States of America, hyoduk-shin@kellogg.northwestern.edu

1 - Versioning Strategy of Information Goods with Network Externality in the Presence of Piracy

James Zhang, University of California-Irvine, Irvine, CA, 92697, United States of America, james.zhangzhe@uci.edu, Shivendu Shivendu

In our model, market consists of two types of consumers who receive some common utility from the basic functionality of the information good but have heterogeneous valuation for other value enhancing functionalities. We show that versioning is optimal when the proportion of high valuation consumers is neither too large nor too small. Sellers can deploy appropriate versioning strategy to mitigate the impact of piracy on information goods with network externality.

2 - Design and Evaluation of a Multi-attribute Online Procurement Auction Mechanism with Information Asymmetry

Hossein Ghasemkhani, University of Washington Seattle, Foster School of Business, 4295 E. Stevens Way NE Paccar Hall, Seattle, WA, 98105, United States of America, hossein@u.washington.edu, Yong Tan, Kamran Moinzadeh

We have studied a firm which conducts repeated online reverse auctions. Every supplier's bid includes a sample and price. The firm infers the quality of the product and using a scoring mechanism ranks the suppliers. Then every supplier gets a share of the total procurement based on their share. Using a game-theoretic framework and incorporating the inherent information asymmetry, we look at the characteristics of the equilibriums and investigate how the firm can maximize its long-term profit.

3 - Social Network Effects on Performance and Layoffs

Lynn Wu, Assistant Professor, Massachusetts Institute of Technology, 60 Wadsworth St, Cambridge, MA, 02142, United States of America, linwu@mit.edu

By studying the changes in networks and performance before and after the adoption of a social networking tool, I consider two intermediate outcomes by which brokerage is theorized to improve work outcomes: information diversity and social communication. Analysis shows that the information diversity is more correlated with generating billable revenue than is social communication. However, social communications, is more correlated with reduced layoff risks than is information diversity.

4 - Competition for Integration and Services in Open Source Software

Hyoduk Shin, Assistant Professor, Northwestern University, Kellogg School of Management, Evanston, IL, 60201, United States of America, hyoduk-shin@kellogg.northwestern.edu, Terrence August, Tunay Tunca

In recent years, firms motivated by revenues from software service markets have become primary contributors to open source development. We explore firms' economic incentives to foster open source software initiatives in lieu of proprietary ones and the role of services in software development and value generation. We present an economic model that analyzes software originators and the contributors' investments in software development as well as pricing of software and services under competition.

■ TB40

H - Walker Room - 4th Floor

Idea Generation and Problem Solving in Innovation Contests

Sponsor: Technology Management

Sponsored Session

Chair: Anant Mishra, George Mason University, 4400 University Drive, VA, 22030, United States of America, amishra6@gmu.edu

1 - Managing Delegated Search over Design Spaces

Sanjiv Erat, Assistant Professor, University of California-San Diego, Rady School, San Diego, CA, United States of America, serat@ucsd.edu, Vish Krishnan

Organizations increasingly seek solutions to their open-ended design problems by employing a contest approach in which search over a solution space is delegated to outside agents. We develop an analytical model to examine the determinants of breadth of solution space searched by outside agents. The model explains clustering of searchers in specific regions of the solution space. Our results show that the breadth of search, while increasing in number of searchers, is sub-linear (logarithmic).

2 - Idea Generation and the Role of Feedback

Joel Wooten, University of Pennsylvania, 500 Huntsman Hall, 3730 Walnut St., Philadelphia, PA, 19104, United States of America, jwooten@wharton.upenn.edu, Karl Ulrich

In many innovation settings, ideas are generated over time and managers face a decision about if and how to provide in-process feedback about the quality of submissions. We use innovation tournament field experiments to examine the effect of feedback on idea generation and show individual-level differences between no feedback, random feedback, and directed feedback.

3 - Participation Strategy, Experience and Likelihood of Winning in Unblind Innovation Contests

Anant Mishra, George Mason University, 4400 University Drive, VA, 22030, United States of America, amishra6@gmu.edu, Cheryl Druehl, Jesse Bockstedt

We examine the dynamics of competition in "unblind" innovation contestsóan increasingly popular format for innovation contests where solutions submitted by contestants as well as the feedback received on them are viewable by other contestants. Using data from 1024 logo design contests involving more than 45000 submitted entries and 2526 unique contestants, we explore the role of participation strategies and prior experience in the contest environment on the likelihood of winning a contest.

■ TB41

H - Waring Room - 4th Floor

New Methods in Managing Innovation

Cluster: New Product Development

Invited Session

Chair: Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, c.loch@jbs.cam.ac.uk

1 - Product Specification Bargaining and Project Failure

Zhijian Cui, Assistant Professor, IE Business School, Calle Marìa de Molina, 13, Madrid, Spain, zhijian.cui@ie.edu, Christoph Loch

Typically, product specifications in NPD projects are the result of a bargaining among several parties (such as R&D and marketing) specification decision-making; a failure to find an agreement sometimes results in project delays or cancellations. In a bargaining model, we study three levers to reduce the cancellation risk: signaling of abandonment costs, adjusting the stakes, and status concerns. We find that all three may reduce the cancelations risk, but only under specific conditions.

2 - Managing Risk and Responding to Uncertainty: A Comparison of Startups in Three Countries

Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, c.loch@jbs.cam.ac.uk

Unforeseeable uncertainty requires startups to be flexible (parallel trials and experimentation). We show that flexibility empirically improves performance in three countries, Israel, Singapore and China, but it is too rarely applied: (A) startups do not explicitly manage uncertainty, and (B) investors do not provide the necessary support. Startups should upgrade their response to uncertainty, and investors should evaluate startup actions by uncertainty resolution rather than by "progress".

3 - Meeting Project Deadlines under Uncertainty: An Alternative to the Critical Chain Project Management

Fabian Sting, Assistant Professor, Erasmus University, Rotterdam School of Management, Rotterdam, Netherlands, fsting@rsm.nl, Arnd Huchzermeier, Dirk Stempfhuber, Christoph Loch

We present a case of a company that has developed an effective alternative system to Critical Chain project management. The system is based on fast problem resolution that offers project workers support and increases cross-task collaboration. At the same time, it reduces project workers' tendency to create individual time buffers. After its implementation, the company's project performance improved. We analyze the key components of the system and show how it differs from Critical Chain.

■ TB42

H - Gwynn Room - 4th Floor

Social Networks and Information Systems

Sponsor: Information Systems Society

Sponsored Session

Chair: Harpreet Singh, University of Texas at Dallas, School of Management, 800 West Campbell Rd, Sm33, Richardson, TX, 75080, United States of America, harpreet@utdallas.edu

1 - Winning Crowdsourcing Contests: A Micro-structural Analysis of Multi-relational Networks

Jiahui Mo, jxm083020@utdallas.edu, Xianjun Geng, Zhiqiang Zheng

This research investigates the impact of two fundamental types of social interactions in crowdsourcing contests - rivalry and friendship - on a solver's chance of winning. We propose triadic embeddedness as a novel conceptual framework for our analysis, in which we highlight multi-relational social interactions within a triplet of neighboring solvers. Our analysis shows that the triadic structures a focal solver is embedded in hae significant effects on her winning chance.

2 - Wisely Allocating Constrained Capacity in a Social-Network
Yasin Ceran, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, ceran@utdallas.edu

We study an online DVD rental system where a new product with a constrained capacity is optimally allocated among the customers in a social network. Depending on the number of movie suggestions customers make to their friends in the network and whether those suggestions are followed, we identify the "important" customers. We propose that satisfying first the important customers results with a faster propagation of word-of-mouth (WOM) and hence a higher number of rentals.

3 - Deviant Behaviors in Social Networks
Sijia Wang, PhD Candidate, Carlson School of Management, University of Minnesota, 321 19th Avenue S., Minneapolis, MN, 55455, United States of America, wang1290@umn.edu, Shawn Curley, Yuqing Ren

Social networks are beginning to find it increasingly difficult to deal with deviant behaviors that can disrupt the community. With anonymity, and the ensuing lack of accountability, users may feel a certain sense of security that allows them to act without constraints. Thus, it is imperative to understand these behaviors, their causes, and potential countermeasures. We look at a variety of platforms and the behaviors that are observed in each.

■ TB43

H - Suite 402 - 4th Floor

Models and Algorithms for Energy System Design and Operations

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Bo Zeng, Assistant Professor, University of South Florida, Tampa, FL, 33647, United States of America, bzeng@usf.edu

1 - Large Scale Wind Integration with Security Constraints
Michael Chen, Assistant Professor, Department of Mathematics and Statistics, York University, Toronto, Canada, chensy@mathstat.yorku.ca, Ming Zhao

Large scale wind integration in a day-ahead market requests an efficient, secure and cost effective unit commitment solution. We model this problem in a two-stage stochastic integer programming. The stochastic model considers the next day intermittent wind, transmission line, bus voltage and ramping under different wind profiles. We develop an efficient flexible partition and cutting plane method in Benders' decomposition.

2 - Energy-Aware Database Management: A Multiple Period Assignment Model
Bo Zeng, Assistant Professor, University of South Florida, Tampa, FL, 33647, United States of America, bzeng@usf.edu, Wei Yuan, Peyman Behzadnia, Yicheng Tu

Making databases energy-aware is of high economic and sustainable significance. We aim at the design and implementation of an energy-aware DBMS. A multi-period assignment model is built and solved to guarantee the performance and to reduce power consumption.

3 - An Exact Algorithm for 2-Stage Robust Model with MIP Recourse and its Applications in Power Systems
Long Zhao, Doctoral Student, University of South Florida, Department of Industrial and Management Syste, Tampa, FL, United States of America, longzhao@mail.usf.edu, Bo Zeng

We propose an exact algorithm for a class of the two-stage robust optimization problems with MIP Recourse problems. Several applications in power systems are presented to illustrate the effectiveness of the algorithm.

■ TB44

H - Suite 406 - 4th Floor

Supply Chain Disruptions

Cluster: Managing Disruptions in Supply Chains
Invited Session

Chair: Larry Snyder, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, larry.snyder@lehigh.edu

1 - Inventory Management for an Assembly System Subject to Supply Disruptions
Lin He, Research Assistant, Lehigh University, 417 Mechanic St, Bethlehem, PA, 18015, United States of America, lih308@lehigh.edu, Larry Snyder

For an assembly system, long-run balance allows it to be reduced to serial systems when disruptions are not present. We show that a modified version can be true under disruption risk. Based on it, we propose a method for reducing the system into a serial system with extra inventory at certain stages which face supply disruptions. We also propose a heuristic for solving the reduced system. A numerical study shows that this heuristic performs very well, typically within a few percent of optimal.

2 - Disruption Recovery Planning in Public Tram Systems: Practices and Decision-making Models
Amy Zeng, Worcester Polytechnic Institute, School of Business, 100 Institute Road, Worcester, MA, 01609, United States of America, azeng@WPI.EDU, Yan Fang, Christian Durach

Trams are reviving again in many regions of the world due to their low carbon emission and better utilization of resources, but can break down due to unexpected events. We first describe the transnational comparison results of disruption recovery planning practices and associated implications for research, and then present decision-making modeling examples and results for collaborative efforts that aim at reducing recovery service time and increasing passengers' satisfaction.

3 - Supplier Base Design and Product Deployment Strategies under Product Recall
Ying Rong, Assistant Professor, Shanghai Jiaotong University, No. 535, Fahuazhen Road, Shanghai, China, yrong@sjtu.edu.cn, Z. Max Shen

When product recalls happen, companies not only have to deal with additional logistical costs but also a damaged reputation. In this talk, we provide a model that integrates supplier base design decisions with product deployment strategies to alleviate the severe consequences of product recall. We show deployment can affect the degree of supply diversification.

■ TB45

H - Suite 407 - 4th Floor

Algorithmic and Implementation Issues in Auctions

Cluster: Auctions
Invited Session

Chair: Sasa Pekec, Duke University, Fuqua School of Business, Durham, NC, United States of America, pekec@duke.edu

1 - Auctions with Exclusivity Premium
Changrong Deng, Duke University, Fuqua School of Business, Durham, NC, United States of America, changrong.deng@duke.edu, Sasa Pekec, Giuseppe Lopomo

Multiple identical items are allocated to market participants who have private valuations for a single item and additional value for obtaining all items exclusively. An ex post incentive compatible and individually rational mechanism is derived for several exclusivity premium models. We present an ascending two-stage auction procedure that implements the allocation and payments of the optimal mechanism when the exclusivity premium can be derived by scaling item valuations.

2 - Mixed-bundling Auctions with Reserve Prices
Pingzhong Tang, Carnegie Mellon University, Computer Science Department, Pittsburgh, PA, 15213, United States of America, kenshin@cs.cmu.edu, Tuomas Sandholm

We study a class of two-item auctions, where we add "reserve prices" to mixed-bundling auctions. We show the optimal auction in this class yields significantly higher revenue than prior auctions that could be solved in closed form. Its revenue is also comparable to that obtained via sampling and approximation within broader classes.

3 - from Convex Optimization to Randomized Mechanisms: Toward Optimal Combinatorial Auctions
Shaddin Dughmi, Postdoctoral Researcher, Microsoft Research, One Microsoft Way, Redmond, WA, 98051, United States of America, shaddin@gmail.com, Qiqi Yan, Tim Roughgarden

We consider the design of computationally-efficient and incentive-compatible mechanisms for welfare maximization in combinatorial auctions. In particular, we present a polynomial-time, incentive-compatible, 63%-approximation mechanism for a fundamental variant of the problem. To obtain our result, we develop a new technique for the design of polynomial-time and incentive-compatible mechanisms based on convex optimization.

4 - Online Stochastic Display Ad Serving (with Ad Exchange)
Vahab Mirrokni, Senior Research Scientist, Google Research, 111 8th Avenue, New York, NY, United States of America, mirrokni@google.com

Online ad serving is a rich source of challenging algorithmic and stochastic optimization problems. I will discuss both adversarial and stochastic models and present approximation algorithms along with experimental results showing the effectiveness of these approximation algorithms on real data sets. Throughout the talk, I will touch on primal-dual and power-of-two-choices techniques, and the combined problem with Ad Exchanges. I will conclude with several open problems.

■ TB46

H - Suite 403 - 4th Floor

Advances in Oral and Written Communication Instruction

Sponsor: INFORM-ED

Sponsored Session

Chair: Judith Norback, Georgia Institute of Technology, Atlanta, GA, United States of America, judith.norback@isye.gatech.edu

1 - Soft Skills are Not Really "Soft:" The Professional Communication for Engineers Course at Texas Tech University
Dean Fontenot, Texas Tech University, Lubbock, TX, United States of America, Dean.fontenot@ttu.edu

For many, if not most, engineering students, learning to write technical documents to communicate to an audience specific and detailed information about a process or product is as "hard" as learning to apply technical aspects to engineering design. We will describe our Professional Communications for Engineers course and how the course prepares students to be ready to enter the workforce with essential communications skills.

2 - Using an Executive-Based Rubric to Improve Engineering undergraduates' Presentation Skills at Georgia Tech
Judith Norback, Georgia Institute of Technology, Atlanta, GA, United States of America, judith.norback@isye.gatech.edu

A scoring rubric based on executive input has been used to advance Georgia Tech undergraduate engineering presentation instruction. Two semesters' results show improvement of skills. Integration into Capstone Design and other engineering courses will be described. A Teachers' Guide and Descriptions of the "Wow" Behavior for each Skill will be shared.

3 - Oral and Written Communication Instruction in Business and Engineering at UC Berkeley
Candace Yano, University of California-Berkeley, IEOR Department, Berkeley, CA, 94720-1777, United States of America, yano@ieor.berkeley.edu

I will describe several of the programs available to students at UC Berkeley in both Engineering and Business, including a "Teaching Business" course for Ph.D. students.

4 - Critical Thinking and Writing: Lost Arts?
Susan Lantz, Trine University, Angola, IN, United States of America, lantzs@trine.edu

As educators, we teach students the importance of critical thinking and good communication skills. Trine University uses a critical thinking rubric and a writing rubric to evaluate students' capstone course reports each year. The engineering and business students generally score higher than students in education or arts and science.

■ TB47

H - Dunn Room - 3rd Floor

Latest Developments in Container Operations

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Luca Quadrifoglio, Assistant Professor, Texas A&M University, 405 Spence St., CE/TTI Bldg. - 301I, College Station, TX, 77843-3136, United States of America, quadrifo@tamu.edu

1 - Optimisation of Dual-cycle Container Handling Process at Seaport Terminals
Jiabin Luo, University of Southampton, University RD, Highfield, Southampton, SO17 1BJ, United Kingdom, jl18g09@soton.ac.uk, Yue Wu

This research presents a model for the dual-cycle process of unloading and loading containers between a ship and container yard.We consider vehicle scheduling and storage location problems simultaneously,which discussed separately in the literature.This research aims to decide how vehicles are scheduled to pick up/drop off which containers from the ship/yard to minimize the whole unloading/loading time.A number of numerical experiments are carried out to verify the performance of the model.

2 - Reducing Empty Container Repositioning Costs in the Hinterland of Seaports through Container Sharing
Sebastian Sterzik, University of Bremen, Wilhelm-Herbst-Strafle 5, Bremen, Germany, sterzik@uni-bremen.de, Herbert Kopfer

The potential of exchanging empty containers among cooperating trucking companies in the hinterland of seaports is analyzed by comparing two scenarios. In the first scenario empty containers are exclusively used by their owners. In the second scenario empty containers are allowed to be interchanged among several owners. Both scenarios lead to an integrated model considering empty container repositioning and vehicle routing simultaneously. The emerging cost savings are quantified by using CPLEX.

3 - Advances in Gantry Crane Operations at Container Terminals
Stefan Voss, Professor, University of Hamburg, IWI - Von-Melle-Park 5, Hamburg, 20146, Germany, stefan.voss@uni-hamburg.de

We investigate advances in handling and rehandling of containers at maritime container terminals. This includes latest technology such as double and triple rail mounted gantry cranes. We assume that the stacking area of a terminal has already been arranged. Our methodology uses discrete event simulation as well as recent matheuristics.

■ TB48

H - Graham Room - 3rd Floor

IT and Sensors

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Tao Xing, PhD Candidate, University of Utah, 110 Central Campus Dr, MCE 2000, Salt Lake City, UT 84112, United States of America, tao.xing@utah.edu

1 - On a Two-stage Time-dependent OD Calibration Methodology for Matching Link Counts and Speed Profile
Xianbiao Hu, University of Arizona, Tucson AZ, United States of America, huxianbiao@gmail.com, Yi-Chang Chiu

Adjusting time-varying OD matrices to match both observed link counts and speed profile has been a challenging problem for calibrating dynamic traffic assignment (DTA) models. The proposed two-stage approach integrates optimization and traffic flow theory for effective and efficient model calibration. Model formulation and numerical testing results are presented.

2 - Variable Time Discretization for Time-Dependent Shortest Path Algorithms
Ye Tian, University of Arizona, 1127 E. James E. Rogers Way, Tucson, AZ, 85721, United States of America, tianye0112@gmail.com, Yi-Chang Chiu, Yang Gao

This talk introduces a variable time discretization strategy for a time-dependent A* shortest path algorithm. The strategy is aimed at determining the optimal memory allocation for time-dependent travel times data in order to achieve a desirable compromise between accuracy and memory usage. The results show that with the same amount of computer memory usage, the proposed variable time discretization strategy achieves much higher accuracy than that of uniform time discretization.

3 - A Linear-Integer Programming Model for Sensor Location Flow-Estimation Problem

Ning Wang, Arizona State University, 1710 S. Jentilly Ln Apt26, Tempe, AZ, 85281, United States of America, nwang14@asu.edu

In traffic network modeling, Origin-Destination (OD) matrix is usually estimated for the purpose of providing high-quality input for some decision making procedures. Since a lot of OD matrix estimation models depend on the link flow observations from counting sensors, which can only be located on limited number of links in the traffic network, a mixed integer programming model is proposed to find a location solution, which can provide good result in OD matrix estimation models.

4 - Designing Heterogeneous Sensor Networks for Estimating and Predicting Path Travel Time Dynamics: An Information-Theoretic Modeling Approach

Tao Xing, PhD Candidate, University of Utah, 110 Central Campus Dr, MCE 2000, Salt Lake City, UT, 84112, United States of America, tao.xing@utah.edu

We present an information-theoretic sensor location model that aims to maximize information gains from a set of point, point-to-point and probe sensors in a traffic network. The methods are developed and demonstrated within a Kalman filtering-based travel time estimation/prediction framework for both recurring and non-recurring traffic conditions.

■ TB49

H - Graves Room - 3rd Floor

Perfect Sampling and Rare-event Simulation Methodology

Sponsor: Simulation

Sponsored Session

Chair: Jose Blanchet, Columbia University, 500 W 120 St, New York, NY, United States of America, jose.blanchet@columbia.edu

1 - Monte Carlo Techniques for Reflected Processes

Xinyun Chen, Columbia University, S M Mudd Building, 500 West 120th Street, New York, NY, 10027, United States of America, xc2177@columbia.edu, Jose Blanchet

We will discuss some techniques that can be used to estimate the steady state of a reflected process via simulation. Using these techniques, we can sample exactly from the steady distribution of a stochastic fluid networks. For more complicated reflected Brownian motions, we are able to simulate the process and the steady state with any precision desired under the uniform toplogy.

2 - Self-learning Markov Chain Monte Carlo from a Large Deviations Point of View

Jingchen Liu, Assistant Professor of Statistics, Columbia University, 1255 Amsterdam Avenue, Room 1030, New York, NY, 10027, United States of America, jcliu@stat.columbia.edu, Henrik Hult, Xuan Yang

Measuring the convergence of Markov chains and comparing the efficiency among different MCMC schemes have been a long lasting problem. In this talk, we propose using the large deviations rate function as an efficiency measure of a MCMC scheme. This measure turns out to be consistent with the existing asymptotic results in literature. In addition, the proposed efficiency measure can be evaluated numerically by the Markov chain itself and thus can be combined with adaptive MCMC schemes.

3 - Efficient Exact Sampling of Multi-server Queues

Aya Wallwater, Columbia University, 325 S. W. Mudd Building, 500 W. 120 Street, New York, NY, 10027, United States of America, aw2589@columbia.edu, Jose Blanchet

We describe how to obtain unbiased samples (also known as exact samples) for the steady-state distribution of multi-server queues with low computational complexity. Our approach combines the use of regenerative theory, Bernoulli factories and efficient importance sampling techniques. Efficient exact samplers are known for single-server queues (Ensor and Glynn (2000)) with light-tailed service times. Our methods are also applicable to heavy-tailed service times.

4 - An Efficient Algorithm Approximating the Failure Probability of a Network with Random Shocks

Juan Li, Columbia University, 601 W 112th Street, New York, NY, 10025, United States of America, jl3035@columbia.edu, Jose Blanchet, Marvin Nakayama

Considering an irreducible network with random shocks sharing among nodes, we compare different simulation algorithms to approximate the probability that the network fails. When the failure of this network is a rare event, the conditional Monte Carlo method is optimal among these algorithms. Supporting simulation results are provided.

■ TB50

H - Ardrey Room - 3rd Floor

Behavioral Studies in Hospitals and Healthcare

Sponsor: Behavioral Operations Management

Sponsored Session

Chair: Julie Niederhoff, Assistant Professor, Syracuse University, 721 University Avenue, Syracuse, NY, 13244, United States of America, jniederh@syr.edu

1 - Correlates and Predictors of Observed Hand Hygiene Compliance to Reduce Nosocomial Infections

Ken Schultz, Associate Professor, Air Force Institute of Technolgy, 2950 Hobson Way, WPAFB, OH, 45433, United States of America, ks28@cornell.edu, Reidar Hagtvedt, Sarah Forgie

Nosocomial infections cause by improper hand hygiene kill up to 100,000 people in the US annually. The problem is not well understood. Many studies rely on self reported compliance statistics. While research shows these to be inaccurate, if correlated they can still be used. Many in the health care field believe that doctors are the worst offenders but there is little data. We compare survey data and observational data to explore these questions.

2 - Physician Perceptions of Operating Room Setup and Cleanup Times Reflect Team Activity Not Actual Times

Franklin Dexter, Professor, University of Iowa, Department of Anesthesia, 200 Hawkins Drive, 6JCP, Iowa City, IA, 52242, United States of America, franklin-dexter@uiowa.edu, Danielle Masursky

78 surgeons and anesthesiologists at a hospital estimated characteristics of his/her turnover times during prior year. Quantitative and qualitative analyses showed responses about turnover times were not literally referring to time, but instead to factors perceived as contributing to the time (e.g., attitude about facility and activity of its personnel). Results (1) explain why satisfaction has been unrelated to changing times and (2) show managers should not rely on "expert" judgments of the times.

3 - Message Framing and Congruency Effect

Danping Wang, Xi'an Jiaotong University, No.28, Xianni West Road, Xi'an, China, danping.wang@yahoo.com, Gui-jun Zhuang, Qian Peng, Yin Zhou, Wenbo Teng

The article provides a new model to explain framing effect. It proposes that if the nature of health behavior is compatible with the regulatory orientation initiated by framed message, involvement and self-efficacy perception, consumers will arouse "feeling right" perception. This response provides additional information about the advocated health behavior, such as attitude, intention and actual behavior.

4 - Empirical Results for Habitual Citizenship Behavior in Hand-hygiene Compliance

Reidar Hagtvedt, University of Alberta School of Business, 2-43 Business Building, Edmonton, AB, T6G2C7, Canada, Hagtvedt@ualberta.ca, Kenneth L. Schultz, Sarah Forgie

Compliance with hand-hygiene regulations is vital to effectively combat healthcare-acquired infections, yet the behavior is largely unobserved, explicitly a secondary task, and partially a routine. We propose to expand the Theory of Planned Behavior to include the habitual and dynamic aspects of such behavior, and classify such phenomena as habitual citizenship behavior. Two studies, one observational and one survey-based, provide data to test our hypotheses.

5 - An Empirical Study of Reneging Behavior of Patients in an Emergency Department

Ehsan Bolandifar, Washington University in St. Louis, Olin Business School, St. Louis, MO, United States of America, bolandifar@wustl.edu, Tava Olsen, Nicole DeHoratius

From 1996 to 2006 the annual number of Emergency Department (ED) visits in the U.S. increased nearly 32%. As a consequence, ED crowding has led to increases in patient wait times and therefore the rate of patients who leave without being seen (LWBS) that can have serious effects on patient's health. Consequently it is becoming more and more important to better understand how patients react to increases in waiting time. We use data set from an ED to study reneging behavior of patients from ED.

■ TB51

H - Caldwell Room - 3rd Floor

Network Models

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Yanfeng Ouyang, Associate Professor, University of Illinois, Urbana-Champaign, Department of Civil Environmental Engineering, Urbana, IL, United States of America, yfouyang@illinois.edu

1 - A New Cost Structure for the Facility Location Problem in Megacities

Josue Velàzquez, PhD Candidate, ITESM, Carlos Lazo 100, Col. Santa Fe, Mexico City, DF, 01389, Mexico, josue.velazquez@itesm.mx, Edgar Blanco, Jan C. Fransoo, Jaime Mora-Vargas

Typically, the p-median facility location problem considers a cost structure related to the number of units shipped and the distance traveled. However, for the case of megacities in emerging economies, there exists a constraints on truck capacities, since in some areas of high demand (such as historical centers or areas of low living standards) trucks with large capacity cannot enter. We propose a new cost structure for the p-median facility location problem based on the specificities in truck capacity in these megacities. Analytical results show that both approaches provide the same solution under conditions of identical truck capacity. However, when this is not the case, our approach tends to locate the facility location closer to the demand node where only small truck can enter. We test the model on a case for a company in Bogota, Colombia.

2 - Worst Case Conditional Value-at-Risk Minimization in Hazardous Materials Transportation

Changhyun Kwon, Assistant Professor, University at Buffalo, SUNY, 400 Bell Hall, Buffalo, NY, 14260, United States of America, chkwon@buffalo.edu

This paper proposes a new method for mitigating risk in hazmat transportation, based on CVaR measure, considering the worst case scenario. While CVaR models are popularly used in financial portfolio optimization problems, its application in hazmat transportation is new. We show that the proposed CVaR model provides a flexible and robust route decision making framework for hazmat carriers.

3 - New Look at System Optimal Dynamic Traffic Assignment and Earliest Arrival Flow Problems

Hong Zheng, Postdoc Researcher, University of Arizona, 1209 E. Second Street, Bldg. 72, Bldg. 72, Tucson, AZ, 85721-0072, United States of America, hzheng@email.arizona.edu, Yi-Chang Chiu, Pitu Mirchandani

We show that the earliest arrival flow (EAF) on the node-arc network without dividing into cells is theoretically one of the optimal solutions of system optimal dynamic traffic assignment (SO-DTA) on the cell based network, in case the cell properties are time-invariant. It establishes a direct link between dynamic network flow and dynamic traffic assignment problems. The result also provides insights towards better understanding SO-DTA.

4 - Counterinsurgency through Network Analysis and Structural Search

Xin Chen, Assistant Professor, Southern Illinois University, Edwardsville, IL, 62026, United States of America, xchen@siue.edu

In counterinsurgency, insurgents need to be neutralized, i.e., captured, destroyed, or isolated. Resources such as time available to respond to insurgencies are often limited; decisions must be made as to which insurgents should be neutralized to minimize the possibility and scale of insurgencies. This research designs an analytical framework based on network and social sciences, and provides an effective and efficient tool for neutralization of insurgent networks under resource constraints.

5 - Emergency Rescue Location Planning under the Risk of Probabilistic Disruptions

Yanfeng Ouyang, Associate Professor, University of Illinois, Urbana-Champaign, Department of Civil Environmental Engineering, Urbana, IL, United States of America, yfouyang@illinois.edu, Shi An, Na Cui, Xiaopeng Li

This paper presents a reliable rescue location problem to optimize rescue location planning, evacuee allocation, and rescue vehicle re-assignment in case the rescue locations are disabled by the disaster. A compact mixed-integer program model is proposed to minimize the total system cost for rescue location set-up, rescue vehicle operations, evacuee transportation and queuing delay.

■ TB52

H - North Carolina - 3rd Floor

Facility Logistics II

Sponsor: Transportation Science and Logistics/Facility Logistics

Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States of America, ananth@engr.wisc.edu

1 - Semantic Template for Model Based Warehouse Analysis and Design

Michael Schmidt, Fraunhofer IML, Joseph-von-Fraunhofer Str. 2-4, Dortmund, 44227, Germany, Michael.B.Schmidt@iml.fraunhofer.de, Detlef Spee, Michael ten Hompel, Leon McGinnis

Tools that enable new warehouse designs to be completed faster, cheaper, and with better resulting performance require a formalized understanding of the artifact and a standard representation of its components. We present a warehouse semantics model template for unit load warehouses using SysML. This model forms the basis for any design task — from describing structure, behavior and requirements to the integration of parametric analysis.

2 - Stochastic Models of AVS/RS with Vertical Conveyors

Debjit Roy, University of Wisconsin-Madison, Madison, WI, United States of America, droy@wisc.edu, Ananth Krishnamurthy

Traditional AVS/RS use lifts for vertical transfer of unit loads between multiple tiers. Using stochastic models, we show that use of segmented conveyors yields significant improvements in throughput and cycle times. Comparison of alternate system configurations are also carried out to derive design insights.

3 - Approximate Performance Analysis of Production Lines with No Buffers

Ivo Adan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612 AZ, Netherlands, iadan@tue.nl, Paul Frenken, Marcel van Vuuren

We study production lines with single-machine workstations and no buffers. The process times are generally distributed with offsets. We develop an efficient and accurate approximation method, based on two-moment iteration, to estimate steady-state performance measures such as throughput and delay. The method is applied to a case study in the automobile industry.

■ TB53

H - South Carolina - 3rd Floor

Joint Session DM/QSR: Data Mining for Process Monitoring

Sponsor: Data Mining/Quality, Statistics and Reliability

Sponsored Session

Chair: Young Seon Jeong, Khalifa University of Science, Technology and Research, P.O. Box 127788, Abu Dhabi, United Arab Emirates, young.jeong@kustar.ac.ae

Co-Chair: Norman Kim, Rutcor, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, norman.kim@gmail.com

1 - Kriging Estimation That is Robust with Respect to Outliers and Skewed Data

Taejin Park, KAIST, 291 Daehak-ro, Yuseong-gu, Daejeon, 305-701, Korea, Republic of, bizenth@kaist.ac.kr, Jinho Kim, Ying Hung

In the Gaussian Kriging model, errors are assumed to follow a Gaussian process. This assumption is reasonable in many cases, but is not appropriate for such situations as outliers are present or the error distribution is skewed. To prevent such a drawback, we propose a robust estimation procedure of Kriging parameters by utilizing the L1 and epsilon-insensitive loss functions in place of L2. A machining experiment data are analyzed to verify the effectiveness of the proposed method.

2 - understanding Inspection Reports of Marine Structures Using Text Mining

Seungkyung Lee, Seoul National University, Seoul, Korea, Republic of, sklee83@snu.ac.kr, Bongsuk Kim, Minhoe Hur, Sungzoon Cho, Dongha Lee, Deahyung Lee

Up to 20 million parts of a Marine structure is inspected manually during assembly processes. 300 inspection reports per day result on mobile devices at a local manufacturing plant. The texts in reports hinder management from understanding the nature of defects: where and when they occur and how often, for instance. In this study, we apply text mining and clustering techniques to structure and cluster reports to help better understand defects and allows one to manage them better.

3 - Orthogonal Signal Correction and Wavelet Based Logical Analysis of Data Model

Munevver Mine Subasi, Assistant Professor, Florida Institute of Technology, 150 W. University Blvd, Melbourne, FL, 32901, United States of America, msubasi@fit.edu, Myong K (MK) Jeong, Norman Kim, Juan Felix Avila Herrera, Ersoy Subasi, Michael Lipkowitz

We use orthogonal signal correction (OSC) and wavelet analysis as preprocessing tools to significantly improve the performance of Logical Analysis of Data (LAD). The proposed approach is applied to the African American Study of Kidney Disease and Hypertension mass spectra data to identify combinatorial biomarkers that can accurately predict the progression rate of chronic kidney disease.

4 - Online Seizure Prediction Using a Reinforcement Learning Approach

Shouyi Wang, Research Assistant, Rutgers University, 900 Davidson Road, APT 84, PISCATAWAY, NJ, 08854-5655, United States of America, shouyisxty@gmail.com

This study proposes an adaptive framework which combines reinforcement learning, online monitoring and adaptive control theory into a patient-specific online seizure prediction system. The adaptive properties of this framework allow for patient-specific seizure prediction, permitting greater flexibility and sensitivity for a wide range of patients with various types of epileptic seizures.

■ TB54

H - Charlotte Hall - 3rd Floor

Semiconductor Industry

Contributed Session

Chair: Seungchul Lee, Postdoctoral Research Fellow, The University of Michigan, 1035 H.H. Dow, 2300 Hayward St., Ann Arbor, MI, 48109, United States of America, seunglee@umich.edu

1 - Effective WIP Dependent Lot Release Policies for Semiconductor Manufacturing Systems

Carlos Salazar, Universidad de los Andes, Cra 1 Este #19A-40, Bogota, Colombia, cf.ruiz1135@uniandes.edu.co, Raha Akhavan-Tabatabaei, Laura Oyuela

We propose a stochastic framework to explore lot release policies in wafer fabs. These policies are based on the WIP threshold of the bottleneck station. Our results show that this type of policy is effective in cycle time improvement while keeping the same level of throughput compared with a case where no policy is applied. The proposed policy is practical and needs less considerations for implementation compared to policies such as CONWIP.

2 - Multi-shift Workforce Planning Considering overtime Decisions

Shrikant Jarugumilli, Graduate Research Assistant, Missouri S&T, Engineering Management & Systems Eng., Rolla, MO, 65401, United States of America, sj35f@mail.mst.edu, Scott E. Grasman, Naiping Keng

We present workforce planning models for assembly-test facilities that operate twenty-four hours a day in two non-overlapping twelve hour shifts. Workforce planning in such facilities requires the determination of allocation of workers to individual shifts every planning cycle (two weeks) and worker allocation to machine group every shift based on qualification, skill-level and overtime constraints.

3 - Weighted Least Slack Time Ratio (WLSTR): Scheduling Heuristic for Time Constrained Route Segments

Sugje Sohn, Staff Engineer, Intel Corporation, 5000 W Chandler Blvd, Chandler, AZ, 85226, United States of America, sugje.sohn@intel.com

Semiconductor manufacturing involves the sequential and reentrant flow of route segments that need to be completed within their designated time limits in addition to the constraints of throughput due date. The research defines the lot dispatching heuristic, Weighted Least Slack Time Ratio (WLSTR) and a simulation analysis demonstrates the performance comparing with several typical heuristics for multiple product and heterogeneous serial machine models.

4 - Job Scheduling Considering the Effect of Maintenance in Semiconductor Manufacturing

Seungchul Lee, Postdoctoral Research Fellow, The University of Michigan, 1035 H.H. Dow, 2300 Hayward St., Ann Arbor, MI, 48109, United States of America, seunglee@umich.edu

We develop simulation-based optimization methods which would lead to the best wafer release policy to maximize the overall yield of the wafers in a semiconductor manufacturing system. Since chamber degradation will jeopardize wafer yields, chamber maintenance is taken into account for the wafer sequence decision-making process. As results, this work shows that job scheduling has to be managed based on the chamber degradation condition and maintenance activities to maximize overall wafer yield.

5 - Optimal Regulatory Commitment

Thomas Weber, Associate Professor, Ecole Polytechnique Fédérale de Lausanne, College of Management of Technology, Lausanne, CH-1015, Switzerland, thomas.weber@epfl.ch

In this paper, we analyze a game where a regulator chooses the cost at which a preliminary policy can be modified after an agent reacts to it. We characterize the regulator's optimal commitment policy. While the framework is general and nonparametric, we discuss our findings in the context of the provision of incentives for private R&D investments in pollution-reduction technologies.

■ TB55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS: Topics in Analytics

Sponsor: Analytics/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Warren Lieberman, President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, warren@veritecsolutions.com

1 - Assessing the Opportunity for Enhanced Analytics

Warren Lieberman, President, Veritec Solutions, 824 Miramar Terrace, Belmont, CA, 94002, United States of America, warren@veritecsolutions.com, Bruce Patty

Estimating the potential benefits and appropriate level of investment for improved decision support is often the first step in a comprehensive analytics effort. Drawing on examples across a range of industries, this presentation highlights processes, analytics, and lessons learned that appear to have widespread applicability when conducting an "Opportunity Analysis."

2 - Developing an Organizational Analytics Maturity Model for Improving Executive Decisions

Norman Reitter, Advisor, Information Technology, Concurrent Technologies Corporation, 100 CTC Drive, Johnstown, PA, 15904, United States of America, reittern@ctc.com

Emerging as the home for "analytics", we have the opportunity to support competitive value through improved decisions. An Organizational Analytics Maturity Model (OAMM) allows organizations to understand how well their existing information resources support their decisions, which types of analytics to invest in, and how to restructure their human resources. This paper proposes an OAMM for assessing an organization's analytics health and making changes to improve decision-making.

3 - A Conceptual Framework of Analytics Success

Avijit Sarkar, Associate Professor, University of Redlands, 1200 E. Colton Avenue, Redlands, CA, 92373, United States of America, avijit_sarkar@redlands.edu, Hindupur Ramakrishna

Organizations are increasingly investing in analytics with varying degrees of success. Neither business analytics (BA) success is well-defined, nor factors that impact BA success well understood. This work presents a conceptual framework which links technological and organizational factors to BA success. Validation of the framework is presented as a collection of propositions regarding the relationship between factors, their interaction, and BA success and is supported by existing literature.

■ TB56

H - Biltmore Boardroom - 2nd Floor

Patient Admissions

Contributed Session

Chair: Li Sun, Research Assistant, University of Louisville, 782 Theodore Burnett Ct Apt#3, Louisville, KY, 40217, United States of America, li.sun@louisville.edu

1 - A Probabilistic Model for Predicting Readmissions in Medical Centers

Chandan Reddy, Assistant Professor, Wayne State University, 5057 Woodward Avenue, Suite 3010, Detroit, MI, 48202, United States of America, reddy@cs.wayne.edu, Adel Alaeddini, Kai Yang

In this paper, we develop a hybrid model based on survival models, collaborative filtering and Bayesian inference to predict the probability of readmission in medical centers. Our robust and accurate prediction model can be used to enable a effective preventive strategy to reduce the rate of readmissions and to improve the discharge process. The effectiveness of the proposed approach is demonstrated using healthcare data collected at a medical center.

2 - Insights from a Deployment-Aware Model: How to Improve Psychological Health Treatment for Veterans

John Hess, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E38-642, Cambridge, MA, 02139, United States of America, johnhess@mit.edu

Models currently used by the military for personnel management assume that any given military base will have a constant annualized demand for psychological healthcare. Our model explicitly accounts for the movement of troops into and out of combat zones, supporting a more refined analysis of demand and of proposed resource allocation schemas and policy changes.

3 - The Impact of ICU Utilization on Patient Discharge and Readmission Rate

David Anderson, University of Maryland, 4306 Van Munching Hall, College Park, MD, United States of America, danderson@rhsmith.umd.edu, Carter Price, Bruce Golden, Wolfgang Jank

We investigate how ICU utilization affects patient discharge rate at a large urban hospital. After proving that the discharge rate is higher when utilization is high, we show that patients discharged from a highly utilized ICU are significantly more likely to be readmitted to the hospital.

4 - Optimization Models for Patient Allocation During a Pandemic Influenza Outbreak

Li Sun, Research Assistant, University of Louisville, 782 Theodore Burnett Ct Apt#3, Louisville, KY, 40217, United States of America, li.sun@louisville.edu, Gail DePuy

Mathematical models are developed to optimize patient allocation in terms of minimizing the patients' cost of access to services, balancing the workload among hospitals, and satisfying hospital resource capacity during a pandemic influenza outbreak. Models also help predict resource shortages during the outbreak and the hospitals can be alerted to consider increasing the capacity or requesting additional capacity from agencies. A case study from Jefferson County, KY is presented.

■ TB57

W - Providence I- Lobby Level

Runway Scheduling Problems

Sponsor: Aviation Applications

Sponsored Session

Chair: Ahmed Ghoniem, University of Massachusetts Amherst, 121 Presidents Dr., Amherst, MA, 01003, United States of America, aghoniem@som.umass.edu

1 - A Decomposition Approach to Mixed-mode Multiple-runway Sequencing Problems

Farbod Farhadi, PhD Candidate, University Massachusetts Amherst, 121 Presidents Dr., Amherst, MA, 01002, United States of America, ffarhadi@som.umass.edu, Ahmed Ghoniem

We present optimization models for mixed-mode multiple-runway sequencing problems with the objective of minimizing the makespan or the total weighted completion times. Decomposition techniques are investigated along with optimization-based heuristics. Extensive computational results are reported.

2 - Enhanced Formulations for Aircraft Sequencing over Multiple Runways

Mohamed Kharbeche, Qatar University, College of Engineering, Department of Mechanical and Industrial Eng, Doha, Qatar, medkharbeche@yahoo.fr, Hanif Sherali, Ahmed Ghoniem, Ameer Al-Salem

We propose mixed-integer programming models for arrival-departure aircraft sequencing problems over multiple runways. Valid inequalities, symmetry-defeating constraints, and preprocessing schemes are proposed. Extensive computational results are reported for exact and heuristic methods.

3 - Approximate Algorithms for Aircraft Arrival and Departure Scheduling over Multiple Runways

Ghaith Rabadi, Associate Professor, Old Dominion University, Engineering Management & Systems Enginee, 241 Kaufman Hall, Norfolk, VA, 23529, United States of America, GRabadi@odu.edu, Gulsah Hancerliogullari, Ameer Al-Salem

The problem addressed is the landing and departing aircraft assignment to runways and sequencing the aircrafts on each runway such that sequence-dependent separation times between aircrafts are respected. Flights have release and target times and are weighted differently. The objective is to minimize the total weighted tardiness. This is NP-hard parallel machine scheduling problem for which we present new heuristic algorithms to find approximate solutions.

■ TB58

W - Providence II - Lobby Level

Changing Paradigms in Military Logistics Related OR and Simulation Practices

Sponsor: Military Applications Society

Sponsored Session

Chair: Susan Laird, Sr. Operations Research Analyst, Naval Air Systems Command, 47060 McLeod Road, Patuxent River, MD, 20670, United States of America, susan.laird@navy.mil

1 - The Pursuit of a Modular Simulation Tool Set Applicable to Naval and Marine Corps Aviation Programs

Susan Laird, Sr. Operations Research Analyst, Naval Air Systems Command, 47060 McLeod Road, Patuxent River, MD, 20670, United States of America, susan.laird@navy.mil, Gary Flenner

Changes in supply chain management, new transportation options, application of TOC and LEAN, and changes to acquisition have greatly changed supportability analysis needs. Couple this with new simulation methods and agile development techniques, logistics networks can be thoroughly tested prior to implementation to insure best value. This presentation will discuss the efforts by NAVAIR to achieve a tool suite, the technical and paradigm changes needed, and some of the early successes.

2 - Flexibility and Educator: The underestimated Skills of an Analyst

David Solomon, NAVAIR, 21620 Liberty Street, Lexington Park, United States of America, david.solomon1@navy.mil

Customers seeking modeling and simulation as a means to solve complex problems begin with varying amounts of M&S expectations and experience. This range can span from those who know the necessary information and correct questions to ask in order to get the answers they need to those who struggle to define the problem needing answered. This presentation will discuss contrasting experiences with customers possessing differing expectations and levels of understanding of modeling and simulation.

3 - underestimating the Bullwhip Effect – The Assumption of Decomposability

Dean Chatfield, Assistant Professor of IT & DS, Old Dominion University, 2063 Constant Hall, College of Business and Public Admin., Norfolk, VA, 23529, United States of America, dchatfie@odu.edu

Many current approaches to supply chain inventory system modeling decompose a supply chain into a set of node pairs. This decomposition is based on the assumption that the entire structure will act as the simple sum of the activities of the node pairs. We investigate the impact this decomposition has on bullwhip effect measurement. Using simulation, we show that a decomposition-based modeling approach significantly underestimates the amount of order variance amplification.

■ TB59

W - Providence III - Lobby Level

Service Innovation

Sponsor: Service Science

Sponsored Session

Chair: Haluk Demirkan, Arizona State University, Information Systems Department, Tempe, 85287, United States of America, Haluk.demirkan@asu.edu

1 - Exploring the Building Blocks of Service Innovation: The Role of Customer Value Drivers

Haluk Demirkan, Arizona State University, Information Systems Department, Tempe, 85287, United States of America, Haluk.demirkan@asu.edu, Robert Harmon, Ellen Chan

Establishing a strong link between customer value requirements and the value-producing activities of the firm is the foundation on which the co-creation of value is based. The success of a new service can often depend on a small nuance that can be difficult to pinpoint. This research presents a systematic approach for assessing the impact of economic, performance, supplier, and buyer value dimensions that can influence perceptions and drive service innovation design and adoption decisions.

2 - Methods in Service Innovation - Current Trends and Future Perspectives

Thomas Meiren, Fraunhofer IAO, Nobelstr. 12, Stuttgart, Germany, thomas.meiren@iao.fraunhofer.de, Thomas Burger, Kathrin Schnalzer

The complexity of service innovation stretches many established innovation methods to their limits and there seems to be a clear need for the development of new service-specific methods. In workshops with scientists and practitioners more than 300 different methods in the field of service innovation were identified and analysed. The presentation discusses the main findings and includes a roadmap for further research.

3 - On Fundamental Problems of Service Innovation in the Social-System – Program Oriented Society

Ryo Sato, Professor, Yokohama National University, 79-4 Tokiwadai,, Hodogaya-ku, Yokohama, 2408501, Japan, rsato@ynu.ac.jp, Ayako Kawai, Yasuto Fukunaga

The social-system-program oriented society has come out after mass-production industrialized society. Since the value from service is more focused on than concrete products, different strategies are needed to be installed. The fundamental problem of our social-program oriented society is that we do not have sufficient discipline, methodology, or design method. An methodology for service innovation is presented with several cases.

■ TB60

W - College Room - 2nd Floor

Efficient First-Order Methods for Convex Optimization and Its Applications

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Shiqian Ma, Columbia University, 500 W 120th Street, Mudd, Room 313, New York, NY, 10027, United States of America, sm2756@columbia.edu

1 - Fast First-Order Methods for Stable Principal Component Pursuit (SPCP) Problem

Necdet Serhat Aybat, Columbia University, IEOR Department, New York, NY, United States of America, nsa2106@columbia.edu

SPCP is a non-smooth convex optimization problem, the solution of which is shown in theory and practice to enable one to recover the low rank and sparse components of a matrix whose elements have been corrupted by Gaussian noise. We show how several first-order methods can be applied to this problem efficiently and that the subproblems that arise in Nesterov's method and alternating direction augmented Lagrangian methods either have closed-form solutions or can be solved very modest efficiently.

2 - Accelerated Linearized Bregman Method

Bo Huang, Columbia University, 500 W.120th St., Room 313, New York, NY, 10027, United States of America, bh2359@columbia.edu, Shiqian Ma, Donald Goldfarb

We propose and analyze accelerated linearized Bregman (ALB) methods for solving the basis pursuit and the matrix completion problems. We show that the ALB algorithm improves the iteration complexity from $O(1/\epsilon)$ to $O(1/\sqrt{\epsilon})$ with the main computational effort remains almost the same. The numerical simulation demonstrates that the ALB achieves a great improvement over the original linearized Bregman method.

3 - Structured Sparsity via Alternating Partial Linearization Methods

Zhiwei (Tony) Qin, Columbia University, 500 West 120th St., New York, United States of America, zq2107@columbia.edu, Donald Goldfarb, Katya Scheinberg

We propose a unified framework under which learning problems with both overlapping l_1/l_2- and $l1_l\infty$-regularization can be efficiently solved. As the core building-block of the framework, we develop new algorithms using an alternating partial-linearization technique, and we prove their iteration complexity. We test the proposed algorithms on a collection of data sets and apply them to two real-world examples to compare the relative merits of the two norms.

■ TB61

W - Sharon Room - 2nd Floor

Sensors, Signals and Flow

Contributed Session

Chair: Fatemeh Sayyady, North Carolina State University, 2501 Stinson Drive, 206 Mann Hall, Raleigh, United States of America, fsayyad@ncsu.edu

1 - A Heuristic Algorithm for the Sensor Location Problem

Di Zhang, University of Louisville, Department of Industrial Engineering, JB Speed Building, Room 304, Louisville, United States of America, jasonzhangdi87@gmail.com, Lihui Bai

We consider the sensor location problem that places the minimum number of sensors on the nodes of a transportation network so that the flow of the entire network is uniquely determined. We develop a heuristic method that identifies incremental flow, if exists, in the "hidden network." Numerical results are reported for randomly generated networks.

2 - Vehicle Flow Optimization in Freeways by Ramp Metering

Seyedbehzad Aghdashi, PhD Student, North Carolina State University, 2510-203 Avent Ferry Rd, Raleigh, NC, 27606, United States of America, saghdas@ncsu.edu

Freeways in populated areas are usually suffered by congestion. One way to overcome this issue is to control the flow of the vehicles into the bottleneck. The best way of limiting the number of vehicles going to bottleneck is ramp metering. This research employs mathematical optimization to come with the optimal pattern of metering in a ramp before bottleneck of the main line.

3 - Multi-objective Mathematical Model for the Placement of Sensors on Traffic Network

Fatemeh Sayyady, North Carolina State University, 2501 Stinson Drive, 206 Mann Hall, Raleigh, United States of America, fsayyad@ncsu.edu, Yahya Fathi, George List, John Stone

We consider the problem of locating Weight-In-Motion (WIM) sensors on a traffic network considering two objectives. The first objective minimizes the total truck traffic dissimilarity among WIM locations and their corresponding non-WIM locations. The second objective maximizes the truck traffic dissimilarity among WIM locations in order to provide diversity in collected data. We formulate the problem as a integer linear programming problem and present a Lagrangian-heuristic approach to solve it.

■ TB62

W - Independence Room - 2nd Floor

Uncertainty in Power Output

Contributed Session

Chair: Justin Foster, PhD Candidate, Boston University, 15 St. Mary's Street, Room 140, Brookline, MA, 02446, United States of America, jfoster2@bu.edu

1 - Examination of a Wind Power Exit Fee with a Real Options Approach

Chung-Hsiao Wang, LGE KU Energy LLC, 102 Spruce Ln, Louisville, KY, 40207, United States of America, chunghsiao@hotmail.com, Chenlu Lou, Jo Min, Karla Valenzuela

For a rational wind power producer, we examine the economic decision process when the government imposes an exit fee as a means of subsequent environmental restoration after the termination of a windmill. Based on Geometric Brownian Motion processes and real options approaches, we show how such a producer makes rational decisions regarding his/her exit and entry strategies. Managerial insights and economic implications are illustrated via numerical analyses.

2 - Including Management Policies in a Simulation Model of a Renewable Energy System

Cristina Azcárate, Associate Professor, Public University of Navarra, Campus Arrosadìa, Pamplona, Na, 31006, Spain, cazcarate@unavarra.es, Fermìn Mallor, Rosa Blanco

One drawback of wind farms is their random input which results in a random output. This means that peak output does not always coincide with peak demand and with peak prices neither. This calls for the introduction of newly-developed energy storage equipment. Our work develops a simulation model of wind farms incorporating hydrogen-based energy storage to regulate the output. We address the issue of modeling the management of such systems and test different system-management strategies.

3 - An Application of Periodic Gamma Autoregressive Model to Brazilian Turbined Outflow Time Series

Diogo Braga, PhD Student, COPPE – UFRJ, PESC/COPPE – UFRJ, Centro de Tecnologia, Rio de Janeiro, RJ, 68511, Brazil, diogobmbraga@gmail.com, Nelson Maculan

This paper explores Periodic Gamma Autoregressive Models (PGAR) in the sense of conditional probability distribution to model brazilian turbined outflow time series. This type of series has some features which seem to be more adaptable to Gamma models, like nonnegative random values. The main purpose is comparing periodic Gaussian models to PGAR. The results suggest that periodic Gamma and Lognormal models performances are very similar, but they are quite better than Normal models.

4 - A Mean-Variance Model of Optimal Wind Turbine Portfolio Selection to Mitigate Wind Power Variability

Akiner Tuzuner, Assistant Professor, Istanbul Kemerburgaz University, Department of Industrial Engineering, Mahmutbey Dilmenler Caddesi, No:26, Istanbul, 34217, Turkey, akiner.tuzuner@kemerburgaz.edu.tr, Fikret Korhan Turan, Selcuk Goren

Temporal and spatial variations in wind speeds result in variations in the power obtained from wind farms, a great obstacle for their integration to power grids. Existing studies address the mitigation of wind power variability by integrating several wind farms at different sites. We propose such mitigation at the individual site level by using different types of wind turbines on a given wind farm. We perform mean-variance analyses for different objectives adopted by the wind farm planner.

5 - Optimal Price-Quantity Bids by Flexible Loads: The Case of Plug-in Hybrid Electric Vehicles

Justin Foster, PhD Candidate, Boston University, 15 St. Mary's Street, Room 140, Brookline, MA, 02446, United States of America, jfoster2@bu.edu, Michael Caramanis

We focus on flexible loads providing fast reserves necessary for integration of extensive wind generation, while observing distribution network congestion. We extend our earlier optimal bidding algorithm in hour-ahead power markets to address broader bidding choices. More specifically, we compute optimal price-quantity bids by leveraging intuition from a simplified linear problem in order to develop an algorithm solving the full non-linear problem.

■ TB63

W - Tryon North - 2nd Floor

Evolutionary Multi-Objective Optimization 5

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Patrick Reed, Associate Professor, The Pennsylvania State University, 212 Sackett Building, University Park, PA, 16802, United States of America, preed@engr.psu.edu

1 - Multi-objective Operating Room Planning and Scheduling

Srimathy Mohan, Arizona State University, Department of Supply Chain Management, Tempe, United States of America, srimathy@asu.edu, Qing Li, John Fowler

A multi-objective simulation optimization approach is developed for the Operating room scheduling problem, which integrates an optimization module of Random keys genetic algorithm and non-dominated sorting genetic algorithm II to guide the search of Pareto optimal solutions, and a simulation module to evaluate the performance of a given schedule. Some managerial questions are analyzed.

2 - Multiple Criteria Objective for Solving the Split Delivery Vehicle Routing Problem

Gautham Rajappa, Ph.D. Student, University of Tennessee, Department of Industrial Engineering, 416 East Stadium Hall, Knoxville, TN, 37996, United States of America, grajappa@utk.edu, Joseph Wilck

The goal of this presentation is to present a stochastic SDVRP model with a multiple criteria objective function. First, the traditional model is compared to a loaded-vehicle model with an example and computational studies. Then a stochastic model is presented, including an argument for why a stochastic model is more realistic given current conditions concerning fuel cost.

3 - Hybrid Genetic Algorithm Applied to Biobjective Scheduling Problem in an Assembly Line with JIT

Jaime Mora-Vargas, Head. IE Graduate Program, Tec de Monterrey CEM, Carr. Lago de Guadalupe km 3.5, Atizapan de Zaragoza, 52926, Mexico, jmora@itesm.mx, Miguel Gonzalez-Mendoza, Nestor Velasco-Bermeo

Whether a company's main activity is the production or assembly of goods the scheduling process plays a really important role. Most of real life scheduling problems involves more than one objective, in most of the cases they're opposite to each other and even compete for the same resource. This paper analyzes the application of hybrid genetic algoriths to bi-objective objective function in order to optimize a scheduling problem in an assembly line with JIT.

■ TB64

W - Queens Room - 2nd Floor

Community-Based Operations Research II

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Michael Johnson, Associate Professor, University of Massachusetts Boston, 100 Morrissey Boulevard, McCormack Hall, Room 3-428A, Boston, MA, 02125-3393, United States of America, Michael.Johnson@umb.edu

1 - Evaluating the Perceived Impact of Community-based OR Projects

L. Alberto Franco, Warwick Business School, University of Warwick, Coventry, United Kingdom, alberto.franco@wbs.ac.uk

This presentation reports on the positive impacts attributed to a soft OR intervention conducted to support the work of a client group tasked with tackling teenage pregnancy in an English borough. The intervention involved the combined use problem structuring and decision conferencing methods for project prioritisation and budgeting. Other non-expected outcomes will be also discussed and explained in terms of the different ways OR models are interpreted and used by participants in interaction.

2 - Evaluation of Transportation Practices in the California Cut Flower Industry

Christine Nguyen, Daniel J. Epstein Department of Industrial & Systems Engineering, University of Southern California, CA, United States of America, nguyen7@usc.edu, Maged Dessouky, Alejandro Toriello

California's share of the national market for cut flowers has decreased from 64% to 20%. California flower farmers' largest competitors are South American farmers, particularly Colombian and Ecuadorian, who have benefitted from the 1991 Andean Trade Preference Act. The law cut import tariffs from South American nations on a range of goods, resulting in Colombia capturing 75% of the U.S. flower market. This paper evaluates the California cut flower industry's current transportation practices at the request of the California Cut Flower Commission. The project investigates the feasibility and cost of establishing a shipping consolidation center in Oxnard, California. The problem is formulated using a Mixed-Integer programming model. The model estimates a 34.8% shipping cost decrease, $20M, if all California farms participated in the consolidation center.

3 - Problem Structuring Methods for Community Operations Research

Jonathan Rosenhead, London School of Economics, Houghton Street, London, United Kingdom, j.rosenhead@lse.ac.uk

Community groups are unlike the conventional clients of OR. They don't have the hierarchy and management structures, the access to resources, the familiarity with receiving technically-based advice. Yet they often have problems of great complexity which can threaten the very existence of the community. In a parallel dichotomy Problem Structuring Methods are quite unlike conventional OR methods. The presentation will try to demonstrate how the two less conventional strands are a good fit.

■ TB65

W - Kings Room - 2nd Floor

Innovations in Service Delivery

Sponsor: Service Science

Sponsored Session

Chair: Nilanjan Chattopadhyay, Associate Professor, Institute of Management Technology, Raj Nagar, Ghaziabad, UP, 201010, India, nchattopadhyay@gmail.com

1 - An Exploratory Study of How E-Healthcare Can Challenge Traditional Rural Healthcare System In India

Sreya Chattopadhyay, Doctoral Student, University of Rajasthan, J L Nehru Marg, Jaipur, RJ, India, sreyaonline@gmail.com, Harsh Dwivedi, Nilanjan Chattopadhyay

This paper attempts to find out the innovations in service delivery of internet based healthcare and the reporting mechanism related to health for rural area. This paper attempts to study the various steps taken by the government of India to benchmark them with similar practices in developed economies. This study attempts to identify challenges faced by rural healthcare mechanism and explore if an internet based model can successfully overcome the same.

2 - Supply Chain Contracting with Competing Suppliers under Asymmetric Information

Ruina YANG, The Hong Kong University of Science and Technology, Tower A108, University Apartment, HKUST, Hong Kong, China, rnyang@ust.hk, Chung-Yee Lee

We employ a screening model to examine the problem of supply chain contracting in a context of two suppliers and one retailer. We mainly study a two-part tariff and a quantity discount contract. In the paper, we derive the retailer's optimal strategy and fully characterize the suppliers' optimal contract design. When the two products are independent, or imperfect substitutes, we evaluate the performances of these two contracts in terms of information rent and suppliers' expected profits.

3 - Effects of Service Innovation on Effectiveness and Efficiency of Restaurants in India

Nilanjan Chattopadhyay, Associate Professor, Institute of Management Technology, Raj Nagar, Ghaziabad, UP, 201010, India, nchattopadhyay@gmail.com, Sajeev Abraham George

Restaurant business in India has witnessed exponential growth. Objective of this paper is to examine possible relationship between innovativeness, effectiveness and efficiency of a restaurant. For this study, data were collected from 175 restaurants. To conclude, this paper identifies important relationships between operational effectiveness, cost efficiency and innovations in service delivery.

4 - Analytics-driven Service and Product Innovation for Electronics Industry

Changrui Ren, IBM Research China, Diamond Building A, Zhongguancun Software Park, Beijing, China, rencr@cn.ibm.com, Matthieu Van Bilsen, Martin Kienzle, Richard Koay, Jin Dong

As the electronics industry is transforming from traditional product business to "product plus service" business, connected electronic devices have begun to emerge, which expose huge amount of multichannel, real-time data. This presentation will introduce how IBM uses these data in driving services and product innovation for electronics manufacturers through advanced analytics and optimization techniques, such as micro-targeted service delivery, preventive maintenance, and warranty design.

■ TB66

W - Park Room - 2nd Floor

Workforce Planning in the Services

Cluster: Workforce Engineering and Management

Invited Session

Chair: Jennifer Ryan, Associate Professor, Rensselaer Polytechnic Institute, Department of Industrial & Systems Engineering, Troy, NY, 12180, United States of America, ryanj6@rpi.edu

1 - A Rolling Time Horizon Approach to Workforce Planning in Professional Service Firms

Vincent Hargaden, Rensselaer Polytechnic Institute, Industrial & Systems Engineering Department, 110 8th Street, Troy, NY, 12180, United States of America, hargav@rpi.edu, Jennifer Ryan

Using a mixed integer programming base model, we develop a rolling time horizon approach to enable professional service firms to carry out short and long term workforce planning. This technique provides firms with the flexibility to respond to changing demand, while also ensuring consistency in assignment of employee skills to projects which span multiple planning horizons.

2 - HP Enterprise Services Uses Optimization for Resource Planning

Cipriano Santos, Principal Scientist, HP Laboratories, 1501 Page Mill Rd., Mailstop 1140, Palo Alto, CA, 94304, United States of America, cipriano.santos@hp.com, Haitao Li, Tere Gonzalez, Shelen Jain, Kay-Yut Chen, Annabelle Feng, Alex Zhang, Dirk Beyer

Resource Managers at HP Enterprise Services need to match skilled resources with jobs required by services projects. We develop a tool that provides optimization capabilities for matching professionals with diverse skills to jobs and projects, while explicitly accounting for both demand/supply uncertainties, and considering tacit human knowledge and judgment information. This tool was deployed in 2009 and it has reduced service delivery costs and increased workforce utilization.

3 - Staffing Call-centers with Uncertain Demand Forecasts: A Chance-constrained Optimization Approach

Itai Gurvich, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60201, United States of America, i-gurvich@kellogg.northwestern.edu, Tolga Tezcan, Jim Luedtke

We consider the problem of staffing call centers with multiple customer classes and agent types operating under quality-of-service constraints and facing arrival rate uncertainty. We formulate the staffing problem under uncertainty as a chance-constrained optimization problem. Our solution approach generates a frontier of arrival rates that allows us to translate the problem with uncertain demand to one with known arrival rates.

4 - Decision Support for Workforce Transformation at Sasol

Michele Fisher, Principal Operations Researcher, Sasol Technology (Pty) Ltd, 1 Klasie Havenga, Sasolburg, 1947, South Africa, michele.fisher@sasol.com, Lieschen Venter

South Africa is on a challenging and inspiring journey of transformation. Sasol, an integrated energy and chemicals company, is committed to the country's economic empowerment initiatives. OR has built workforce forecasting models to assess profiles and scenarios for employment equity targets and wider human resources decision support. A system dynamics approach reflects evolving and interrelated staff movements due to recruitment, promotion, separations and retirements.

5 - Job Allocation And Worker Hiring Policies for Service System When Workers Migrate

Yue Jin, Bell Labs Ireland, Alcatel Lucent, Blanchardstown Industrial Park, Dublin, Ireland, yue.jin@alcatel-lucent.com

We study the optimal job allocation and worker hiring policies in a service system. In this system, expert and novice workers retire stochastically, novice workers can get promoted to expert group based on good performance, and new novice workers are hired when needed. We model the problem as a Markov Decision Process (MDP). We first analyze the fluid limit of the MDP problem. We then develop an algorithm based on Nearly Complete Decomposition to derive the optimal policies for the MDP problem.

■ TB67

W - Grand A - 2nd Floor

Recommendation Systems

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Praveen Pathak, Univesity of Florida, 8325 SW 16th Pl, Gainesville, FL, 32607, United States of America, praveen.pathak@warrington.ufl.edu

1 - Personal Event Detection in Social Networking Sites

Hong Guo, Assistant Professor, University of Notre Dame, 356 Mendoza College of Business, Notre Dame, IN, 46556, United States of America, hguo@nd.edu, Shengli Li, Praveen Pathak

Social networking sites represent an important platform via which people share information and interact with other people. Online users express their personal events such as wedding, college graduation and travel through various communications tools offered by the social networking sites. These personal events represent commercial opportunities to related service providers. This paper provides a novel technique for detecting personal event. We tested the method with data from MySpace.

2 - Link Recommendation for Contagious Behavior in Social Networks
Lionel Li, (Zhepeng), University of Utah, Department of Operations and Information, Salt Lake City, UT, 84112, United States of America, Lionel.Li@business.utah.edu, Xiao Fang, Olivia Sheng, Xue Bai

Recommended link formation in social networks can facilitate activities in various contexts. While a fully connected network is ideal for maximizing the influence of contagious behavior, negligence of individual interests will lead to an ineffective social structure for such purposes. A linkage recommender is proposed to account for the utilities for both adoption promoter and individual users. It recommends links that are both beneficial to adoption promoter and likely to be accepted by users.

3 - A Latent Space Model for Recommendation Retrieval
Mohammad Khoshneshin, University of Iowa, Iowa City, IA, 52246-1769, United States of America, mohammad-khoshneshin@uiowa.edu, Nick Street

Collaborative filtering (CF) recommends items to users based on the rating history. While most CF algorithms focus on predicting the ratings, the true goal of recommendation is retrieving interesting items. We present a latent space model that outperforms classic CF algorithms in recommendation retrieval.

4 - Sale Forcasting with Recommendation Systems
Juheng Zhang, University of Florida, 306 Diamond Village Apt 10, Gainesville, FL, 32603, United States of America, Juheng@ufl.edu

This paper studies sale forecasting with recommendation systems. The findings show that recommendations have impact on product sale. More interestingly, the reputation of similar products or that of online sellers who share similar characteristics affects product sales.

■ TB68

W - Grand B - 2nd Floor

Industry Job Search

Cluster: Job Placement Services

Invited Session

Chair: Bala Shetty, Professor, Texas A & M University, College Station, TX, 77845, United States of America, B-shetty@tamu.edu

1 - Panel Discussion: Industry Search
Moderator:Bala Shetty, Professor, Texas A & M University, College Station, TX, 77845, United States of America, B-shetty@tamu.edu, Panelists: Jeff Day, Dave Worrall

The panel will discuss the industry interview process and do's and don'ts associated with the job search. In addition to comments from current and former recruiters, time will be provided for questions and answers.

■ TB69

W - Grand D - 2nd Floor

Environmental Issues in Operations Management

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Suresh Muthulingam, Assistant Professor of Operations Management, Cornell University, The Johnson School, 401P Sage Hall, Ithaca, NY, 14853, United States of America, sm875@cornell.edu

1 - Waste Heat Recovery: Opportunity or Burden?
Deishin Lee, Assistant Professor, Harvard Business School, Soldiers Field Road M483, Boston, MA, 02163, United States of America, dlee@hbs.edu, Chonnikarn Fern Jira

There is compelling evidence that firms may be missing opportunities to improve their energy efficiency and even increase revenues by implementing waste heat recovery solutions. We investigate the decision-making process of firms making capital budgeting decisions on process improvement projects that also have environmental benefit. We show how these projects fall into a "no-man's land" in a strategic planning framework and present three possible solutions to increase their priority.

2 - Greenhouse Gas Emissions Accounting: Allocating Emissions from Processes to Co-Products
Nur Keskin, Ph.D. Student, Stanford Graduate School of Business, 655 Knight Way, Stanford, 94305-7298, United States of America, nsunar@stanford.edu, Erica Plambeck

To implement a GHG emissions tax on imports or to evaluate the carbon footprint of a supply chain, one must specify how to allocate the emissions from a process among its co-products. For example, emissions could be allocated in proportion to the economic value or in proportion to the mass of co-products. We investigate the implications of the allocation rule (and flexibility therein) for GHG emissions, trade quantities, consumer surplus, and firms' profits.

3 - Efficient Water Distribution: An Analysis of Coordination Mechanisms
Mili Mehrotra, Assistant Professor, Carlson School of Management, University of Minnesota, 321 19th Ave S., Minneapolis, Mn, 55406, United States of America, milim@umn.edu, Srinagesh Gavirneni, Vijay Mookerjee, Milind Dawande

In developing countries, inequity in surface water distribution to farms arises due to their relative physical locations - Head-reach and Tail-end. Allocations to tail-end farms must pass through their head-reach counterparts, resulting in inequitable sharing and suboptimal social productivity if farmers are left to their own incentives. We propose two decentralized coordination mechanisms: rate-card and water-insurance for efficient, fair, and sustainable distribution.

4 - Investment in Energy Efficiency by Small and Medium-Sized Firms
Suresh Muthulingam, Assistant Professor of Operations Management, Cornell University, The Johnson School, 401P Sage Hall, Ithaca, NY, 14853, United States of America, sm875@cornell.edu

We investigate the adoption & non-adoption of energy efficiency initiatives using a database of over 100,000 recommendations provided to more than 13,000 small & medium-sized manufacturing firms. We identify several behavioral factors that influence firms' decisions of which energy-efficiency initiatives to adopt. We draw implications for enhancing adoption of energy-efficiency initiatives & for other decision contexts where a collection of process improvement recommendations are made to firms.

Tuesday, 12:30pm - 2:30pm

Interactive Session

Grand Ballroom, Prefuntion

Interactive Poster Session – Tuesday

Contributed Session

Chair: Ertunga C. Ozelkan, University of North Carolina-Charlotte, ecozelka@uncc.edu
Co-Chair: Nilay Tanik Argon, University of North Carolina-Chapel Hill, nilay@unc.edu
Co-Chair: Brian Denton

1 - A Promotion Decision System for Random Pricing in Electronic Commerce
Jianghua Wu, Associate Professor, Renmin University, Remin University, School of Business, Beijing, 100872, China, jwu@ruc.edu.cn

In this paper, we present a framework to study promotion strategy for an on-line retailer by incorporating some new features in electronic commerce. Online consumers may wait for up to a certain period of time to get their interested products at a lower price. Under e-commerce environment, online retailers can offer promotion more frequently and intelligently. Specifically, we model online retailerís price variation as a Markov process and derive the optimal price and profit for the retailer.

****2 - A Simulated Annealing Algorithm for Testing the Collective Consumption Model**
Fabrice Talla Nobibon, Post Doc, University of Liège, HEC-Management School, Rue Louvrex 14, Liège, 4000, Belgium, Fabrice.TallaNobibon@ulg.ac.be, Bram De Rock, Laurens Cherchye, Yves Crama, Frits C.R. Spieksma

This paper proposes an efficient procedure for testing the collective consumption model on large dataset. The problem is first formulated as a global optimization problem and next a simulated annealing algorithm is derived for solving it. Computational experiments are performed on real-life data.

3 - A Study on the Relationship between Formal Leader and Informal Leader Based on Evolutionary Game
Shuxiang Li, Xi'an Jiaotng University, No.28, Xianning West Road, School of Management, Xi'an, 710049, China, sxli2004@sohu.com

The paper explores the relationship between formal leader and informal leader based on evolutionary game theory. The result shows that there are two evolutionarily stable strategies. The formal leader and informal leader can establish cooperation through reasonable institutional arrangement such as decreasing the cost of cooperation or increasing the profit of cooperation.

****Competition Submission**

4 - Analysis of Transactional Ticket Queue Data for Staffing Decisions
Kaan Kuzu, Assistant Professor of Production and Operations Management, University of Wisconsin - Milwaukee, 3202 N. Maryland Ave., Milwaukee, WI, 53202, United States of America, kuzu@uwm.edu

We consider the staffing policy for a multi-server Ticket Queue with multiple service types. Using the transactional data from a bank, we estimate system input parameters such as customers' patience times and abandonment rates. We propose an algorithm to facilitate dynamic staffing decisions and benchmark the current bank policy with the proposed policy.

5 - Integrating of Product Life Cycle Issues in Technology Selection
Amir Sanayei, PhD Student, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, sanayei@wayne.edu

Selection of a proper technology is one of the most strategic tasks that should have been taken in early stages of new product development. Enterprises need to consider product life cycle (PLC) issues in the technology selection process. In this paper we discuss the importance of considering PLC issues in technology selection process .We propose a decision-making framework to select the best technology using a range of design, manufacturing and environmental factors.

6 - Formulating Scenario Generation in Bank Stress Testing
Zhimin Hua, City University of Hong Kong, 605C Hall 8 City U. Student Residence, 22 Cornwall Street, Kowloon Tong, Hong Kong - PRC, zmhua2@student.cityu.edu.hk, J.Leon Zhao

Robust scenario generation is crucial to deriving effective results in bank stress testing. However, few studies paid much attention to this issue, due to the difficulty to quantify scenarios and the subjective nature of scenario selection. We formulate the scenario generation problem based on a stress testing metamodel. Then we formalize the scenario generation process and propose optimization-based decision support methods to assist the generation of stressed scenarios.

****7 - Hotelling T2 Control Chart for Monitoring Freeway Incident Detection**
Joonse Lim, Georgetown Preparatory School, 10900 Rockville Pike, North Bethesda, MD, United States of America, joonlim@gmail.com, Youngsul Jeong

This talk presents a multi-resolution wavelet-based Hotelling T2 control chart for monitoring freeway incident detection, which integrates a wavelet transform into a statistical control chart. The experimental results present that the proposed algorithm in this paper is a promising alternative for freeway automatic incident detections.

8 - Strategies of Firms within the Energy Innovation Landscape
Charles Jones, Research Fellow, Harvard Kennedy School, 63 Eastland Rd, Jamaica Plain, MA, 01230, United States of America, skuk_jones@yahoo.com

Based on data from a pilot-scale survey, supported by expert interviews, the strategic decisions of firms to engage in energy technology innovation are inferred. Small scale participants are important players in the energy innovation landscape. Firms react to costs more than opportunities by innovating. Hypotheses for a follow-on survey and implications for strategy and policy are presented.

****9 - Wind Farm Design Optimization Using a Viral Systems Algorithm**
Carlos Ituarte-Villareal, Reasearch Assistant, University of Texas - El Paso, 500 West University Avenue, El Paso, TX, 79968-0521, United States of America, cmituartevillarreal@miners.utep.edu, Jose Espiritu

A new viral systems optimization algorithm is developed to find the optimal number and position of wind turbines in large wind farms with the main objective of minimizing the cost per unit power produced from the wind park, the developed algorithm is applied to three well known problems

****10 - Simulation Study of Fast Track Process in Hospital Emergency Department**
Vyahriti Joshi, UNC Charlotte, Charlotte, NC, 28262, United States of America, vyahriti28@gmail.com, Churlzu Lim, Gary Teng

In this study, we consider a fast track (FT) process for non-urgent patients implemented at an emergency department (ED). Using a discrete-event simulation model, we identified bottleneck processes and workload imbalance with FT process. We propose a new process, called Smart Track (ST) process. With the proposed process, the simulation study displays a substantial reduction in the length of patientís stay in ED with the waiting time.

11 - The Donor-Dependent Scoring Schemes for Cadaver Kidney Allocation
Yichuan Ding, student, Stanford University, 14 Comstock Circle, Apt. 106, Stanford, CA, 94305, United States of America, y7ding@stanford.edu, Stefanos Zenios

In the U.S., the ranking of candidates on the cadaver kidney transplantation waitlist is determined by a scoring scheme, which can be classified into two categories: donor-dependent and donor-independent. By modeling the waitlist, we give a rigorous proof that a donor-dependent scoring scheme will enlarge the range of kidneys that will be accepted by rational candidates. Our simulation test shows that a donor-dependent scoring policy decreases the number of discarded kidneys by 7%.

****12 - Cost of Equity in Defensive Resource Allocations in the Face of a Possibly Non-strategic Attacker**
Xiaojun Shan, Cost of equity in defensive resource allocations in the face of a possibly non-strategic attacker, State University of New York-Buffalo, 435 Bell Hall, Buffalo, NY, 14260, United States of America, xshan@buffalo.edu, Jun Zhuang

We study trade-off between equity and efficiency by developing a hybrid model, where a government allocates defensive resources among multiple potential targets, while reserving a portion (represented by the equity coefficient) for equal distribution (according to geographical areas, population, density, etc.) The terrorist could be strategic or non-strategic.

13 - Counterinsurgency through Network Analysis and Structural Search
Xin Chen, Assistant Professor, Southern Illinois University-Edwardsville, 3079 Engineering Building, Edwardsville, IL, 62026, United States of America, xchen@siue.edu

In counterinsurgency, insurgents need to be neutralized, i.e., captured, destroyed, or isolated. Resources such as time available to respond to insurgencies are often limited; decisions must be made as to which insurgents should be neutralized to minimize the possibility and scale of insurgencies. This research designs an analytical framework based on network and social sciences, and provides an effective and efficient tool for neutralization of insurgent networks under resource constraints.

****14 - Pre-positioning Repair Items for Aids to Navigation due to Natural Disaster**
Jessye Bemley, Graduate Student, North Carolina A&T State University, 5328 West Market Street, Apt. 3G, Greensboro, NC, 27409, United States of America, jlbemley@gmail.com, Lauren Davis, Xiuli Qu

Aids to Navigation (ATONs) assist ships, vessels and mariners with navigation through waterways. If these aids are damaged, they can hinder the movement of supplies to support recovery from a disaster. A stochastic facility location model is used to show the benefit of pre-positioning repair items in order to maximize the repair of ATONs.

****15 - Decision Making on Pre-disaster Preparedness and Post-disaster Relief**
Fei E, SUNY at Buffalo,, 330 Bell Hall, Industrial Engineering, Buffalo, NY, 14260-2050, feihe@buffalo.edu, Jun Zhuang

Huge amounts of resources have been invested in preventing and recovering from disasters. However, the effective economic strategy to balance resource allocations for pre-disaster and post-disaster efforts is unclear. In this paper, a two-stage stochastic model is proposed to study this tradeoff, in order to minimize the total damage and investment costs. Both analytical and numerical results are presented; and future research directions are discussed.

****16 - Decisions in Disaster Recovery Operations: A Game Theoretic Perspective on Organization Cooperation**
John B. Coles, University at Buffalo, Industrial and Systems Engineering, Buffalo, NY, jbcoles@buffalo.edu, Jun Zhuang

In this project we propose an approach to guide decision makers in emergency environments on how to relationship selection and development to improve resource utilization in the wake of a disaster. Using game theory, we provide an initial approach for the development of a decision support framework for emergency managers.

****17 - Optimization of Dispatching the Gas Company's Employees in Case of a Huge Earthquake**
Toshinori Sasaya, Tokyo Gas Company, LTD., 5-20, Kaigan 1-Chome, Minato-Ku, Tokyo, Japan, sasaya@tokyo-gas.co.jp, Shinnosuke Kimura, Wataru Inomata, Yuuki Noritou, Hiroshi Kashio, Kanako Nakayama, Hidetaka Shinozaki

It is very important for gas companies to recover the gas supply system as soon as possible after a huge earthquake occurs. We develop the simulation model for the dispatching of our company's employees when a huge earthquake occurs and optimize the dispatching of the employees. The expected traveling time is dramatically improved because of the optimization. Now we consider the real-time optimization system.

****18 - Workforce Assessment for an Urban Police Department**
Toni Sorrell, Virginia Commonwealth University, 1015 Floyd Avenue, PO Box 842014, Richmond, VA, 23284, United States of America, tpsorrel@vcu.edu, J. Paul Brooks, David Edwards, Robyn Diehl, Sudharshana Srinivasan

We have created a simulation to model the current policing system of an urban police department. The results of the simulation determine the number of police officers required to satisfy the benchmarks of the police department.

**Competition Submission

****19 - Characterizing Uncertainty in Supply and Demand for Non-profit Food Distribution Organizations**

Lauren Davis, Assistant Professor, North Carolina A&T State University, McNair Hall Rm. 404, 1601 East Market St., Greensboro, NC, 27411, United States of America, lbdavis@ncat.edu, Christina Harris, Sabin Blumenfeld, Sylvester Winbush, Julie Ivy

Food insecurity is a growing problem in the United States. Food Banks are one of the key non-profit organizations actively engaged in efforts to address this problem. Matching supply with demand is challenging in this environment. Several approaches to characterizing need (demand) and availability of supply are presented.

20 - Potential Impact of Plug-in Electric Vehicles on Power Systems

Lizhi Wang, Iowa State University, Industrial and Manufacturing Systems Eng, Iowa State University, Ames, IA 50011, United States of America, lizhiwang80907@gmail.com

Plug-in electric vehicles (PEVs) have been identified by many as part of a solution to problems in the transportation sector. However, electric power systems must be prepared to embrace the new challenges and opportunities that come with the PEV recharging load. In this study, we present a bilevel optimization approach to measure the potential impact of PEV recharging load on power systems. We also propose to mitigate the potential impact through better design of time-of-use electric rates.

****21 - Experimental Analysis of Aggregate Planning with Flexible Requirements Profile**

Edil Demirel, Teaching Assistant in Systems Engineering and Engineering Management Program, University of North Carolina-Charlotte, 9201 University City Blvd, Charlotte, NC, 28223-0001, United States of America, edemirel@uncc.edu, Churlzu Lim, Ertunga C. Ozelkan

Demand uncertainty causes changes in production plans, which create nervousness to the manufacturer. Flexibility Requirements Profile (FRP) is an approach to stabilize production plans. In this study, we propose aggregate planning combined with FRP. The efficacy of the proposed method is discussed via a designed experiment with various factors.

22 - Integrated Production and Distribution Scheduling Problem with Perishable Product

Wennian Li, Graduate Student, Clemson University, 103 Freeman Hall, Clemson University, Clemson, SC, 29634-0920, United States of America, wennial@clemson.edu

The integrated production and distribution scheduling problem is considered with a perishable product. This research uses non-identical vehicles and allows each vehicle to make multiple trips during the time horizon. The model determines the production schedule and transportation routing (number of vehicles and routes for each) to satisfy a set of known customers demand to minimize the total transportation cost.

****23 - Method of Subsequent Modification of Functional for Solving Transportation Problem**

Vladimir Tsurkov, Head of Department, CC RAS, Vavilov Str., 40, Moscow, 119333, Russia, tsurkov@ccas.ru

New method of solving transportation problem is proposed based on decomposition of original statement into 2D optimization problems. Integer representation and monotonicity of target function in stepwise solution procedure ensures finiteness of required calculation amount. As a result, instead of one optimal solution of the original statement, a system of limitations emerges, from which all optimal solutions can be obtained. Numerical examples demonstrating the algorithm workflow are listed.

24 - Optimal care Location and Transportation Planning in the VA Healthcare System

Mehmet Erkan Ceyhan, Post-doc Research Associate, Northeastern University, Northeastern University, 363 Snell, Engineering Center, 360 Huntington ave, Boston, MA, 02115, United States of America, m.ceyhan@neu.edu, Brian Shiner, James Benneyan, Bradley Watts

Location-allocation models that seek to determine the optimal location of medical services across a geographic network of facilities can result in significant cost and service improvements. In this study, the optimal assignment of sleep disorder service across New England area is investigated. Given the current suboptimal conditions, service network is aimed to be improved in terms of cost and accessibility by locating additional services and capacity expansions.

25 - Robust bi-objective Optimization Model for Dynamic Supply Chain: A Case Study for a Petroleum Company

Amirhossein Khosrojerdi, University of Oklahoma, Norman, OK, United States of America, akhosrojerdi@ou.edu, Ali Hadizadeh, Mathias Henningsson

This study considers the problem of location, allocation and production planning of a petroleum company by using a bi-objective MILP model. The model includes inventory, transportation and refinery maintenance decisions. Customersí demand and availability of refineries are considered as uncertainty parameters and will be treated by using robust optimization techniques. Maximizing companyís revenue and customersí service level are two objectives in this model.

26 - Modeling the Design of 4G Wireless Aggregation Architectures

Ioannis Papapanagiotou, NC State University, 890 Oval Driver, Raleigh, NC, 27606, United States of America, ipapapa@ncsu.edu, Michael Devetsikiotis

The recent proliferation of mobile devices has led to an exponential growth of wireless data traffic. Currently, the already deployed architectures cannot handle this demand. The goal of this work is to build service-rich and cost-effective architecture that would be scalable and versatile to accept the transformations resulting from the introduction of the emerging wireless traffic patterns.The main challenges include non-stop delivery, service flexibility, policy management and reduced risk.

27 - Material Allocation, Routing and Dispatch System (MARDS)

Tanju Yurtsever, Senior Mts, Maxim Integrated Products, 14900 Spillman Ranch Loop, Austin, TX, 78738, United States of America, tanju.yurtsever@maxim-ic.com, Jehn Johns, Ivan Hovey, Michael Bates

In Semiconductor Manufacturing, material running on the right tool at the right time is critical to ensure the greatest throughput on equipment. One of the main reasons this is not achieved is due to the material not being in the right place. At the San Antonio Factory, we have designed, developed, and implemented a system that will tell users where to move material and where to run it in real time. The factory is made up of over 2000 lots and over 700 equipment.

28 - New MIP Models for an Extended Version of Flexible Job Shop Problem

Marcio Oshiro, PhD. Student, University of Sao Paulo, Rua do Matao 1010, Sao Paulo, SP, 05508-090, Brazil, oshiro@ime.usp.br, Paulo Feofiloff, Ernesto Birgin, Cristina Fernandes, Debora Ronconi, Everton Melo

Flexible Job Shop (FJS) is an extension of the NP-hard Job Shop problem where each operation can be processed by more than one machine. This work proposes two mixed integer linear programming models for FJS with minimization of makespan as performance measure. Computational experiments suggest that these models achieve better results than a model from the literature. Our experiments include new instances based on real problems that require a more general version of FJS captured by our models.

****29 - Scheduling Conflicting Families of Jobs on Parallel Machines to Minimize Tardy Jobs and Total Tardiness**

Nitin Shenoy, PhD Student, Texas Tech University, Department of Industrial Engineering, TX, United States of America, nitin.shenoy@ttu.edu, Milton Smith

This research describes a heuristic algorithm that generates production schedule for a number of different families of jobs on parallel machines. The aim of the research was to find a schedule for conflicting job families that cannot run simultaneously on adjacent parallel machines. In order to understand this, a case study is illustrated in this research. Initially, a mathematical model was developed with constraints; number of machines that can run simultaneously, the conflicting jobs criteria, sequence dependent setup time, available hours per shift and the available material. Each job had a different due date and processing time. Heuristics such as Shortest Processing time, Earliest Due Date and Branch & Bound were used to queue the jobs available. The objective was to minimize number of tardy jobs and total tardiness.

****30 - Enhanced Classification for High-throughput Data with an Optimal Projection and Hybrid Classifier**

Jingying Zhang, University of Arkansas, 707 W Treadwell St., Apt.16, Fayetteville, AR, 72701, United States of America, zhangjingying8@gmail.com, Joon Jin Song

A bottleneck for High-throughput data analysis is to reduce the high dimensionality for subsequent analysis. PCA is a popular tool for the dimensionality reduction. Since this approach is not always effective, we consider a different criterion, CVA. To more enhance classification performance, we propose an integrated classification framework to combine the criterion and two hybrid classification methods and compare with several popular classification methods by using cross-validation.

31 - Modeling Food Bank Operations Using Agent-Based Simulation

Ashley Hovenkamp, NCSU, 916-5 Shellbrook Ct, Raleigh, NC, 27609, United States of America, ashovenk@ncsu.edu, Julie Ivy

We use agent-based simulation to model the interactions of agents associated with the operations of a food bank network consisting of a distribution hub and branches. Agents in the model include food donors, food bank branches and hub and food assistance agencies with which the food bank works. Simulation is used to characterize the dynamic nature of the interactions between each of the agent types.

****Competition Submission**

32 - Optimal Sampling Laws for Constrained Simulation Optimization on Finite Sets

Susan Hunter, Virginia Tech, Industrial & Systems Engineering, Blacksburg, VA, 24061, United States of America, srhunter@vt.edu, Nugroho Pujowidianto, Chun-Hung Chen, Loo Hay Lee, Raghu Pasupathy

Consider the context of ìstochastically‖ constrained simulation optimization on a finite set. Assuming the objective and constraints have a multivariate normal distribution, we fully characterize the asymptotically optimal sampling allocation across competing systems. The resulting algorithm is easily implementable with immediate practical implications.

33 - How to Interact with Bloggers

Ya-Hui Hsing, PhD student, Keio University, 2-15-45 Mita, Minato-ku, Tokyo, Japan, keibobo@gmail.com, Yutaka Hamaoka

We propose a model that integrates consumersí motivation to post eWOM, firmsí responses to the postings, and accompanied consumersí attitude change to the firm or brand. Online survey confirmed that among firmsí response strategies, taking care postings and providing unique information have positive impact to posting behavior and improve attitude to the firm.

34 - The Mechanism of Cyclical and Self-Organized Change of Choice Set Size

Hiroshi Kumakura, Professor, Senshu University, 2-1-1 Higashi-mita, Tama, Kawasaki, 2148580, Japan, kumakura@isc.senshu-u.ac.jp

A cyclical and self-organized change of choice set size (the number of brands consumer buying) is discussed. A cyclical change of choice set size is shown by POS data, then the mechanism in which choice set size fluctuates self-organizedly under interaction among consumers and companies is proposed.

35 - Intellectual Property Licensing Strategy and Two-sided Network Effect in Supply Chain

Tingting Jiang, student, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60201, United States of America, tingting-jiang@northwestern.edu

The paper studies licensing strategy of intellectual property (IP) vendors. In contrary to traditional supply chain parties, IP vendors must form an ecosystem in a supply chain to maximize profit. This paper studies this new network form of supply chain. The results can also be applied to supply chain intermediaries.

36 - Knowledge Sharing in Buyer-Seller Chains

Hulya Yazici, FGCU, 10501 FGCU South, Fort Myers, FL 33965 United States of America, hyazici@fdcu.edu

The purpose of this study is to determine the antecedents of knowledge sharing between suppliers and buyer of a service supply chain. The role of the need-based psychological and action-based behavioral variables on tacit knowledge sharing is investigated. Results indicate that mutual dependency and organizational linkage as well as psychological variables such as trust and commitment relate to knowledge sharing between buyer and suppliers and contribute to supply chain visibility.

37 - Reverse Bullwhip Effect under Limited Production Capacities

Linna Du, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, linna.du@business.uconn.edu

This research investigates compound causes of the reverse bullwhip effect (RBE) by considering an inventory system with limited production capacities and arbitrary demands. The supply chain is modeled as a single-input, single-output control system driven by uncertain demands under asymmetric demand information. We discuss the optimal policy and how our analytical findings can be managerially applied to reverse bullwhip mitigation strategies.

38 - Serial and Parallel Supply Chain Configuration with Delivery Time, Price and Service Level Dependent

Li Qian, Associate Professor, South Dakota State University, Solberg Hall 313, Brookings, SD, 57006, United States of America, li.qian@sdstate.edu

Optimal supply chain configuration and proper operational strategy are the two important prerequisites for any business organization for maximizing profit. In this research, the market is segmented based on the degree of customersí aversion to wait and inclination to guaranteed service level. The real delivery time is stochastic for each supplier in the supply chain. The extensive numerical analyses for each model are conducted with brief conclusions.

**39 - Pricing for Production and Delivery Flexibility

Yaxian Li, Pricing for Production and Delivery Flexibility, Georgia Institute of Technology, 4212 Renaissance Way N.E., Atlanta, GA, 30308, United States of America, yli41@gatech.edu, Martin Savelsbergh, George Nemhauser

In the single-item, single-level uncapacitated lot-sizing problem, we investigate offering price discounts in return for production and delivery flexibility. We present a polynomial time algorithm for solving the resulting quadratic optimization problem. Our theoretical and computational results show that this type of strategy can yield significant increases in profit.

**40 - Stability Valuation of Production with a Hybrid Algorithm with a Simulation-improved Genetic Phase

Mariano Frutos, Dr., Universidad Nacional del Sur and Conicet, Av. Alem 1253, Department of Engineering, Bahìa Blanca, 8000, Argentina, mfrutos@uns.edu.ar, Fernando Tohmé, Barbara Damiani, Daniel Rossit, Elizabeth Garmendia

We present an evolutionary multi-objective algorithm to assess the value of stability in a production process in a Job-Shop environment. The novelty of our approach is the incorporation of a simulation process into the genetic phase of the algorithm. This allows filtering and ordering the solutions, improving their quality.

**41 - The Design of Efficiency Indexes for Port Operations

Daniel Carbone, Mg., Universidad Nacional del Sur, Av. Alem 1253, Department of Engineering, Bahìa Blanca, 8000, Argentina, daniel.carbone@uns.edu.ar, Mariano Frutos, Fernando Tohmé

We discuss here ways in which port activities can be assessed. Our approach is to develop indexes capturing their efficiency in terms of their impact on logistic chains. We intend to apply these indexes to evaluate the performance of port operations and the promotion of foreign trade activities.

42 - Rational Expectations of Monetary Policy Changes and the Term Structure of Interest Rates

Gonzalo Cortazar, Pontificia Universidad Catolica de Chile, Vicuna Mackenna 4860, Santiago, Chile, gcortaza@ing.puc.cl, Gonzalo Valdes

This paper uses current bond prices to estimate market expectations for future rate changes by a Monetary Authority. The model explicitly takes into account rational expectations in a traditional Brownian Motion no-arbitrage model for the dynamics of the short rate. The model is estimated using a Kalman Filter and applied to an emerging market (Chile) with low liquidity.

43 - Load and Unload Planning for Ultra Large Size Containerships

Masoud Hamedi, Research Associate, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, masoud@umd.edu, Ali Haghani

In recent years, fully cellular containerships have been increasing both in number and size due to economy of scale. Turnaround time is a critical performance measure in containership operations. This research presents an optimization model and solution results for ultra large size containership stowage planning with crane considerations.

44 - Model Predictive Control Method for Vehicle Platoon Control under High-latency Wireless Communicatio

Hao Zhou, University of Michigan, 1205 Beal Ave., IOE Building, Ann Arbor, MI, 48109, United States of America, haozhou@umich.edu

Progress in V2V communication allows automatically control of vehicles and organize them into platoons with short intra-platoon distances. One major issue with platoon control is the negative impacts of wireless communication latency. We propose a decentralized longitudinal platoon control method using MPC method and analyze its sensitivity to derive the safety conditions for this method. Simulations were used to test the effectiveness and safety under two communication latency settings.

45 - The Importance of the Villages in Turkey Railway Transport Logistics

Bahar Ozyoruk, Dr., Gazi University, Faculty of Engineering, Department of Industrial Engineering, Maltepe Ankara, 06570, Turkey, bahar@gazi.edu.tr

In this study, we emphasized the importance of logistics and transportation logistics villages. Rail transport in Turkey were investigated. To increase the share of freight transport, logistics, rural areas should be established which try to answer the question. Alternative sites were evaluated with the established mathematical model solution.

**46 - Explicit and Tacit Knowledge Sharing within Global Virtual Teams

Yajiong Xue, East Carolina University, Slay 302, Greenville, NC, 27858, United States of America, yajiong.xue@gmail.com, Brenda Killingswoth, Yongjun Liu, Huigang Liang

Knowledge sharing (KS) in global virtual teams (GVT) is essential. This research investigates factors facilitating the KS behavior in GVT. We first requested 19 VT from 3 countries to accomplish 4 simple tasks which involved the exchange of explicit knowledge only. Second, we asked 11 VT from 2 countries to accomplish 2 complicated tasks which involved the exchange of explicit and tacit knowledge. Team and individual-focused factors are found to significantly influence KS behavior in 2 cases.

**Competition Submission

**47 - Optimization-based Design of Novel Molecules with Desired Properties

Apurva Samudra, PhD Candidate, Carnegie Mellon, 1107 Doherty Hall, Carnegie Mellon, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, apurva@cmu.edu, Nikolaos Sahinidis

We present a systematic optimization-based framework for the design of novel molecules with desired properties. The highly complex molecular design problem is decomposed into stages using integer optimization methods to generate molecular compositions and structures from descriptors. We illustrate the use of integer and nonlinear optimization methods at appropriate stages to handle a variety of design problems efficiently.

48 - Analytics and Performance Measures: Evaluation of the Air Force Knowledge Management

Eric Tucker, Assistant Professor of Management, U.S. Air Force Academy, 2354 Fairchild Dr, USAF Academy, CO, 80920, United States of America, eric.tucker@usafa.edu

Organizations are faced with a deluge of data. As a result, managers struggle to determine what data to track to improve performance. The Air Force is no different. It collects a large amount of user data within its knowledge management system. The key question is:How does an organization determine what data should be collected to develop useful performance measures? This study uses an analytic approach to evaluate the current knowledge management system data and resulting performance measures.

**49 - Optimal Kinematics of Supercoiled Filaments

Francesca Maggioni, DMSIA, University of Bergamo, Via dei Caniana 2, 24127, Bergamo, Italy, francesca.maggioni@unibg.it, Florian Potra, Marida Bertocchi

In this poster we propose kinematics of supercoiled filaments as solutions of the elastic energy minimization by bending and torsional influence. Time parameters are described by cubic spline and their values at grids points are the unknowns in a large-scale optimization problem. These results find useful applications in DNA biology.

**50 - Analysis of Variability in Primary Care: The Case of a Family Medicine Practice

Hyun Jung Oh, Ph.D Student in Industrial Engineering, UMASS, 160 Governors Drive, Amherst, MA, 01003, United States of America, hyunjuno@engin.umass.edu, Hari Balasubramanian, Ana Muriel

Outpatients in primary care practices significantly differ from those in specialties. In particular, a family medicine practice involves a higher variety of cases: the same team cares for patients of all ages, birth to end of life, suffering from any type of ailment related to both their physical and mental health. To understand this variability and its key predictive factors, we collected data for 5 days at a family medicine practice in Massachusetts. The relevant performance measures are: time in a waiting room, time with a medical assistant, waiting time for a provider or a medical assistant, time with a provider, and total time in the system. The objective is to identify factors that cause variability in patient flow measures (face time with provider, waiting time for a provider, and total time in the system) with the goal of improving patient scheduling.

**51 - Computer Modeling & Experiments of Glycosylation Modulation Dynamics in Cardiac Electrical Signaling

Dongping Du, University of South Florida, 14329 Wedgewood Circle Apt.202, Tampa, FL, 33613, United States of America, dongpingdu@mail.usf.edu, Hui Yang

Physics-based simulation models are developed mathematically to simulate multi-scale cardiac electrical signaling. The glycosylation modulation parameters from physical experiments are incorporated into computer models at the level of ion channels to predict the variations of electrical conductions in cells and tissues. Computer and physical experiments are intertwined in this study.

**52 - Mining of Neuroimaging Data for Alzheimer's Disease Study by Novel Statistical Methods

Shuai Huang, Research Assistant, Arizona State University, 2343 West Main Street, Apt. 2080, Mesa, AZ 85201, United States of America, shuang31@asu.edu, Jing li

Rapid advances in neuroimaging techniques provide great potentials for study of neurodegenerative diseases, such as the Alzheimerís disease (AD). These techniques produce ultra-high-dimensional (millions of variables), noisy (low signal-to-noise ratio) data sets, which make many conventional statistical models fall short. In this poster, we show how novel statistical models can be developed and how they can be used for knowledge discovery of AD from neuroimaging datasets.

**53 - Model Calibration through Minimal Adjustments

Chia-Jung Chang, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, Room 217, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, cchang43@gatech.edu, Roshan Joseph Vengazhiyil

Model calibration refers to estimating unknown parameters in a physics-based model from real data. When model assumption is violated, the estimates become inaccurate leading to poor model prediction. Besides, all works ignore the potentially important bias that can occur in the observations. In this work, we develop a methodology for calibrating the physical model in the presence of both model and experimental biases. Two real case studies are presented to demonstrate the prediction ability.

**54 - Optimal Reliability Design of Multi-Sensor Systems Using Bayesian Networks

Shahrzad Faghih Roohi, Department of Industrial & Systems Engineering, National University of Singapore, Blk E1, #07-26, Engineering Drive 2, Singapore, Singapore, shahrzad.faghihroohi@nus.edu.sg, Min Xie, Kien Ming Ng

This paper presents an efficient approach for reliability analysis of the kind of safety monitoring systems calling multi-sensor systems. The main purpose is to find an optimal reliable configuration of the system which minimizes the total loss caused by abnormality. Using Bayesian Networks, the state probabilities of the sensors are estimated at different trials to be applied for system modelling and optimal decision making. The numerical example shows the proposed approach with more details.

**55 - Optimal Supersaturated Design for Penalized Variable Selection Methods

Dadi Xing, Optimal Supersaturated Design for Variable Selection, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States of America, dxing@purdue.edu, Hong Wan, Yu Zhu

In the supersaturated design(SSD)study, most existing criteria for constructing optimal SSD are motivated and further justified from the estimation perspective. We will propose a number of optimality criteria for the construction of SSD from the perspective of penalized variable selection methods. The properties of these criteria will be discussed. A computing algorithm will be used to construct such optimal SSD, examples of simulation and an application of tue algorithm will also be presented.

**56 - Utilizing MADA Methods for Effective Selection of Focus Areas in Critical Infrastructure Recovery

Okan Pala, UNC Charlotte, 9201 University City Blvd, Charlotte, NC, 28213, United States of America, opala@uncc.edu, David Wilson, Ertunga Ozelkan

We present a framework that explores the performance of various Multi-Attribute Decision Analysis (MADA) methods that make recommendations to decision makers for critical infrastructure (CI) recovery. We measure the performance of selected MADA techniques for various outage situations with various preference settings. We have validated our approach by creating lookup table to compare selected MADA methods across various types of CI scenarios in a representative emergency situation.

**57 - Monte Carlo Simulation Based Inventory Algorithm to Achieve Target Service Levels with Job Lot Sales

Hemant Adhav,Manager - Supply Chain Analytics, Mu Sigma Inc., 3400 Dundee Rd., Suite 160, Northbrook IL 60062, United States of America, hemant.adhav@mu-sigma.com, Christie Berry, Matthew Graham, Ravindra Jore, Aditya K,, Alexander Quinn

Traditional inventory algorithms are based on assumptions which may not hold true for demand profiles with job lot or bulk sales. This algorithm applies service level concepts to calculate safety stock. Profiles are generated based on demand patterns, seasonality etc. A coin sorter methodology is used to select profiles that effectively account for job lot sales. Monte Carlo simulation is leveraged to calculate Safety Stock. The result is reduced stock outs with right-sized inventory.

**Competition Submission

Tuesday, 1:30pm - 3:00pm

■ TC01

C - Room 201A

OM Models with Customer-Driven Demand

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Rui Yin, Assistant Professor, Arizona State University, Department of Supply Chain Mgmt, Tempe, AZ, United States of America, Rui.Yin@asu.edu

1 - The Value of Clickstream Tracking: Advance Demand Information, Product and Price Personalization

Tingliang Huang, Assistant Professor, University College London, Gower Street, London, WC1E 6BT, United Kingdom, t.huang@ucl.ac.uk

Motivated by the fast growing practice of web analytics generated by the Internet clickstream tracking technology, we study the value of using this technology to collect advance demand information (ADI) for operational decisions and advance preference information (API) for either product or price personalization when selling to strategic customers. Our study investigates the value of Operations-Marketing Collaboration.

2 - Strategic Customers and Commitments in a Decentralized Supply Chain

Ali Parlakturk, University of North Carolina-Chapel Hill, Kenan- Flagler Business School, Chapel Hill, NC, 27599, United States of America, Ali_Parlakturk@unc.edu, Mustafa Kabul

We consider a decentralized supply chain serving forward-looking consumers in two periods. The supplier and the retailer dynamically set the wholesale and retail price to maximize their own profits. The consumers are strategic in deciding whether and when to buy the product. We find that while a centralized system always benefits from making price and quantity commitments, this is not true for a firm in a decentralized supply chain due to how the other firm reacts to such commitments.

3 - Buying from the Babbling Newsvendor: Availability Information and Cheap Talk

Gad Allon, Northwestern University, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Achal Bassamboo

Provision of real-time inventory availability information by a firm to its customers has become prevalent in recent years. Often, this information cannot be credibly verified by the customer. We analyze the the problem of how a firm can influence its customers' buying behavior.

4 - Intertemporal Pricing with Boundedly Rational Consumers

Ying-Ju Chen, University of California- Berkeley, 4121 Etcheverry Hall, Berkeley, CA, 94720, United States of America, chen@ieor.berkeley.edu, Selina Cai

Our paper demonstrates that the presence of flexible pricing plans can be attributed to consumers being boundedly rational. Additionally, a single pricing plan may emerge as an optimal pricing scheme even when the consumers are heterogeneous in their degrees of rationality and the seller cannot differentiate among the consumers.

■ TC02

C - Room 201B

Assortment Planning and Customer Choice

Contributed Session

Chair: Almula Camdereli, Georgetown University, McDonough School of Business, 37 and O Streets, N.W.,, Washington, DC, 20057, United States of America, zac2@georgetown.edu

1 - Strategic Planning of a Configurable Product

Edward Umpfenbach, Wayne State University, 4815 Fourth Street, Detroit, MI, 48202, United States of America, Eumpfenbach@wayne.edu, Ratna Chinnam, Alper Murat

Companies producing configurable products need to make tradeoffs between product variety in their assortment and efficiency in their operations. We present a MIP model to help make these tradeoffs, designed with input from Ford Motor Company. The model seeks to optimize the product mix offerings with full consideration for design and operation of the supply chain networks, leading to solutions that are more profitable over the life-cycle of the product for the company.

2 - Aligning Product Mix and Supply Chain Strategies: An Empirical Analysis

Kyoungsun Lee, Ph.D. candidate, Purdue University, 403 W. State Street, Lafayette, IN, 47909, United States of America, lee430@purdue.edu, Ananth Iyer

We develop empirical links between product variety, demand and associated demand uncertainty. We focus on three results. (i) We show that as variety increases, the number of possible consumer preference scenarios increases. (ii) We analyze the impact of synchronizing variety and customer segments with associated product margin. (iii) We suggest the possible impact of adjusting SKU inventory locations on costs. We show that managing variety can be a key ingredient of supply chain performance.

3 - Assortment Planning for Configurable Products

Ali Taghavi, Wayne State University, department of Industrial & Systems Engin, Room 1073, Detroit, 48202, United States of America, taghavi@wayne.edu, Ratna Chinnam

A manufacturer's assortment is the set of products that the company offers to its customers. Assortment planning needs to balance benefits captured from diversifying the assortment and costs incurred by increasing assortment complexity. In this study, we build a framework that looks for the optimal assortment for a manufacturer of configurable products. Due to high stock-out rates in certain industries, we present a mathematical framework for handling stock-out substitution within the model.

4 - Customer Preferences and Opaque Intermediaries

Xiaoqing Xie, Assistant Professor, Shanghai University of Finance and Economics, Room 702,12, Lane 318 of Sanmen Road, Yangpu District, Shanghai, 200439, China, xkx2@cornell.edu, Chris Anderson

We develop an online choice experiment to understand consumer preferences among multiple online distribution channels including regular full information sales channel (e.g. Expedia) and opaque sales channels where some attributes of the product or service are disguised until after purchase (e.g. Hotwire, Priceline). A Multinomial Logit model is employed to analyze the experimental data and measure the consumer tradeoffs between price and other attributes of the product.

5 - The Effect of Online Streaming on Subscription-based Video Rental Services

Almula Camdereli, Georgetown University, McDonough School of Business, 37 and O Streets, N.W.,, Washington, DC, 20057, United States of America, zac2@georgetown.edu, Victor Richmond Jose

Video rental retailers are tending to transition from renting physical media to live online streaming. We consider a subscription-based flat-fee retailer that is deciding how to price their services by providing its clients several packages that will allow them to watch movies and TV shows either through the web or through DVDs by postal mail. Using a heterogeneous customer base, we study the optimum bucket pricing strategy and analyze the effects of online media coverage on the pricing policy.

■ TC03

C - Room 202A

Newsvendor and Risk

Contributed Session

Chair: Onur Bakir, Assistant Professor, TOBB Economy and Technology University, TOBB ETU, Endustri Muhendisligi Bolumu, Sögütözü Caddesi, No: 43, Kat:1, Ankara, 06560, Turkey, nbakir@etu.edu.tr

1 - A Multiproduct Risk-averse Newsvendor with Law-invariant Coherent Measures of Risk

Sungyong Choi, Nanyang Technological University, 50 Nanyang Avenue, School of MAE, Singapore, 639798, Singapore, sungyongchoi@gmail.com, Andrzej Ruszczynski, Yao Zhao

We consider a multiproduct risk-averse newsvendor under the law-invariant coherent measures of risk. In the paper, we have two key research questions. They are the impacts of degree of risk aversion and demand correlation under risk to the optimal solutions. Then I examine how the interplay of these two impacts affects the solutions dynamically in independent and dependent demand cases. By obtaining several analytical propositions and numerical insights, I provide a comprehensive understanding.

2 - Multiproduct Newsvendor under Best and Worst Dependence Structures

Enis Kayis, HP Labs, 1501 Page Mill Rd, Palo Alto, United States of America, enis.kayis@hp.com, Kemal Guler, Mehmet Sayal, Burcu Aydin

Faced with multiple demand streams, a newsvendor has to decide inventory levels to satisfy total demand. Independent and comonotonic demand streams are well documented in the literature. We bridge the gap and investigate how dependence structure in the demand sources affects the pooled inventory level and provide comparative statistics on the optimal level. We show that misspecification of dependence structure may lead to suboptimal inventory levels and under/over estimation of profits.

3 - The Newsvendor's Optimal Incentive Contracts for Multiple Advertisers

Zhengping Wu, Assistant Professor, Singapore Management Univerisity, 50 Stamford Road, Singapore, 178899, Singapore, zpwu@smu.edu.sg, Pascale Crama, Adam (Wanshan) Zhu

We consider a newsvendor who earns a revenue from the sales of her product to end users as well as from multiple advertisers paying to obtain access to those end users. We study the optimal decisions of a price-taking and a price-setting newsvendor when the advertisers have private information about their willingness to pay. We focus on the impact of the number of advertisers on the newsvendor's optimal decisions.

4 - Risk-averse Newsvendor Model under the CVaR Criterion with Unknown Parameter

Mengshi Lu, UC Berkeley, 4141 Etcheverry Hall MC 1777, University of California, Berkeley, CA, 94720-1777, United States of America, mengshi@berkeley.edu

We study the risk-averse newsvendor probelm under the conditional value-at-risk (CVaR) criterion. The demand is known up to the location and/or scale parameter. Based on historical demand data, we use the operational statistics approach to integrate parameter estimation and optimization.

5 - Sensitivity of Inventory Management Policies to the Level of Risk Aversion

Onur Bakir, Assistant Professor, TOBB Economy and Technology University, TOBB ETU, Endustri Muhendisligi Bolumu, Sögütözü Caddesi, No: 43, Kat:1, Ankara, 06560, Turkey, nbakir@etu.edu.tr

Recently, the question of how inventory policies behave as a function of risk aversion has been of academic interest. It has been shown for exponential utility functions that inventory policy is robust to changes in risk aversion. However, the average inventory level could be sensitive to the decision maker's level of risk aversion. We investigate this relationship in detail and extend our results to widely used utility functions other than exponential.

■ TC04

C - Room 202B

Surrogate and Derivative Free Optimization III

Sponsor: Computing Society/Optimization: Surrogate and Derivative-free Optimization(Joint Clusters)

Sponsored Session

Chair: Christine Shoemaker, Ripley Professor, Cornell University, Civil & Environmental Engr, Operations Res.and Information Engr., Ithaca, NY, 14850, United States of America, cas12@cornell.edu

1 - Multi-start Global Optimization with Surrogates

Tipaluck Krityakierne, PhD Student, Cornell University, Center for Applied Mathematics, Ithaca, NY, 14853, United States of America, tk338@cornell.edu, Christine Shoemaker

A Surrogate MultiStart (SO-MS) method is presented that can solve global optimization problems when used in conjunction with any convergent local optimization method. We develop the algorithm and conduct numerical experiments to evaluate the effectiveness of the proposed algorithm compared to the well-known Multilevel Single Linkage (MLSL) multistart method.

2 - Multi Objective Optimization of Computationally Expensive Problems through Radial Basis Functions

Taimoor Akhtar, PhD Student, Cornell University, Ithaca, NY, United States of America, ta223@cornell.edu, Christine Shoemaker

A strategy called "Gap-Optimized Multi-Objective Optimization using Response Surfaces" (GOMORS) is proposed, which uses Radial Basis Functions and multi-objective evolutionary optimization, iteratively, to select new expensive evaluation(s) points. Application to an 18-dimensional groundwater model, and comparison against ParEGO and NSGA-II, depicts relative efficiency of GOMORS within a limited evaluation budget.

3 - Derivative-free Optimization Enhanced Surrogate Models for Energy Systems Optimization

Alison Cozad, Graduate Strudent, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, acozad@andrew.cmu.edu, Nick Sahinidis

We propose a model generation method that uses derivative-based and derivative-free optimization alongside machine learning and statistical techniques to learn algebraic models of detailed simulations. Once a candidate set of models is defined, they are tested, exploited, and improved through the use of derivative-free solvers to adaptively sample new points. We combine the set of surrogate models with design specs to formulate a algebraic nonlinear problem for energy systems optimization.

4 - A Clusterwise Response Surface Methodology for Optimization

Rodrigo Scarpel, Instituto Tecnológico de Aeronàutica, Pça. Marechal Eduardo Gomes, 50, ITA - IEM, São José dos Campos, SP, 12228-900, Brazil, rodrigo@ita.br

Response surface methodology is useful for the modeling and analysis of problems in which a response of interest is influenced by several variables and the objective is to optimize this response. In this work a clusterwise regression model, that is a nonparametric procedure that performs cluster analysis within a regression framework, was employed in order to incorporate the parameter heterogeneity. An empirical application was performed in order to evaluate this approach.

■ TC05

C - Room 203A

Analysis of Misspecified Models in Revenue Management and Repeated Decision Problems

Cluster: Tutorials

Invited Session

Chair: William Cooper, University of Minnesota, Industrial and Systems Engineering, Minneapolis, MN, 55455, United States of America, billcoop@me.umn.edu

1 - Analysis of Misspecified Models in Revenue Management and Repeated Decision Problems

William Cooper, University of Minnesota, Industrial and Systems Engineering, Minneapolis, MN, 55455, United States of America, billcoop@me.umn.edu

A parametric optimization model is said to be misspecified if no setting of its parameter values yields a correct representation of the actual objective function of the decision maker. This talk describes recent research on the dynamics of application of misspecified models over a sequence of problem instances, where parameter estimates are dynamically updated as the instances unfold. Particular attention will be give to problems in revenue management and pricing.

■ TC06

C - Room 203B

Multiobjective and Quadratic Objectives in Scheduling

Contributed Session

Chair: Frédéric Dugardin, University of Technology of Troyes, 12, Rue Maris Curie, Troyes, 10000, France, frederic.dugardin@utt.fr

1 - Solving a Stochastic Single Machine Problem with Initial Idle Time and Quadratic Objective

Hossein Soroush, Professor, Kuwait University, Department of Stat. & Opns Res., POB 5969, Safat, 13060, Kuwait, h.soroush@ku.edu.kw

We study a single machine scheduling problem with random processing times in which a fixed idle time is allowed to be inserted before the processing of the first job begins. The objective is to determine the sequence and the idle time that jointly minimize the expected value of the sum of a quadratic cost function of idle time and a weighted sum of a quadratic function of job lateness. An exact algorithm is developed to solve this NP-hard problem.

2 - Optimal Consultant Routing and Assignment
Randy Hoff, Student, SMU, 2701 Stanford Ave, Dallas, TX, 75225, United States of America, rhoff@smu.edu, Andrew Yu

Consultant travel expenses are one of the largest budget items for many national consulting firms. This project minimizes the total cost of consultant travel and staffing while meeting client needs. The method employs a "cluster first, route second" methodology. First a set covering binary integer programming heuristic is presented to cluster clients. Then the relaxed problem is formulated as a mixed integer LP model using cluster locations and demand with consultant skills and availability.

3 - Multiobjective Fixed Produce Flexible Shop Scheduling with Transportation Considerations
Casey Trail, Pennsylvania State University, Harold & Inge Marcus Department of Industrial, & Manufacturing Engineering, University Park, PA, 16802, United States of America, cdt138@psu.edu, José A. Ventura

This work introduces a scheduling problem where heterogeneous processors must move between jobs to perform heterogeneous operations. Any processor is capable of performing any operation on any job. The time and cost required to perform operations is heterogeneous across processors and locations and travel time between jobs is nontrivial. The problem is to assign operations to workers and route them through the jobs in a way that minimizes conflicting objectives associated with cost and time.

4 - Lorenz Dominance and Multi-objective Reentrant Scheduling: A Comparative Study
Frédéric Dugardin, University of Technology of Troyes, 12, Rue Maris Curie, Troyes, 10000, France, frederic.dugardin@utt.fr, Farouk Yalaoui, Lionel Amodeo

This contribution deals with an overview on the different algorithms that use Lorenz dominance. The problem studied is the multi-objective scheduling of a reentrant hybrid flowshop. Each task becomes a due date, preemption is not allowed, and each stage is composed of multiple identical machines. The two objectives are the minimization of both makespan and total tardiness. The algorithms are tested on several instances of the literature and their performances are measured using usual criteria.

■ TC07

C - Room 204

Regulatory Compliance in the Automotive Industry

Cluster: Law, Law Enforcement and Public Policy

Invited Session

Chair: Erica Klampfl, Technical Leader, Ford Research & Advanced Engineering, Room 3255, RIC Building, Dearborn, MI, 48124, United States of America, eklampfl@ford.com

1 - Investment Strategies for Automotive and Electricity Sector Carbon Compliance
Katie Caruso, University of Michigan, 2190 G.G. Brown, 2350 Hayward Street, Ann Arbor, MI, 48104, United States of America, kacaruso@umich.edu, Steven Skerlos, Erica Klampfl, Mark Daskin, Yimin Liu, Michael Tamor

Emission reduction through vehicle electrification depends on sufficient market adoption and accessibility to low-emitting electricity sources. A mixed integer model is used to elucidate joint investments for least-cost achievement of 2050 IPCC goals in the automotive and electricity sectors. We will describe the solution approach and results of the study that bound total cost and determine when and to what extent these sectors should co-invest in CO2-reducing technologies to achieve compliance.

2 - Engine Calibration Process Optimization
Erica Klampfl, Technical Leader, Ford Research & Advanced Engineering, Room 3255, RIC Building, Dearborn, MI, 48124, United States of America, eklampfl@ford.com, Jenny Lee, David Dronzkowski, Kacie Theisen

This work explores how to reduce the engine calibration process while satisfying regulatory constraints around NOX, particulate matter, noise, and fuel consumption. Our proposed method models the problem as a Binary Integer Program that simultaneously selects the best grid spacing and optimized number of points to test, while guaranteeing that all specified constraints hold. We present an example that demonstrates how we can reduce the number of necessary test points by approximately 56%.

3 - Design Incentives to Increase Vehicle Size Created from the Reformed U.S. Fuel Economy Standards
Kate Whitefoot, University of Michigan, 2250 GG Brown Building, 2350 Hayward Street, Ann Arbor, MI, 48109, United States of America, katewhitefoot@gmail.com, Steven Skerlos

An oligopolistic equilibrium model of the automotive industry is presented where firms can respond to the size-based CAFE regulations by modifying vehicle dimensions, implementing fuel-saving technology features, and making tradeoffs between acceleration performance and fuel economy. Results suggest that firms have a substantial profit-incentive to respond to the CAFE standards by increasing vehicle size, undermining expected gains in fuel economy by 1-4 mpg.

■ TC08

C - Room 205

Hybrid Methods V: Scheduling

Sponsor: Computing Society/ Constraint Programming and Integrated Methods

Sponsored Session

Chair: Louis-Martin Rousseau, École Polytechnique de Montréal, C.P. 6079, Succ. Centre-ville, Montréal, Canada, louis-martin.rousseau@polymtl.ca

1 - Solving a Combined Routing and Scheduling Problem in Forestry
Laurent Michel, Associate Professor, University of Connecticut, 371 Fairfield Rd, Storrs, CT, 06269, United States of America, ldm@engr.uconn.edu, Louis-Martin Rousseau, Nizar El Hachemi, Jean-Francois Audy

We consider the weekly transportation problem in forestry which arises when transporting logs from forests to wood mills. The approach solves the problem in three phases to generate the routes for shifts and drivers, to select the routes that meet the mill demands and finally to schedule the routes and meet the loading/unloading resource constraints. The hybrid is implemented using COMET 2.0, a platform for hybrid optimization. The method is evaluated on one industrial case.

2 - A Logic-based Benders Approach to Scheduling with Alternative Resources and Setup Times
Tony Tran, University of Toronto, 5 King's College Rd, Toronto, ON, M5S3G8, Canada, tran@mie.utoronto.ca, Chris Beck

A logic-based Benders decomposition is proposed to minimize the makespan of an unrelated parallel machines scheduling problem with sequence and machine dependent setups. The decomposition uses a MIP master problem and a traveling salesman problem subproblem. Computational results comparing Benders and a MIP formulation show that the Benders model is able to find optimal solutions up to five orders of magnitude faster as well as solving problems four times the size possible previously.

3 - A Constraint Programming Approach for a Batch Processing Problem with Non-identical Job Sizes
Louis-Martin Rousseau, École Polytechnique de Montréal, C.P. 6079, succ. Centre-ville, Montréal, Canada, louis-martin.rousseau@polymtl.ca, Arnaud Malapert, Gueret Christelle

This paper presents a constraint programming approach for a batch-processing machine with the objective of minimizing the maximal lateness. The CP formulation uses a decomposition approach and is enhanced with a new optimization constraint that applies cost based domain filtering techniques. Comparisons to a mathematical formulation show that CP can optimally solve problems that are one order of magnitude greater than those solved by the mathematical formulation.

4 - Challenging and Extending Constraint-based Scheduling Techniques
Stefan Heinz, Zuse Institute Berlin, Takustr. 7, Berlin, 14195, Germany, heinz@zib.de, Chris Beck

Despite the success of constraint programming (CP) for scheduling applications, mixed integer programming (MIP) is arguably more widely used for such problems. In this talk, we focus on resource allocation and scheduling problems. We empirically demonstrate that the standard MIP model now out-performs the standard CP model. We show that constraint integer programming models out-perform both standard models and achieve performance competitive with the state-of-the-art decomposition approach.

■ TC09

Revenue Management

C - Room 206A

Topics in Revenue Management

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Wei Ke, Simon-Kucher & Partners, 435 Riverside Dr, Apt 24, New York, NY, 10025, United States of America, weike1@gmail.com

1 - Loan Pricing Optimization under Preference Reversal Effects

Wei Ke, Simon-Kucher & Partners, 435 Riverside Dr, Apt 24, New York, NY, 10025, United States of America, weike1@gmail.com, Ozge Sahin

When applying a discrete choice model to a loan origination data set, we found evidence that there existed two demand-price elasticity relationships on the same loan offer—one for the loan interest rate and one for the corresponding monthly payment. In the higher interest rate regime, customer demand appeared to be lower for a given interest rate than for the corresponding monthly payment; this was reversed in the lower interest rate regime. We quantify this phenomenon in this research.

2 - An EM Algorithm to Estimate a General Class of Choice Models

Gustavo Vulcano, Associate Professor, New York University, 44 West Fourth St, Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu, Garrett Van Ryzin

We propose an EM method to estimate unobservable and substitutable demand. We assume that the market is composed by a prefixed set of customer types characterized by preference lists, and jointly estimate the arrival rates and the proportion of different types. We also provide a market discovery mechanism that allows to enlarge the initial set of types in order to increase the likelihood of the observed transactions. Our numerical experiments confirm the potential of our estimation approach.

3 - Endogeneity and Price Sensitivity in Consumer Lending

Ahmet Serdar Simsek, PhD Student, Columbia University, 4L Uris Hall, Columbia Business School, New York, NY, 10027, United States of America, asimsek13@gsb.columbia.edu, Robert Phillips, Garrett Van Ryzin

Endogeneity occurs in loan pricing when a lender uses unrecorded borrower characteristics that are correlated with price-sensitivity in setting the price. Endogeneity can lead traditional regression approaches to under-estimate price elasticity. We use two sources of auto loan data: one from an on-line lender and one from an indirect lender to test for endogeneity. We present our results as well as recommendations for how to detect and control for endogeneity in the estimation process.

■ TC10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - IBM ILOG Optimization – IBM ILOG CPLEX Optimization Studio and Advanced Analytics

Ferenc Katai, Product Manager, IBM ILOG CPLEX Optimization Studio, 1 New Orchard Road, Armonk, NY, 10504, United States of America, ferenc.katai@fr.ibm.com

Come learn about the latest developments in IBM ILOG CPLEX Optimization Studio including how you can combine optimization with the predictive analytics of IBM SPSS, bringing you entirely new capabilities as an operations researcher. Recent and upcoming releases will be discussed, with an advance peek at new features and performance advances. A live demo illustrating the combination of SPSS and CPLEX will be presented. You will see the benefits of leveraging the IBM software portfolio, delivered by the undisputed leader in optimization and advanced analytics.

2 - AMPL Optimization - AMPL Models for "Not Linear" Optimization Using Linear Solvers

Robert Fourer, AMPL Optimization LLC, 900 Sierra Pl. SE, Albuerque, NM, 87108-3379, United States of America, 4er@ampl.com

Popular solvers for mixed-integer linear programming can also be applied effectively to various extensions and generalizations of linearity. We describe features of the AMPL modeling language that encourage modeling with "not linear" features including discrete domains, logical restrictions, and a range of formulations that are equivalent to conic quadratic programs.

■ TC11

C - Room 207A

Learning and Marketing in Social Networks

Sponsor: Applied Probability

Sponsored Session

Chair: Mohsen Bayati, Assistant Professor of Operations, Information and Technology, Stanford University, 655 Knight Way, Stanford, CA, 94305, United States of America, bayati@stanford.edu

1 - Optimal Pricing and Marketing over Social Networks

Vahab Mirrokni, Senior Research Scientist, Google Research, 111 8th Avenue, New York, NY, United States of America, mirrokni@google.com

We discuss the use of social networks in implementing viral marketing strategies. While influence maximization has been studied more, we study revenue maximization, arguably, a more natural objective. Here, a buyer's decision to buy an item is influenced by the set of other buyers that own the item and the price at which the item is offered. I will survey results from a sequence of four recent work on this topic. In particular, we will touch on methods with and without price discrimination.

2 - The Dynamics of Bargaining in Networks

Yashodhan Kanoria, Stanford University, 227 Ayrshire Farm Lane Apt 308, Stanford, CA, 94305, United States of America, ykanoria@stanford.edu, Christian Borgs, Jennifer Chayes, Mohsen Bayati, Andrea Montanari

Bargaining networks model the behavior of a set of players who need to reach pairwise agreements for mutual benefit, as in the labor market, the housing market and the 'market' for social relationships. A crucial but little understood aspect of bargaining is its dynamics. We present a natural model of the bargaining dynamics on general networks, and show rapid convergence to a 'Nash bargaining solution'. We also describe ongoing web experiments on bargaining.

3 - Prisoner's Dilemma on Graphs with Large Girth

Vahideh Manshadi, Stanford University, Stanford, CA, United States of America, vahidehh@stanford.edu, Amin Saberi

We study the evolution of cooperation in populations where individuals play prisoner's dilemma on a network. Every node corresponds on an individual choosing whether to cooperate or defect in a repeated game. The players revise their actions by imitating those neighbors who have higher payoffs. We show that when interactions take place on graphs with large girth, cooperation is more likely to emerge. On the flip side, in graphs with many cycles of length 3 and 4, defection spreads more rapidly.

■ TC12

C - Room 207BC

Joint Session ICS/ENRE: Stochastic Optimization in Energy Systems

Sponsor: Computing Society- Computational Stochastic Optimization/Energy, Natural Resources and the Environment

Sponsored Session

Chair: Warren Powell, Professor, Princeton University, 230 Sherrerd Hall, Princeton, NJ, 08544, United States of America, powell@princeton.edu

1 - An Hour-ahead Prediction Model for Heavy-tailed Spot Prices

Jae Ho Kim, Princeton University, Princeton, NJ, United States of America, jaek@princeton.edu, Warren Powell

We propose an hour-ahead prediction model for electricity prices that captures the heavy-tailed behavior that we observe in the hourly spot market in the Ercot (Texas) and the PJM West hub grids. We present a model according to which we separate the price process into a thin-tailed trailing-median process and a heavy-tailed residual process whose probability distribution can be approximated by a Cauchy distribution. We show empirical evidence that supports our model.

2 - Approximate Dynamic Programming for the Load Curtailment Problem

Hugo Simao, Senior O.R. Engineer, Princeton University, Sherrad Hall 112, Princeton, NJ, 08544, United States of America, hpsimao@Princeton.edu, Hyun Bin Jeong, Warren Powell, Boris Defourny

The widespread utilization of smart meters in electricity distribution will allow for a higher penetration of demand response policies, one of which is load curtailment. The increased number of curtailment options, coupled with uncertainty in load levels and feeder outages, poses an interesting stochastic optimization problem. We propose to use approximate dynamic programming to solve this problem. We will investigate its merits and limitations, through the discussion of computational results.

3 - Approximate Dynamic Programming for the Stochastic Unit Commitment Problem with Demand Response

Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Rd., Rm. C210, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu, Frank Schneider

Independent system operators are encouraged to use demand response where demand response loads are bid in the market. We present a dynamic program for solving a stochastic version of the model. A tailored approximate algorithm is explored.

■ TC13

C - Room 207D

Revenue Management in Service and Manufacturing

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Lila Rasekh, Sr. Operations Research Analyst, Walt Disney World, Orlando, FL, United States of America, lila.rasekh@disney.com

1 - A Revenue Management Approach to Merchandize Group Optimization

Lila Rasekh, Sr. Operations Research Analyst, Walt Disney World, Orlando, FL, United States of America, lila.rasekh@disney.com

Pricing and revenue optimization is becoming increasing popular subject in retail industry. Accurate forecasting and price optimizer leverages the competitive advantage in retail industry. It also provides a better tool for managers to act faster in a volatile market. Specifically, this paper presents a unique linear model that is used to maximize the total revenue of merchandises items, based on the forecasted demand and historical price points.

2 - Competitive Dynamic Pricing with Uncertain Production Cost

Soheil Sibdari, Associate Professor, Charlton College of Business, University of Massachusetts Dartmouth, 285 Old Westport Road, North Dartmouth, MA, 02747, United States of America, ssibdari@umassd.edu, David Pyke

This paper studies a two-firm dynamic pricing model with uncertain production costs. The firms produce the same perishable products over an infinite time horizon. In each period, each firm determines its price and production levels based on its current production cost and its opponent's previous price level. We use an alternating-move game to model this problem and show that there exists a unique subgame perfect Nash equilibrium in production and pricing decisions.

3 - Augmenting Revenue Maximization Policies for Facilities Where Customers Wait for Service

Yasar Levent Kocaga, Assistant Professor, Yeshiva University, 500 West 185th Street, New York, United States of America, kocaga@yu.edu, Phil Troy, Avi Giloni

We identify the optimal pricing policy for a multi-server queue under state dependent social optimization and state dependent revenue maximization when arrivals belong to several classes with different service valuations and waiting costs. We establish that the optimal revenue is bounded by the optimal social welfare and that some or most of the surplus revenue can be achieved if customers can be clustered into groups with similar benefits or waiting costs and prices are tailored to each group.

4 - Modeling a Hotel Room Assignment Problem

Yihua Li, Walt Disney World, Orlando, FL, 32830, United States of America, Yihua.li@disney.com

This paper studies hotel room assignment for reservations. We develop a heuristic method to maximize the number of bookings assigned to rooms. A feasible solution from the heuristic method is fed to an MIP formula for an expedited solution. Based on numerical tests, our proposed model and algorithm considerably outperform the traditional manual practice of room assignments. The empty nights between two adjacent assignments of the same room, called gaps, cause losses of service capacity. Our model reduces gaps when assigning rooms

■ TC14

C - Room 208A

Long-Term Power Systems Planning with New Features of Smart Grids

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Qipeng (Phil) Zheng, Assistant Professor, West Virginia University, P.O. Box 6070, Morgantown, WV, 26506, United States of America, qipeng.zheng@mail.wvu.edu

1 - Improving Power Stability and Sustainability via Smart-grid Operations and Utility Pricing

Siqian Shen, Assistant Professor, University of Michigan, Industrial & Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, siqian@umich.edu, Chin Hon Tan

Smart-grid technologies have opened up a variety of energy management options. We study problems of optimizing both household operations and suppliers' utility pricing strategies, to improve power sustainability and stability, in which consumers intelligently respond to real-time energy price by using smart appliances. We formulate the problems using DP and stochastic MIP.

2 - Including Short-run Demand Response in Long-run Generation Planning Models

Benjamin Hobbs, Professor, Johns Hopkins University, 313 Ames Hall, Baltimore, MD, 21218, United States of America, bhobbs@jhu.edu, Ronnie Belmans, Cedric DeJonghe

Three methods are proposed to integrate demand response into generation capacity models with operational constraints, including cross-price elasticities that account for load shifts among hours. Interactions of efficiency investments and demand response are also modeled. Numerical examples shows strong impacts upon the optimal amounts and mix of generation capacity. The flexibility of demand response also increases the optimal amount of wind capacity.

3 - Anti Islanding in Transmission Switching

Jianhui Wang, Argonne National Laboratory, 9700 South Cass Avenue, Argonne, IL, United States of America, jianhui.wang@anl.gov, James Ostrowski

Transmission switching provides a way to increase the efficiency in power systems operations by altering the topology of the transmission network. Altering the transmission topology can affect the reliability of the network. Incorporating reliability into the optimization problem increases the difficulty of an already complex optimization problem. We provide an algorithm to deal with the islanding problem caused by transmission switching without significantly increasing computation time.

4 - Transmission and Generation Capacity Expansion with Unit Commitment – A Multiscale Stochastic Model

Qipeng (Phil) Zheng, Assistant Professor, West Virginia University, P. O. Box 6070, Morgantown, WV, 26506, United States of America, qipeng.zheng@mail.wvu.edu, Andrew Liu

This talk presents an energy system expansion planning model. It includes upgrade and expansions on generation capacity, transmission, and energy storage, while incorporating lower-level stochastic unit commitment which considers the new features of smart grid, such as high renewable penetration, etc. This becomes a large-scale multistage stochastic mixed integer program with two levels of uncertainties. To solve this problem, we use the nested branch-and-price algorithm.

■ TC15

C - Room 208B

Decision Making in Interdependent Systems

Sponsor: Decision Analysis

Sponsored Session

Chair: Kash Barker, University of Oklahoma, School of Industrial Engineering, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, kashbarker@ou.edu

1 - Optimal Resource Allocation for Recovery of Interdependent Systems

Cameron MacKenzie, PhD Candidate, University of Oklahoma, School of Industrial Engineering, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, cmackenzie@ou.edu, Kash Barker

The recent oil spill in the Gulf negatively impacted several industries in the region such as tourism and fishing. A risk-based input-output model can demonstrate how those direct impacts propagate to other economic sectors. We

develop a decision model to determine the optimal resource allocation to assist impacted sectors recover, maximizing the region's production. Necessary and sufficient conditions are derived for both static and dynamic decision problems.

2 - Robust Decision-making for Dynamic Disruptions to Interdependent Economic Systems

Raghav Pant, PhD Candidate, University of Oklahoma, School of Industrial Engineering, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, rpant@ou.edu, Thomas Landers, Kash Barker

A significant problem encountered when making risk-based decisions in interdependent economic systems prior to a disruptive event involves data uncertainty and unpredictability of particular disruptive events. We integrate robust optimization with a dynamic interdependency model to bound uncertainties, providing corresponding bounds to optimized economic losses. Our approach is helpful in accounting for extreme the possible worst-case consequences, thereby strengthening decision-making.

3 - Inventory-based Prioritization Methodology for Assessing Inoperability and Economic Loss

Joost Santos, Assistant Professor, Engineering Management and Systems Engineering, The George Washington University, 1776 G Street NW, Suite 101, Washington, DC, United States of America, joost@gwu.edu, Joanna Resurreccion

This paper studies the impact of inventory on the recovery of interdependent sectors. Input-output models help identify critical sectors based on inoperability and economic loss. A dynamic prioritization tool allows preference structure elicitation. A Virginia case study reveals a high concentration of: (i) manufacturing sectors under the inoperability objective, and (ii) service sectors under the loss objective. The approach is flexible and can be applied to other regions and scenarios.

4 - Measuring Resilience in Interdependent Systems

Christopher Zobel, Associate Professor, Pamplin College of Business, Virginia Tech, 2072 Pamplin Hall, Blacksburg, VA, United States of America, czobel@vt.edu

The concept of disaster resilience can be characterized as a function of both the initial loss due to a disaster event and the subsequent time to recovery. In the context of an interdependent system of infrastructure assets, the resilience of different subsystems may have varying impacts on the performance of the system as a whole. This paper examines the multi-dimensional nature of these impacts as a step towards characterizing system resilience in a new and potentially useful way.

■ TC16

C - Room 209A

Economics, Supply Chain and Logistics Analysis of Biofuels III

Sponsor: Energy, Natural Resources and the Environment/ Environment and Sustainability

Sponsored Session

Chair: Guiping Hu, Iowa State University, IMSE Department, Ames, IA, 50011, United States of America, gphu@iastate.edu

1 - Locating Corn Stover Biorefineries to Minimize Feedstock Transportation

Mark Wright, Massachusetts Institute of Technology, Department of Chemical Engineering, Cambridge, MA, United States of America, markmw@mit.edu, W. Ross Morrow, Robert Brown

We present a model that minimizes biofuel production costs by determining the locations of thermochemical biorefineries. The model optimizes the location of mature fast pyrolysis and hydroprocessing biorefineries in the U.S. Midwest and the distribution of biofuels to 217 metropolitan areas. This reduces transportation costs by $1.15 billion per year compared to randomly located biorefineries. This comparison suggests an approach to significantly reduce the retail price of biofuels.

2 - Short-term Energy Portfolio Management with Abandonment Option

Zhen Liu, Engineering Management & System Engineering, University of Missouri-Rolla, Rolla, MO, 65409, United States of America, zliu@mst.edu

We study the optimal time to abandon a CO2-intensive plant of a firm with a portfolio of plants to maximize the expected profit. We formulate the problem as a mixed optimal stopping/control problem, and characterize the optimal strategies through finite difference method.

3 - Supply Chain Optimization for Hybrid Coal, Biomass and Natural Gas to Liquid (CBGTL) Facilities

Josephine A Elia, Princeton University, Dep. of Chemical and Biological Eng, Engineering Quadrangle, Princeton, NJ, United States of America, josephine@titan.princeton.edu, Richard C. Baliban, Christodoulos A Floudas

A novel mixed-integer linear optimization model is formulated to determine an optimal energy supply chain network to fulfill the United States transportation fuel demands using hybrid coal, biomass, and natural gas to liquid (CBGTL) facilities. The model identifies the optimal locations of the CBGTL facilities and the optimal distributions of feedstock and product under different scenarios, with a key focus of minimizing the overall fuel production costs for the entire network.

■ TC17

C - Room 209B

Project Selection and Assessment

Sponsor: Decision Analysis

Sponsored Session

Chair: Ilia Tsetlin, Associate Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, Singapore, ilia.tsetlin@insead.edu

1 - Creating Strategic Portfolios Instead of Optimizing Project Selection

Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, c.loch@jbs.cam.ac.uk, Stelios Kavadias

Portfolio selection frameworks have considered financial value maximization in combination with a balance across generic strategic dimensions (e.g. market risk vs. technology risk). This is too generic for portfolio with diverse objectives, such as new technologies versus new products. We propose a selection process that focuses on strategic alignment. Partition the total set of projects upfront into buckets with differing strategic goals, and then evaluate different tradeoffs in each bucket.

2 - Sequential Exploration of a Large Oil Field

Jim Smith, Professor, Duke University, Fuqua School of Business, Durham, NC, 27708-0120, United States of America, jes9@duke.edu, Jo Eidsvik, Gabriele Martinelli, David Brown

We consider the problem of sequentially exploring a large oil field. Dependence among prospects is described by a Bayesian network; probabilities are updated as results are observed. The problem is too large to solve exactly as a dynamic program. We develop tractable heuristics by decomposing the field into clusters of prospects and show how to compute upper bounds on the expected reward for an optimal strategy using information relaxations. In our examples, these heuristics are nearly optimal.

3 - Outlining the Project Development and Assessment in the MNC's Executive Board

Otso Massala, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, Otso.MASSALA@insead.edu, Ilia Tsetlin

Developing and selecting projects is an important part of managing a business. We identify project assessment criteria for a multinational company specializing on paint-related solutions, and we describe the assessment procedure that would be aligned with the company's strategic objectives and current situation. We discuss the benefits of this approach for project development and implementation, as well as highlight related theoretical and practical challenges.

4 - Simultaneous Signaling

James Dearden, Professor of Economics, Lehigh University, Department of Economics, Bethlehem, PA, 18015, United States of America, jad8@Lehigh.edu, Tolga Seyhan

In university and job application processes, an applicant to a particular institution may be able to increase the probability of receiving an offer by demonstrating his or her interest. In a simultaneous-decision model, we demonstrate that a greedy algorithm implements the optimal decision rule. Our work generalizes Chade and Smith (2006). Following our characterization of the optimal mechanism, we perform a comparative statics exercise.

■ TC18

C - Room 210A

Scheduling in the Supply Chain

Cluster: Scheduling and Project Management

Invited Session

Chair: Marc Posner, Professor, Ohio State University, Integrated Systems Eng., 1971 Neil Avenue, Columbus, OH, 43210, United States of America, posner.1@osu.edu

1 - Subcontracting in the Presence of Transactional and Contractual Customers

Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Eugene, 97403, United States of America, tolga@uoregon.edu, Zhibin Yang

We consider a subcontracting setting whereby a third-party, which has committed some portion of its available capacity to long-term (contractual) customers, seeks one-time transactions with short-term (transactional) customers to contract its remaining availability. Assuming the third-party prioritizes contractual customer's workload, we study various coordination and information asymmetry issues that arise and provide contract forms that coordinate all pricing and subcontracting decisions.

2 - Revised Delivery-time Quotation in Scheduling with Tardiness Penalties

Rui Zhang, McMaster University, Hamilton, L8S 4M4, Canada, zhangr6@mcmaster.ca, George Steiner

We present a model for the rescheduling of orders with simultaneous assignment of attainable due dates to minimize due date escalation and tardiness penalties. We prove that the problem is NP-hard and present a pseudo-polynomial algorithm for it. We also present a fully polynomial time approximation scheme for the problem.

3 - Scheduling with Outsourcing Options

Weiya Zhong, Shanghai University, Department of Mathematics, Shanghai, 200444, China, wyzhong@shu.edu.cn

We consider a scheduling problem where jobs can be processed in house on a single machine or subcontracted. If a job is subcontracted, its delivery lead time is a piecewise function of the total processing time of out-house jobs. The objective is to minimize the weighted sum of the maximal completion time and the total processing cost. We prove that the problem is NP-hard and propose a pseudo-polynomial time algorithm.

■ TC19

C - Room 210B

Analytics & Optimization in the Finance Industry

Sponsor: Financial Services Section

Sponsored Session

Chair: Jim Bander, Toyota Financial Services, jim.bander@gmail.com

1 - Properties of Linear Feedback Trading Strategies in GBM Markets

James Primbs, Assistant Professor, Stanford University, Huang Engr. Ctr. 358, 475 Via Ortega, Stanford, CA, 94305, United States of America, japrimbs@stanford.edu, B. Ross Barmish

The power of linear feedback is demonstrated in the context of the so-called Simultaneous Long-Short (SLS) strategy developed in our recent work. In an idealized GBM market, the main result is that the SLS feedback controller guarantees a non-negative expected value for the trading gain which, under specified conditions, is positive with exceedingly high probability. Finally, the use of the SLS controller is illustrated via detailed numerical examples.

2 - Monte Carlo Methods on American Option Sensitivities Estimation

Yanchu Liu, Chinese University of Hong Kong, 619, William Mong Engineering Building, Hong Kong, Hong Kong - PRC, ycliu@se.cuhk.edu.hk

In this paper we develop efficient Monte Carlo methods for estimating American option sensitivities. Applying the conventional pathwise derivative and likelihood ratio techniques, we manage to obtain unbiased simulation estimators to first- and second-order sensitivities. One important feature of the American option, the continuous-fit condition of the optimal exercising boundary, turns out to be essential in derivation. The proposed estimators can be easily embedded.

3 - The Polygamous Marriage Problem: Lending Strategies When There are Limits on Capital Available

Lyn Thomas, University of Southampton, Southampton, United Kingdom, L.Thomas@soton.ac.uk, Bob Huang

Some banks put limits on how much a branch may lend in a given period or how much capital the branch can use under the Basel Accord. Thus when a prospective borrower applies for a loan the lender has to decide whether to give that loan or whether less risky and so more profitable borrowers will appear subsequently.We investigate the form of the optimal strategy and relate it to other problems in the OR literature.

4 - Margining Option Portfolios by Network Flows

Dmytro Matsypura, Lecturer, The University of Sydney, Business School, Sydney, Australia, dmytro.matsypura@sydney.edu.au, Vadim G. Timkovsky

As shown in Rudd and Schroeder (M.Sci., 1982), the problem of margining option portfolios where option spreads with 2 legs are used for offsetting can be solved in polynomial time. However, spreads with only 2 legs do not provide an accurate measure of risk. Hence, margining practice also employs spreads with 3 and 4 legs. A polynomial time solution to the extended problem with up to 4 legs is not known. We propose a network flow algorithm for this extension and present a computational study.

5- Collections Optimization

Breanne Cameron, Cambio Technologies, breanne.cameron@cambiotechnologies.com

In financial services, optimization has been primarily associated with the pricing of credit products, where such solutions produce output such as rate sheets. A growing area, however, is in the servicing and collection side of financial services where optimization can be used to improve collections performance, mitigate losses, and even provide workout alternatives for distressed borrowers that provide alternatives that benefit both the borrower and the lender. An extension of this application also enables investors to accurately price debt for acquisition. This session will explore how this is being done today and why its adoption will grow in the future.

■ TC20

C - Room 211A

Recent Advances in Deterministic Global Optimization

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Aida Khajavirad, Carnegie Mellon University, Mechanical Engineering, Pittsburgh, United States of America, aida@cmu.edu

1 - An Iterative Scheme for Valid Polynomial Inequality Generation in Binary Polynomial Programming

Miguel Anjos, Ecole Polytechnique de Montreal, Mathematics & Industrial Engineering, Montreal, QC, Canada, :miguel-f.anjos@polymtl.ca, Bissan Ghaddar, Juan Vera

We propose an iterative scheme that improves the semidefinite relaxations without incurring exponential growth in their size by generating valid polynomial inequalities. For binary polynomial programs, we prove under mild conditions that the proposed scheme converges to the global optimal solution. We also present computational comparisons to other methods in the literature.

2 - Cutting Planes for Linear Complementarity Constraints

Trang Nguyen, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, trang@ufl.edu, Mohit Tawarmalani, Jean-Philippe Richard

We discuss the problem of generating strong cutting planes, in the space of the original variables, for linear programs with complementarity constraints. In particular, we exploit complementarity constraints to derive cuts from the optimal simplex tableaux of the LP relaxation of the problem. We discuss the geometry of these sets and compare the strength of the cuts thus obtained vis-a-vis RLT, disjunctive, and other approaches in the literature.

3 - Multi-variate, Multi-term, and Multi-constraint Relaxations for Global Optimization with BARON

Nick Sahinidis, Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, Pittsburgh, PA, United States of America, sahinidis@cmu.edu, Mohit Tawarmalani, Xiaowei Bao, Aida Khajavirad, Keith Zorn

This talk focuses on the third generation of branch-and-reduce algorithms that recently started to emerge. Based on multi-variate, multi-term, and multi-constraint relaxation techniques, these algorithms sharpen lower bounds and enhance performance. The talk will describe convex/concave envelopes for such functions, and present extensive computational results with the implementation of these envelopes in BARON.

4 - Exploiting Convexity in Global Optimization
Aida Khajavirad, Carnegie Mellon University, Mechanical Engineering, Pittsburgh, United States of America, aida@cmu.edu, Nick Sahinidis

Many nonconvex optimization problems become convex once the domain of a small subset of their variables has been restricted. This situation arises frequently in the context of partitioning-based global optimization algorithms. We equip BARON with an advanced convexity detection tool that checks for convexity in every node of the search tree and utilizes local solvers and specialized algorithms when convexity conditions are met. Extensive computational results will be presented.

■ TC21

C - Room 211B

Advances in Stochastic Programming

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Guzin Bayraksan, University of Arizona, Systems and Industrial Engineering, Tucson, United States of America, guzinb@sie.arizona.edu

1 - Optimal Stochastic Approximation Algorithms for Strongly Convex Stochastic Composite Optimization
Saeed Ghadimi, University of Florida, Industrial & Systems Engineering, Gainesville, United States of America, sghadimi@ufl.edu, Guanghui Lan

In this talk we present new stochastic approximation (SA) type algorithms, namely, accelerated SA (AC-SA), for solving strongly convex stochastic composite optimization (SCO) problems. These AC-SA algorithms possess optimal or nearly optimal expected rates of convergence for solving a wide class of SCO problems during a given number of iterations. We demonstrate the significant advantages of these algorithms applied to online learning.

2 - Heuristic Approaches for Chance Constrained Problems with Deterministic Constraint Matrices
Daniel Reich, OR Analyst, Ford Motor Company, Research and Innovation Center, 2101 Village Road MD 2122, Dearborn, MI, 48121, United States of America, dreich8@ford.com

We present two heuristic algorithms for chance constrained programming problems with random right-hand side vectors, where the randomness has a finite distribution. Our algorithms iteratively construct and solve sequences of linear programs. We demonstrate through a computational study the effectiveness and scalability of our heuristics, compared with the best known mixed-integer programming solution methods. We also present conditions under which our heuristics fail to provide useful solutions.

3 - A Probability Metrics Approach to Bias Reduction: Application to MRP
Rebecca Stockbridge, University of Arizona, Program in Applied Mathematics, Tucson, United States of America, rstockbridge@math.arizona.edu, Guzin Bayraksan

Previously, we developed a bias reduction technique based on probability metrics, which can be done in polynomial time in sample size. In this talk, we present an extension of this methodology for the Multiple Replication Procedure (MRP) estimators. We point out the differences in the methodology and analysis in the MRP case. We present analytic results for the newsvendor problem, and discuss further theoretical and computational results.

4 - Robust and Stochastically Weighted Multi-objective Optimization Models and Reformulations
Jian Hu, PhD Candidate, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, jianhu@northwestern.edu, Sanjay Mehrotra

We study trade-off weight robustness in modeling risk-averse multi-expert multi-objective/criteria decision making. New concepts of robust and stochastic Pareto optimality describe improving the worst case weighted sum of objectives over a given deterministic and ambiguity weight region respectively. The usefulness of these models is demonstrated using disaster planning and agriculture revenue management examples.

■ TC22

C - Room 212A

Convex Optimization in Statistics and Machine Learning

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Guanghui Lan, Assistant Professor, University of Florida, Industrial & Systems Engineering, Gainesville, FL, United States of America, glan@ise.ufl.edu

1 - On the Accuracy of ℓ_1-filtering of Signals with Block-Sparse Structure
Fatma Kilinc Karzan, Assistant Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, fkilinc@andrew.cmu.edu, Arkadi Nemirovski, Anatoli Juditsky, Boris Polyak

We examine a sparse estimation problem which generalizes image reconstruction with Total Variation regularization. We consider estimating a signal that achieves good approximation in block sparse sense with respect to a known linear transform from its undersampled observations corrupted with nuisance and stochastic noise. We introduce a family of conditions and suggest new methods of recovery based on block-ℓ_1 minimization which have efficiently verifiable guaranties of performance.

2 - A Sparsity Enforcing Stochastic First Order Method for Composite Optimization
Qihang Lin, PhD Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, qihangl@andrew.cmu.edu, Javier Peña, Xi Chen

We propose new stochastic first-order algorithms for solving convex composite optimization problems. Our algorithms are developed using a stochastic estimate sequence. We establish convergence results for the expectation and variance as well as large deviation properties of the objective value of the iterates generated by our algorithm. When applied to sparse regression problems, our algorithms have the advantage of readily enforcing sparsity structures in the solutions in all iterations.

3 - Polynomial-time First-order Algorithms for Total Variation Minimization
Cong Dang, Ph.D. Student, Unfiversity of Florida, Industrial & Systems Engineering, Gainesville, United States of America, congbk1902@gmail.com, Guanghui Lan

Total variation minimization (TVM) is an important convex programming model for image processing. However the solution of this problem is highly challenging due to its high dimensionality and nonsmoothness. We present first-order methods for TVM whose iteration complexity polynomially depends on n and $\log (1/\epsilon)$, where n is the number of pixels and ϵ denotes the target accuracy. We also discuss a few possible extensions of these approaches.

■ TC23

C - Room 212B

Sky Team: Some Studies in Air Traffic Management

Sponsor: Aviation Applications

Sponsored Session

Chair: Arnold Barnett, Professor, Massachusetts Institute of Technology, Sloan School, 30 Wadsworth Street, Cambridge, MA, 02139, United States of America, abarnett@mit.edu

1 - Aircraft Fuel Consumption and NAS Operational Performance
Mark Hansen, University of California Berkeley, 114 McLaughlin Hall, Berkeley, CA, 94720, United States of America, mhansen@ce.berkeley.edu

We seek to quantify the fuel consumption impact of three operational performance measures: schedule padding, airborne delay, and departure delay. We do so by developing an econometric model of airline fuel consumption that isolates the contribution of operational performance. We use actually fuel consumption reported by a major US-based airline.

2 - Integrating Best-equipped Best-served Principles in Ground Delay Programs

Michael Ball, University of Maryland, RH Smith School of Business, College Park, MD, United States of America, mball@rhsmith.umd.edu, Andrew Churchill, Alexander David Donaldson, John Hansman

In this paper, the principle of Best Equipped, Best Served is examined as to its potential role in incentivizing airlines to adopt capacity-enhancing technologies on their aircraft. Three alternate allocation methods for ground delay programs are analyzed relative to their impact on enhancing capacity and giving effective incentives to airlines.

3 - Characteristics of Delay Propagation in a Network of Airports

Amedeo Odoni, Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, arodoni@mit.edu, Nikolaos Pyrgiotis

Delay propagation within networks of intensively utilized airports is a complex phenomenon. We illustrate this complexity through examples involving US and European networks, using our recently-developed Airport Network Delays (AND) model. The examples highlight the impact of the configuration of airline networks on delay propagation.

4 - Man-in-the-loop vs Fast-time Airport Models: Lessons Learned from an LAX Study

Toni Trani, Virginia Polytechnic Institute, School of Engineering, Blacksburg, VA, United States of America, vuela@vt.edu, Arnold Barnett, Michael Ball, Amedeo Odoni, George Donohue

Man-in-the-loop simulations of complex airport operations are compared with fast-time simulations. A case study of modeling Los Angeles International Airport using a complex NASA Tower simulator is presented and compared with fast-time simulation models using discrete-event modeling techniques. A progression in the level of modeling complexity to study airport operations is suggested in this presentation.

■ TC24

C - Room 213A

Advances in Mixed Integer Programming – II

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Santanu S. Dey, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30318, United States of America, santanu.dey@isye.gatech.edu

1 - Decomposition Methods for Computing with Multi-term Disjunctions

Yunwei Qi, PhD Candidate, Department of Integerated Systems Enigeering, The Ohio State University, 210 Baker Systems Bldg., 1971 Neil Avenue, Columbus, OH, 43220, United States of America, qi.47@buckeyemail.osu.edu, Simge Kucukyavuz, Suvrajeet Sen

We compare alternative decomposition strategies for solving cut generation LPs that arise in the context of multi-term disjunctions arising within a cutting plane tree algorithm. Computational results will be presented for standard MIP test problems.

2 - On the Relationship between Lattice Free Cuts and T-branch Split Cuts

Sanjeeb Dash, Research Staff Member, IBM T. J. Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, sanjeebd@us.ibm.com, Neil Dobbs, Oktay Gunluk, Tomasz Nowicki, Grzegorz Swirszcz

We show how to express cuts based on lattice-free sets in R^n as t-branch split cuts (introduced by Li and Richard, 2008) for some integer t > 0. We prove an exponential lower bound on t, by constructing lattice-free sets in R^n which cannot be covered by a sub-exponential number of split sets. We use these results to construct a pure cutting plane algorithm for mixed-integer programs based on t-branch split cuts. Finally, we settle a conjecture of Li and Richards on t-branch split cuts.

3 - Large Scale LP Solving

Matthias Miltenberger, PhD Student, Zuse Institute Berlin, Takustr. 7, Berlin, 14195, Germany, miltenberger@zib.de

Problem sizes are continuously growing and with it the need to handle them appropriately. In the context of linear programming (LP), the use of sophisticated storage structures for sparse data and a fast and stable implementation of the LU-factorization are most crucial in this respect. We discuss these features and present algorithmic concepts for a new LP solver that will be specifically designed to address these issues.

4 - Parallel Replacement Problem with Multiple Asset Types under Economies of Scale

Esra Buyuktahtakin, Assistant Professor, IME Department, Wichita State University, Wichita, KS, United States of America, esra.b@wichita.edu, J. Cole Smith, Joseph Hartman

The parallel replacement problem under economies of scale (PRES) determines minimum cost replacement schedules for a group of assets that operate in parallel and are economically interdependent. We derive cutting plane approaches for an integer programming formulation of PRES with multiple asset types (MPRES), which are motivated by the no-splitting rule in the literature. Experiments illustrate that the inequalities are quite effective for solving MPRES.

■ TC25

C - Room 213BC

Emerging Issues in Supply and Capacity Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Hyun-Soo Ahn, Associate Professor, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, hsahn@umich.edu

1 - Pharmaceutical Production Capacity Investment Decisions and Dynamic Estimation of Trial Success

Ming Yuen, University of California, Berkeley, IEOR Department, Berkeley, CA, 94720, United States of America, mingkyuen@gmail.com, Philip Kaminsky

We consider a pharmaceutical firm that reviews ongoing clinical trials periodically in order to make investment decisions to prepare for commercializing the new drug. In general, it is difficult to assess the probability of passing the required clinical trials for the new drug application. We use a Dirichlet process to model the updating of the posterior distribution of the drug's performance based on the reviews, and optimize investment decisions over time as this distribution is updated.

2 - Stability and Endogenous Formation of Inventory Transshipment Networks

Xin Fang, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, xfang@andrew.cmu.edu, Soo-Haeng Cho

This paper studies a game of inventory transshipment based on networks of multiple firms. The firms first make their inventory decisions independently under uncertain demands, and then decide collectively how to transship excess inventories to satisfy unmet demands. Using the theory of economic and social networks, we examine the stability of various network structures, and then establish equilibrium network structures when the firms form networks endogenously.

3 - Investing in a Shared Supplier in a Competitive Market

Anyan Qi, Stephen M. Ross School of Business, University of Michigan, 701 Tappan St. PhD Office, Ann Arbor, MI, 48109, United States of America, anyqi@umich.edu, Hyun-Soo Ahn, Amitabh Sinha

Some OEMs invest in their supplier even when the supplier serves the firm's competitors. To prevent unwanted spillover, OEMs restrict the use of invested capacity. We evaluate such arrangements and characterize the equilibrium investment outcomes and subsequent competition between OEMs. Among other results, we find that the strongest form of capacity reservation in which both buying firms reserve supplier's capacity portion exclusively is the one that is most likely to elicit adverse outcomes.

4 - The Multi-Item Transshipment Problem with Fixed Transshipment Costs

Michal Tzur, Tel Aviv University, Industrial Engineering Department, Tel Aviv University, Tel Aviv, 69978, Israel, tzur@eng.tau.ac.il, Reut Bonshtain

We consider inventory systems with two-retailers and multi items in which lateral transshipments are allowed and fixed transshipment costs exist. We find optimality conditions for both the transshipment and replenishment policies that maximize the total centralized expected profit of both retailers. For more than two items we develop a simple heuristic which is easier to solve and is shown to perform well. We show that the profit per item increases with the number of items considered.

■ TC26

C - Room 213D

Empirical Research in Operations

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, karan@girotra.com

1 - Are Consumers Strategic? Structural Estimation from the Air-Travel Industry

Jun Li, The Wharton School, University of Pennsylvania, 3730 Walnut Street, 500, Philadelphia, PA, 19104, United States of America, lijun1@wharton.upenn.edu, Serguei Netessine, Nelson Granados

Merging two unique datasets from the air-travel industry, we examine the question whether consumers are strategic and to what degree. We show persistent evidence of strategic consumers across various markets using structural estimation. We further investigate the revenue implications using counter-factual analysis.

2 - The Impact of Customer Heterogeneity on Service Outcomes

Ryan Buell, Doctoral Candidate, Harvard Business School, Soldiers Field Road, Morgan Hall T37, Boston, MA, 02163, United States of America, rbuell@hbs.edu, Dennis Campbell, Frances Frei

We decompose the variance of 58,294 face-to-face retail banking transactions, quantifying the relative importance of customer, employee, process, location and market-level effects on satisfaction outcomes. We find that customer-level differences account for most of the explained aggregate variance, demonstrate that customer compatibility with the operating model is a primary determinant of service outcomes, and show that firms facing greater heterogeneity have less satisfied customers.

3 - Service Competition and Product Quality in the U.S. Automobile Industry

Jose A. Guajardo, Doctoral Candidate, University of Pennsylvania, The Wharton School, 3730 Walnut Street, Philadelphia, PA, 19104, United States of America, josegu@wharton.upenn.edu, Morris A. Cohen, Serguei Netessine

Empirical evidence about the effectiveness of firm services strategies in manufacturing industries is scarce. We formulate and estimate an empirical model to study the joint influence of service attributes and product quality on consumer demand in the U.S. automobile industry, and show that the joint consideration of product and service is essential for the development of an effective competitive strategy. Our model accounts for the endogeneity of firm strategies and for customer heterogeneity.

4 - Deriving Supply Chain Metrics from Financial Data

Robert Bray, Stanford GSB, 29137 Covecrest Dr, Rancho Palos Verdes, CA, 90275, United States of America, robertlbray@gmail.com, Haim Mendelson

We develop an empirical framework to derive supply chain metrics from the Compustat dataset. The method provides a new means to study an array of supply chain phenomena. To illustrate its applicability, we replicate with the Compustat three studies that previously required specialized datasets. Our estimators correspond to a supply-chain model that we develop; the model explains our data remarkably. In short, we translate standard supply-chain theories into workhorse supply-chain estimators.

■ TC27

C - Room 214

Service Quality Related Models

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Yong-Pin Zhou, Foster School of Business, University of Washington, Seattle, WA, 98195-3226, United States of America

1 - Optimal Price-Lead Time Menus for Queues with Customer Choice: Priorities, Pooling & Strategic Delay

Philipp Afeche, University of Toronto, 105 St. George Street, Toronto, ON, M5S3E6, Canada, Philipp.Afeche@Rotman.Utoronto.Ca, Michael Pavlin

We study the design of revenue-maximizing price-lead time menus for serving heterogeneous time-sensitive customers with private information on their preferences. The optimal lead times may differ in two features from those under the best work conserving strict priority policy. 1) Pooling of different customer types into a common service class. 2) Strategic delay to artificially inflate certain lead times. We specify the capacity and demand attributes for which these features are optimal.

2 - Pricing and Diagnosis in Credence Services

Senthil Veeraraghavan, The Wharton School, 3730 Walnut Street, Suite 500, Jon M Huntsman Hall, Philadelphia, PA, 19104, United States of America, senthilv@wharton.upenn.edu, Mehmet F. Pac

Customers often cannot identify the type of service they need, therefore they rely on experts, who also sell the service, for the diagnosis of their problem. The information asymmetry arising upon diagnosis leads to inefficiencies in the provision of the service. The expert has an incentive to over-provide or to ration services, based on the demand, capacity and the waiting cost. We investigate diagnosis, pricing and queue joining decisions in expert service markets using a queuing framework.

3 - Speed-quality Tradeoffs in a Dynamic Model

Vasiliki Kostami, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, vkostami@london.edu, Raj Rajagopalan

An important trade-off faced by many organizations is between speed and quality of service. Working faster may result in greater throughput and less delay but may result in lower quality and dissatisfied customers. In this work, we consider a dynamic model wherein future demand potential is impacted by current speed. We also consider price as a lever in influencing demand. We provide structural results on the optimal behavior of price and speed over time.

4 - Competing in Service Speed and Quality for Repeated Customers

Azin Farzan, Doctoral Student, University of Washington, Box 353226, Foster School of Business, Seattle, WA, 98195-3226, United States of America, afarzan@uw.edu, Yong-Pin Zhou

We analyze a system in which customers purchase services repeatedly from competing firms. Service quality adds to the value of the service while waiting time detracts from it. At each service encounter, customers choose the firm with maximum perceived value. Therefore, firms must determine both its investment in capacity and quality jointly. Moreover, speed and quality may be inherently related and customers may be heterogeneous. We analyze the possible equilibria for each case.

■ TC28

C - Room 215

Management of the Value Chain

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Jennifer Shang, Professor, University of Pittsburgh, 230 Mervis Hall, University of Pittsburgh, Pittsburgh, PA, 15260, United States of America, shang@katz.pitt.edu

1 - Manage Valuable Web Site Visitors Based on Browsing Behaviors

Wei Chang, Univeristy of Pittsburgh, 216 Mervis Hall, Pittsburgh, PA, 15260, United States of America, wchang@katz.pitt.edu, Jennifer Shang

We build a hierarchical probit choice model with latent variables to predict visitors' intention to click on an advertisement at a video streaming web site based on their browsing behaviors. We assess the likelihood of viewers' revisit. Through estimating their lifetime ad clicks, we prioritize site vistors and estimate their values.

2 - Disasters Impacts and Risk Management in a Global Supply Chain Network

Wei Chen, University of Pittsburgh, 233 Mevis Hall, University of Pittsburgh, Pittsburgh, PA, 15260, United States of America, wchen@katz.pitt.edu

Disasters are hard to predict, however their impacts can be devastating and greatly affect the financial performance of the entire supply chain. We propose an integrated model for global supply chain network design, which employs real options method to hedge unexpected hazards along with the risk of exchange rate fluctuation.

3 - Demand and Drug Supply Uncertainty in Cancer Patient Treatment: A Supply Chain Perspective

Shanling Li, Professor, McGill University, Montreal, QC, Canada, shanling.li@mcgill.ca, Lijian Chen

In this research, we consider a supply chain problem in hospitals. The demand for cancer drugs and supply to certain cancer drugs are usually unpredictable. Yet, the treatment to cancer patients can't be delayed. We formulate the problem as a chance-constrained model to meet hospital prescribed service levels by determining the order quantity for particular cancer drugs. Results will generate managerial insights.

4 - Analyzing Risk Exposure of Banking Operations
Nabita Penmetsa, Doctoral Student, Katz Graduate School of Business, 233, Mervis Hall, University of Pittsburgh, Pittsburgh, PA, 15260, United States of America, NPenmetsa@katz.pitt.edu, Jennifer Shang

We analyze the risk exposure of banking operations using Monte Carlo Simulation of a Generalized Semi-Markov Process Model. Simulation helps estimate the losses caused by a disruption for a particular operation mode. The analysis enables us to compare different operation models based on their effectiveness in recovering from a risky event.

■ TC29

C - Room 216A

Dynamic Risk Measures

Cluster: Quantitative Finance

Invited Session

Chair: David Brown, Duke University, Fuqua School of Business, 100 Fuqua Drive, Durham, NC, 27708, United States of America, dbbrown@duke.edu

Co-Chair: Dan Iancu, Assistant Professor, Stanford University, Stanford, CA, United States of America, Iancu_Dan@GSB.Stanford.Edu

1 - Portfolio Execution with Correlated Supply/Demand Dynamics
Gerry Tsoukalas, Stanford University, Huang 170, Stanford, CA, United States of America, gts@stanford.edu, Jiang Wang

We introduce a dynamic multi-asset model of price impact and study the optimal portfolio execution problem where supply and demand sides are dynamic and exhibit various forms of correlations. We show that correlations can lead to a much richer class of optimal strategies which cannot be easily captured via the standard price impact models or solution methodologies. These have implications for risk-management decisions around the execution of large portfolios.

2 - Cooperative Games with General Deviation Measures
Bogdan Grechuk, Professor, University of Leicester, United Kingdom, bg83@leicester.ac.uk

Cooperative games with players using different deviation measures as numerical representations for their attitudes towards risk in investing to a stock market have been investigated. As a central result, it has been shown that investors form a coalition (cooperative portfolio) that behaves similar to a single investor with a certain deviation measure. An explicit formula for that deviation measure has been obtained. An approach to optimal risk sharing among investors has been developed.

3 - The Price of Dynamic Inconsistency for Distortion Risk Measures
Emmanuel Yashchin, IBM Reseach, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, yashchi@us.ibm.com, Paul Huang, Dan Iancu, Dharmashankar Subramanian

Dynamically consistent risk measures, obtained by composing one-step risk measures, are a viable choice for managing risk in multi-period optimization. Static risk metrics are easier to interpret and are often used instead. This can lead to misestimation of the risk and an inconsistent behavior. In this paper, we characterize dynamically consistent measures that provide tight approximations for given inconsistent measures. Our analysis exploits submodular representations of risk measures.

4 - Risk-averse Optimal Path Problems for Markov Models
Ozlem Cavus, Rutgers University, RUTCOR, 640 Bartholomew Road, Piscataway, United States of America, ocavus@rci.rutgers.edu, Andrzej Ruszczynski

We use the recent theory of dynamic risk measures to develop and solve new risk-averse formulations of the undiscounted stochastic shortest or longest path problems in an absorbing Markov Chain. We show that an optimal stationary policy can be found by solving appropriate risk-averse dynamic programming equations and a randomized policy may be strictly better than deterministic policies. We further illustrate our results on a simple organ transplant problem where the patient is risk-averse.

■ TC30

C - Room 216B

Managing Supply Risks

Sponsor: Manufacturing & Service Oper Mgmt/ iFORM SIG

Sponsored Session

Chair: Nan Yang, Assistant Professor, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, MO, 63130, United States of America, yangn@wustl.edu

1 - Managing Supply Disruptions: Procurement Diversification, Demand Rationing and Dynamic Forecast
Long Gao, Assistant Professor, University of California-Riverside, Riverside, CA, 92521, United States of America, longg@ucr.edu, Nan Yang

We study a multiperiod procurement planning and order acceptance problem in the presence of supply disruptions, where multiclass supply and demand information is forecasted dynamically via a Markov model. We characterize the structure of both procurement policy and order acceptance policy by a sequence of thresholds. We also characterize the effects of short-term forecasts on the policy parameters and system performance.

2 - The Value of Process Improvement under Supply Risk in the Presence of Information Asymmetry
Mohammad Nikoofal, PhD Candidate, McGill University, Desautels Faculty of Management, Bronfman Building, 1001 Sherbrooke West, Montreal, QC, H3A 1G5, Canada, mohammad.nikoofal@mail.mcgill.ca, Mehmet Gumus

In this paper, we explore the effectiveness of process improvement as a supply disruption mitigation strategy in the presence of moral hazard and adverse selection. In order to address these issues, we develop a dyadic supply chain model where both the degree of supply disruption risk and supplier's mitigation effort are unobservable from retailer's perspective, and characterize the equilibrium incentive mechanisms between retailer and supplier.

3 - Investment And Wholesale Price for New Product with Time-sensitive Demand
Junghee Lee, Washington University in St. Louis, One Brookings Drive, Campus Box 1133, St. Louis, 63130-4899, United States of America, leejun@wustl.edu, Nan Yang

We investigate a supply chain which needs to develop a new product. The manufacturer is facing random demand which decreases in time. The supplier is responsible for the new product development which is also random and affected by R&D investment. A firm that invests in R&D may determine the wholesale price. We compare firms' performances of two extreme cases; when the manufacturer invests and when the supplier invests. It is interesting to see that being the leader is not always beneficial.

4 - Operational Hedging Against Operational and Disruption Risks
Ping Su, Assistant Professor of Operations Management, Department of Management, Entrepreneurship and General Business, Hofstra University, Hampstead, NY, 11549, United States of America, Ping.Su@Hofstra.edu, Shuguang Liu

We study a global firm whose production network contains a domestic production site and a foreign production site. The domestic is reliable but expensive. The foreign site is cheaper but is subject to disruption risks. We develop a stochastic dynamic programming formulation to characterize the firm's optimal production allocation decisions. The firm's objective is to maximize its expected discounted Constant Relative Risk Aversion (CRRA) utility by dynamically allocating its capital.

■ TC31

C - Room 217A

Joint Session HAS/SPPSN: Infectious Diseases and Interventions I

Sponsor: Health Applications/Public Programs, Service and Needs

Sponsored Session

Chair: Hamed Yarmand, North Carolina State University, 400 Daniels Hall, College of Engineering, North Carolina State University, Raleigh, NC, 27695, United States of America, hyarman@ncsu.edu

1 - Cost-Effectiveness Analysis of Different Interventions in Simple Stochastic Epidemic in a Household

Hamed Yarmand, North Carolina State University, 400 Daniels Hall, College of Engineering, North Carolina State University, Raleigh, NC, 27695, United States of America, hyarman@ncsu.edu, Julie Ivy

We consider the simple stochastic epidemic in a household with state-dependent contact rates. We relate the impact of different interventions (vaccination, antiviral prophylaxis, isolation, and treatment) to the contact rates and define the effect of each intervention as the utility of being healthy. By considering cost of being infective at each time unit as well as cost of each intervention, we conduct a cost-effectiveness analysis for different interventions.

2 - Modeling the Effect of Public Health Resources and Alerting on the Dynamics of Pertussis Spread Disease

Emine Yaylali, North Carolina State University, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, eyaylal@ncsu.edu, Erica Samoff, Reha Uzsoy, Julie Ivy

We modeled a local health department and its response to a pertussis outbreak using discrete-event simulation. The model combines the epidemiologic spread of the disease with public health resources to explore the effects of varying health alert levels and the resource availability on disease. Our results suggest the time to initiate the response and contact tracing as well as resource capacity significantly affect the duration of the outbreak.

3 - Approximation Algorithm for the Pediatric Vaccine Stockpiling Problem

Van-Anh Truong, Columbia University, 500 West 120th Street, 10027, New York, NY, 10027, United States of America, vatruong@ieor.columbia.edu

The U.S. has experienced many major interruptions of its pediatric vaccine production in the past decade. The Centers for Disease Control and Prevention has coped with these shortages by building a national stockpile of pediatric vaccines. The management of this stockpile is difficult due to long and unpredictable production interruptions of a limited number of suppliers and a limited budget. We address policies for managing the stockpiling of a single vaccine over a finite horizon.

■ TC32

C - Room 217BC

Resource Planning

Sponsor: Railway Applications

Sponsored Session

Chair: April Kuo, BNSF RAILWAY, 2400 Western Center Blvd., Fort Worth, TX, 76131, United States of America, April.Kuo@BNSF.com

1 - Locomotive Assignment with Train Delay Options

Sebastian Souyris, Ph.D. Student, The University of Texas at Austin, Red McCombs School of Business, 1 University Station B6500, Austin, TX, 78712, United States of America, Sebastian.Souyris@phd.mccombs.utexas.edu, Kevin Crook, Anantaram Balakrishnan

The locomotive assignment problem, distributing locomotives to support a given train schedule, can be modeled as a multi-commodity flow problem with side constraints. We present a model that incorporates the option to delay a train when enough power is not available or is too expensive to reposition. We will also describe mixed-integer programming and heuristic solution approaches that permit solving real-life instances in reasonable time with small gaps compared to optimal solutions.

2 - General Model of Railway Transportation Capacity

Hans Boysen, Researcher, Royal Institute of Technology (KTH), Traffic and Logistics, Department of Transport Science, Stockholm, SE, 10044, Sweden, heboysen@kth.se

For railway capacity planning, a general model of transportation capacity has been developed, helping to focus attention on what parameters are more significant, as well as the overall capacity effect attainable by combining parameters. Variants of the model address the productivity of infrastructure or train operator, respectively. Application examples will be shown, which may include alternative infrastructure investments, alternative car designs, and/or alternative operating scenarios.

3 - Assigning Train Crews in Double-ended Districts

Xiaoyan Si, The University of Texas at Austin, Department of Mechanical Engineering, 1 University Station C2200, Austin, TX, 78712, United States of America, june_si@utexas.edu, Anantaram Balakrishnan, April Kuo

Train crew assignments in double-ended crew districts must not only meet crew rotation policies but also satisfy sometimes complex crew calling requirements to assure equitable distribution of work among the crew members based at the two stations. Given a set of scheduled trains, we model the problem of assigning the needed crews, consistent with work rules, so as to minimize the total crew deployment and deadheading costs as an integer program, and discuss computational issues and results.

4 - A Time-Space Network Flow Model for Coal/Bulk Reservations Optimization

Ilksen Icyuz, PhD Student, University of Florida, Industrial and Systems Engineering Department, 303 Weil Hall P.O. Box 116595, Gainesville, FL, 32611, United States of America, eceicyuz@ufl.edu, Jean-Philippe Richard, Dharma Acharya, Erdem Eskigun

We study a reservation optimization problem faced by CSX Transportation in monthly basis. We first develop a deterministic time-space network flow model for scheduling coal reservations which considers a variety of information including customer demand with deadlines, rail network characteristics etc. We then incorporate system variations in the stochastic version of the model. Finally, we attempt to solve this large scale problem using time-efficient, sub-optimal heuristics.

■ TC33

C - Room 217D

Functional Data Analysis Methods and Applications

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Kamran Paynabar, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States of America, kamip@umich.edu

Co-Chair: Judy Jin, The University of Michigan, Ann Arbor, MI, United States of America, jhjin@umich.edu

1 - A SPC Procedure for Variance Monitoring with Functional Data

Young Seon Jeong, Khalifa University of Science, Technology and Research, P.O. Box 127788, Abu Dhabi, United Arab Emirates, young.jeong@kustar.ac.ae, Jinho Kim, Jye-Chyi (JC) Lu

This talk presents a new SPC procedure for monitoring local variances with functional data, which integrates a wavelet-based local-random-effect model with a SPC model for individual observations. Evaluation with real-life data sets shows that the proposed SPC procedure shows much smaller average run length (ARL) for detecting the changes of local variations than existing techniques.

2 - Engineered Surface Modeling Using Gaussian Process Models

Ran Jin, Georgia Institute of Technology, 755 Ferst Dr. NW, Atlanta, United States of America, jinr@gatech.edu, Chia-Jung Chang, Jianjun Shi

The high definition engineered surfaces are commonly encountered in manufacturing processes. It is challenging to model the profiles due to large amount of data. We propose a new method to model the output profiles by Gaussian process models, and demonstrate the procedure in the lapping process.

3 - Phase I Control of Simple Linear Profiles with Individual Observations

Arthur Yeh, Professor, Bowling Green State University, Department of Applied Stats and ORs, Bowling Green, OH, 43403, United States of America, byeh@bgsu.edu, Yaser Zerehsaz

In this work, a control charting mechanism, which consists of two control charts, is proposed for Phase I control of simple linear profiles with individual observations. The first control chart is used to monitor the profile parameters. The error variance is monitored using a second control chart which is based on the recursive residuals. Simulation results show that the control charting mechanism is effective in detecting sustained changes in the profile parameters and/or error variance.

4 - Fault Detection and Diagnosis Using Multichannel Nolinear Profile Data

Kamran Paynabar, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States of America, kamip@umich.edu, Judy Jin, Massimo Pacella

There has been extensive research on analysis of nonlinear profiles. Nevertheless, most research deals only with single profiles. In some industrial practices, however, the sensing system records more than one profile at each operation cycle. In this work, for the purpose of fault detection and diagnosis, we propose a method for analyzing multichannel profiles based on uncorrelated multilinear PCA. We show the effectiveness of the proposed method using simulation and a case study.

■ TC34

C - Room 218A

Radiation Therapy Optimization

Sponsor: Health Applications

Sponsored Session

Chair: Timothy Chan, University of Toronto, 5 King's College Rd, Toronto, ON, M5S3G8, Canada, tcychan@mie.utoronto.ca

1 - Sensitivity Analysis for Lexicographic Optimization in Radiation Therapy Treatment Planning

Troy Long, University of Michigan, Ann Arbor, MI, United States of America, troylong@umich.edu, Edwin Romeijn

We study the problem of efficiently identifying and quantifying tradeoffs between different stages in lexicographic optimization for radiation therapy treatment planning. Without an informed approach, physicians can easily overlook highly advantageous alterations to treatment plans. We propose a methodology to determine Pareto frontiers to help physicians identify improved treatment plans. We apply our approach to clinical cases of prostate cancer.

2 - The Computational Challenge of Rotational Modulated Therapy and a 2-stage Multicriteria Approach

David Craft, Massachusetts General Hospital, 30 Fruit St, Boston, MA, 02041, United States of America, dcraft@partners.org, Jeremiah Wala, Dualta McQuaid, Thomas Bortfeld

We review the difficulties of optimizing rotational arc therapy when considering treatment delivery time, which is a large nonconvex optimization problem. We decribe an approach which allows users to explore the tradeoffs between tumor coverage and organ sparing. This is done with a convex model. In a second heuristic step we analyze the tradeoff between dose distribution quality and treatment time, and there produce a deliverable treatment plan. The approach is demonstrated on clinical cases.

3 - Adaptive and Robust Radiation Therapy Optimization for Lung Cancer

Velibor Misic, Department of Mechanical and Industrial Engineering, University of Toronto, 5 King's College Rd, Toronto, ON, M5S3G8, Canada, velibor.misic@utoronto.ca, Timothy Chan

Traditional robust IMRT treatment planning for lung cancer involves defining an uncertainty set, solving a single planning problem and using the solution in all treatment sessions. In this talk, we describe an adaptive robust optimization approach, where the uncertainty set is adaptively updated with information observed over the treatment course. We demonstrate the effectiveness of this approach through a computational study, and present an asymptotic analysis of its performance.

■ TC35

C - Room 218B

Decision Analysis Approaches and Predictive Modeling to Managing Uncertainty in Manufacturing and Service Systems Design & Operations

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu

Co-Chair: Martin Wortman, Professor, Texas A&M University, Department of Industrial & Systems Eng, College Station, TX, 77841, United States of America, wortman@tamu.edu

1 - Functional Logistic Regression for Binary Outputs Based on Wavelet Transforms

Qingyu Yang, Assistant Professor, Wayne State University, United States of America, qyang@wayne.edu

Functional data analysis has received increasing attention in recent years. In this research, we propose a new functional logistic regression model in which wavelet transform is used to represent functional parameters. The newly developed method can be used for a general situation where the model output has binary response depending on multi-stream functional data.

2 - Chemical Mechanical Planarization (CMP) Process Monitoring Using Evolutionary Clustering Analysis

Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu, Omer Beyca, Satish Bukkapatnam, Ranga Komanduri

Chemical Mechanical Planarization (CMP) process is widely used in semiconductor industry. Monitoring CMP is extremely important to respond to process variations and quality. In this research, we use evolutionary clustering analysis to monitor CMP process. Recurrent nested Drichlet process is used to handle nonstationarity of the process by using mixture of Gaussian distributions in a Markovian fashion to monitor emerging and dying out clusters that will detect the changes in process.

3 - Why I don't Aggregate Expert Probability Assessments

Martin Wortman, Professor, Texas A&M University, Department of Industrial & Systems Eng, College Station, TX, 77841, United States of America, wortman@tamu.edu

In the decision-based design of engineered systems, predictive models are often constructed using event probability assessments provided by experts. Methodologies for aggregating probability assessments are widely reported in the literature. In this talk, I explain why I don't aggregate expert probability assessments. My arguments are predicated upon my acceptance of the tenets from which the Expected Utility Theorem, the Kolmorogov axiomization of probability measure, and Arrow's Theorem.

4 - Approaches to Support Early-Stage System Design

Abhi Deshmukh, Professor and Head, Purdue Univerisity, School of Industrial Engineering, West Lafayette, IN, United States of America, abhi@purdue.edu, Martin Wortman, KiHyung Kim

In early-stage system design, high-value decisions are often made using data that is sparse, vague, or entirely non-existent. Under such circumstances, even Bayesian estimators can suffer limited confidence when constructing probability laws that characterize risk associated with the decisions. In this talk, we examine the usefulness and limitation of maximum-entropy based discrete event simulation as a supporting decision-based design in early-stage system development.

■ TC36

C - Room 219A

Choosing Interventions for Optimal Disease Response

Sponsor: Health Applications

Sponsored Session

Chair: Sabina Alistar, Stanford University, 475 Via Ortega, Stanford, CA, 94305, United States of America, ssabina@stanford.edu

1 - Choosing Among Prevention Interventions for Pandemic Influenza

David Hutton, University of Michigan, Ann Arbor, MI, United States of America, dwhutton@umich.edu

We have many different possible public health interventions for the mitigation of an influenza pandemic: prophylactic use of antivirals, vaccines, facemasks, and social distancing. Each of these interventions has a different level of efficacy and cost. We use a dynamic model of influenza to see examine a portfolio of these interventions and characterize trade-offs between using different levels of each.

2 - Optimizing Mammography Screening Policies Considering Adherence: A Behovioral Perspective

Turgay Ayer, Assistant Professor, Georgia Institute of Technology, School of Industrial and Systems Eng., 765 Ferst Drive, Atlanta, GA, 30332, United States of America, ayer@isye.gatech.edu, Oguzhan Alagoz, Natasha Stout, Elizabeth Burnside

The existing controversial breast cancer screening policies consider only women's age but ignore several other personal breast cancer risk factors and women's adherence to screening recommendations. In this study, we propose a model to redesign the controversial breast cancer screening policies by tailoring the screening decisions to women's personal risk and adherence levels.

3 - The Cost-effectiveness of Pre-exposure Prophylaxis Interventions Among MSM

Robert Koppenhaver, Centers for Disease Control and Prevention, 1600 Clifton Rd NE, MS E-48, Atlanta, GA, 30333, United States of America, jmq5@cdc.gov, Stephen Sorensen, Stephanie Sansom

The results of the iPrEx study suggest that pre-exposure prophylaxis (PrEP) may significantly reduce the incidence of HIV in the MSM community. However widespread implementation of PrEP may be too costly. We developed a dynamic compartmental model using behavioral data gathered from New York City to evaluate the cost-effectiveness of various PrEP interventions. We examine the case when all patients receive PrEP in addition to using targeted interventions.

4 - Two Models of HIV Spread: Serodiscordant Heterosexual Couples and Sexual Role Among MSM

Benjamin Armbruster, Northwestern University, 2145 Sheridan, Evanston, United States of America, armbruster@northwestern.edu

We use a Markov model to show that higher divorce rates in sub-Saharan Africa among heterosexual serodiscordant couples (only one partner is infected) greatly affect HIV incidence. Our compartmental model of men who have sex with men (MSM) in India examines the effect on HIV prevalence as traditionally fixed sexual roles during anal sex (insertive or receptive) become less rigid and more individuals adopt a versatile role.

■ TC37

C - Room 219B

Spatial Data Analysis

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Qiang Zhou, University of Wisconsin-Madison, 1513 Universtiy Avenue, Madison, 53706, United States of America, qzhou3@wisc.edu

1 - Modeling the Effect Control Parameters on Surface Generation with Gaussian Process Techniques

Matthew Plumlee, Ph.D. Student, H. Milton Stewart School of Industrial and Systems Engineering, 765 Ferst Drive, Room 214, Atlanta, GA, 30332, United States of America, mplumlee@gatech.edu, Ran Jin, Jianjun Shi, Roshan Joseph

Current research has provided little insight to the effect of control parameters in processes that generate profile responses. This presentation focuses on a methodology that determines this effect on both the mean and stochastic portions of surface generation. Simulation results demonstrate stable estimates and a case study is presented.

2 - Progressive Monitoring for Multi-resolution Data Considering Spatial and Cross Correlations

Hui Wang, University of Michigan, Detroit, MI, United States of America, huiwz@umich.edu, Saumuy Suriano, S. Jack Hu

This talk presents a method of progressive measurement and monitoring of multi-resolution data of machined surfaces. Measurement resolution can be reduced without losing information on surface variations by integrating spatial correlation among data and cross correlation based on process physics. This measurement strategy enables an efficient monitoring scheme by which reduced data are first measured to identify defective areas followed by localized high-resolution measurement on these areas.

3 - Yield Prediction for Integrated Circuits Manufacturing through Bayesian Modeling of Spatial Defects

Tao Yuan, Assistant Professor, Ohio University, 279 Stocker Center, Athens, OH, 45701, United States of America, yuan@ohio.edu

In this presentation, we discuss yield models based on hierarchical Bayesian modeling of clustered spatial defects produced in integrated circuits (IC) manufacturing. We use spatial locations of the IC chips on the wafers as covariates and develop four models based on Poisson regression, negative binomial regression, zero-inflated Poisson regression, and zero-inflated negative regression. Wafermap data obtained from an industrial collaborator are used to illustrate the proposed models.

4 - Process Identification in Semiconductor Manufacturing Using the Time Series-based Method

Xi Zhang, Peking University, 298 Chengfu Rd., Beijing, China, xi.zhang@pku.edu.cn

In this study, we mainly investigate the process failure occurred in semiconductor manufacturing. The multivariate-regression based Generalized Markov Model is proposed in which the process deviations occur in future observations could be detected. Experimental studies on chemical mechanical planarization (CMP) processes are conducted to verify our proposed approach.

■ TC38

H- Johnson Room - 4th Floor

Facility Location

Sponsor: Location Analysis

Sponsored Session

Chair: Tammy Drezner, Professor, California State University, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, tdrezner@fullerton.edu

1 - Environmental Implications of Hub Networks

Morton O'Kelly, Department of Geography, The Ohio State University, Columbus, OH, United States of America, okelly.1@osu.edu

This paper examines the efficiency of hubs from an environmental point of view. The research uses a model of the general flows between a broad system of large cities across multiple continents as an experimental context for understanding the costs and benefits of concentrated flow. The essential ideas are: to examine fuel costs associated with larger aircraft; to determine implications of higher load factors on dense routes; and to model the resulting implications for hub and gateway location.

2 - Locating Undesirable Facilities with Pollution Functions

H. A. Eiselt, University of New Brunswick, P.O. Box 4400, Fredericton, Canada, haeiselt@unb.ca, Vladimir Marianov

We investigate scenarios, in which undesirable facilities are to be located with the objective to minimize the undesirable effects they have on the population, which is assumed to be located at given points. We examine a variety of pollution decay functions, examine their properties, and solve related covering problems.

3 - Continuous Location-Allocation Problems for Empty Container Logistics

Takamori Ukai, Nanzan University, 27, Seirei-cho, Seto, Japan, ukai@nanzan-u.ac.jp, Atsuo Suzuki

We present mathematical models for determining both locations of storage yards and transportation plans of empty containers. The problems are described as generalizations of the location-allocation problem. We allocate the containers to the storage yards so as to minimize the transportation cost instead of allocating to the closest ones. The models are applicable to other logistic problems like locating depots or logistic centers. We propose a heuristic algorithm and show computational results.

4 - Voronoi Diagrams with overlapping Regions
Tammy Drezner, Professor, California State University, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, tdrezner@fullerton.edu, Zvi Drezner

Voronoi diagrams are a tessellation of the plane based on a given set of points into polygons so that all the points inside a polygon are closest to the point in that polygon. All the regions of existing Voronoi diagrams are mutually exclusive. In this paper we define overlapping Voronoi diagram. We allow for points to belong to several regions. The concept is illustrated on a case study of delineating overlapping service areas for public universities.

■ TC39

H - Morehead Boardroom -3rd Floor

Tactical and Operational Issues in e-Commerce

Sponsor: E-Business

Sponsored Session

Chair: Jun Ru, Assistant Professor, University at Buffalo, SUNY, Buffalo, NY, 14260, United States of America, junru@buffalo.edu

1 - Service Quality in B2B Online Auctions
Ming Zhou, San Jose State University, 4069 Rosehill Pl, Dublin, CA, 94568, United States of America, ming.zhou@sjsu.edu, Taeho Park

Service quality in online settings is nothing new to the research world. However, most of the service quality research have been business to consumer (B2C) oriented. How much of the current findings of online service quality are directly transferable to the business to business (B2B) world is yet to be confirmed. We fill the gap with a empirical study of online B2B data to confirm transferability and identify new insights.

2 - Making Better Fulfillment Decisions on the Fly in an Online Retail Environment
Jason Acimovic, PhD Candidate, Massachusetts Institute of Technology, Operations Research Center, 77 Massachusetts Avenue E40-149, Cambridge, MA, 02139, United States of America, acimovic@mit.edu, Stephen C. Graves

We partner with an e-tailer to examine how best to fulfill each customer's order when customers have different service requirements and shipping costs. We report on the development of a heuristic that makes real-time fulfillment decisions by minimizing outbound cost plus an estimate of expected future costs. These estimates are derived from the dual values of a transportation problem. In our experiments, our heuristic shows a reduction of 0.5% in total outbound shipping costs.

3 - Retailer vs. Vendor-managed Inventory and Customers' Store Loyalty
Jun Ru, Assistant Professor, University at Buffalo, SUNY, Buffalo, NY, 14260, United States of America, junru@buffalo.edu, Ruixia Shi, Jun Zhang

It has been widely accepted in the industry that retailers improve profitability by implementing vendor-managed inventory (VMI). We, however, demonstrate that a retailer may be worse off by adopting VMI when retail competition is present. Moreover, the examination of the impact of customers' store loyalty on the value of VMI to the retailer reveals that a retailer with a high customer loyalty benefits from VMI for a wider range of wholesale prices than a retailer with a low customer loyalty.

4 - A Note on the Aggregation and underreporting Biases of Online Reviews
Hongyu Chen, PhD Candidate, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, hxc051200@utdallas.edu, Zhiqiang Zheng, Yasin Ceran

This paper demonstrates the aggregation and underreporting biases commonly afflicting online review studies. We propose a novel approach that explicitly models online reviewers' behavior to rectify these biases. Data from Blockbuster's online review were used to evaluate our model. We find that users reporting probability varies at the different level of sentiment towards a movie: it is 4.6% for a negative sentiment, 34.6% for neutral, and 54.3% for positive sentiments.

■ TC40

H - Walker Room - 4th Floor

Coordination and Management of Knowledge

Sponsor: Technology Management

Sponsored Session

Chair: Gulru Ozkan, Assistant Professor, Clemson University, Department of Management, 101 Sirrine Hall, Clemson, SC, 29634, United States of America, gulruo@clemson.edu

1 - Knowledge Transfer and Knowledge Creation in New Product Development Projects
Wenli Xiao, Ph.D. Candidate, College of Management, Georgia Institute of Technology, 800 West Peachtree NW, Atlanta, GA, 30308, United States of America, wxiao6@gatech.edu, Cheryl Gaimon, Janice Carrillo

Two models are introduced depicting knowledge creation in prototyping, pilot line testing, and on-line experimentation. In both the manager decides the rate of development efforts at each stage. In one model knowledge is transferred to the next stage continuously as would be the case for a small co-located team. In the other model knowledge is accumulated and transferred at discrete times.We compare the optimal solutions to get insights on knowledge development and knowledge transfer strategies.

2 - Cascading Operations Strategy: Balancing Delegation and Coordination
Fabian Sting, Assistant Professor, Erasmus University, Rotterdam School of Management, Rotterdam, Netherlands, fsting@rsm.nl, Christoph Loch

We study strategy processes at six German manufacturing organizations using an organizational search perspective. While the final decision on strategic initiatives remains at the top, strategic initiatives are distributed across hierarchical levels, depending on where expertise is concentrated. The organizations also use multiple mechanisms to coordinate decentralized actors. Coordination and top-down decision making is weighed against the creativity that stems from delegated search.

3 - Managing New Product Development Knowledge between Competing Firms
Gulru Ozkan, Assistant Professor, Clemson University, Department of Management, 101 Sirrine Hall, Clemson, SC, 29634, United States of America, gulruo@clemson.edu, Sriram Venkataraman, Cheryl Gaimon

We introduce a two period stochastic game on KM for NPD of two competing firms. First, leader sets price for knowledge transfer (patents); follower decides how much knowledge to acquire. Next, firms pursue knowledge development (problem solving). Finally, both firms release new products. Insights include impact of uncertain market forces.

■ TC41

H - Waring Room - 4th Floor

Analytics for Innovation I

Contributed Session

Chair: Yijiang Wu, PhD Candidate, Imperial College Business School, 8 Cleveland Avenue, London, W4 1SN, United Kingdom, yijiang.wu09@imperial.ac.uk

1 - Exploring Strategic Choices and Results in a High-tech Industry Sector
Hientaek Ju, Korea University, Korea University Business School, Anam-Dong, Seongbuk-Gu, Seoul, Korea, Republic of, hientaek@korea.ac.kr, Hosun Rhim

As a competitive solution, the combination of products and services draws a lot of attention from entrepreneurs. The presentation aims to report the strategic choices of companies and their results by tracing a high-tech industry sector where the industrial convergent phenomenon is actively prompted. On this basis, our research defines an industry specific product-to-service spectrum, classifies strategic movements of companies, and presents the factors affecting the survival in the progress.

2 - Modeling the Design Processes Leading to Innovative Outcomes
Nur Ozge Ozaltin, PhD Student, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, noceylan@gmail.com, Mary Besterfield Sacre

Engineering innovation is essential to solve many of the "grand challenges" of the 21st century, as it plays a strategic role in competitive environments. The design process is at the heart of innovation. We propose a generalized model advising which activities should be done to get the innovative output. We aim an intervention tool for the managers and the design instructors by investigating this model.

3 - Renewal, Reuse and Reinforcement: Building Capabilities to Shape an Emerging Sustainable City Market
Yijiang Wu, PhD Candidate, Imperial College Business School, 8 Cleveland Avenue, London, W4 1SN, United Kingdom, yijiang.wu09@imperial.ac.uk, Lars Frederiksen, Andrew Davies

This paper reports the findings of an inductive longitudinal process study over a five-year research window to reveal how a global professional service firm built its capabilities in the course of entering and shaping an emerging sustainable city market. We found that three mutually enabling sets of activities; renewal, reuse and reinforcement, constitute the cornerstones of organization's dynamic capabilities and thus support and facilitate the process of capability transformation.

4 - Forecasting and Capacity Management of Innovative Products
Saman Alaniazar, PhD Candidate, Wayne State University, Industrial and Systems Engeering, Detroit, MI, 48202, United States of America, dv2663@wayne.edu, Ratna Chinnam, Alper Murat

We are studying forecasting and capacity planning for innovative products with short life cycles. Given the stochastic nature of the demand in these types of products, we are developing a stochastic version of the Bass diffusion model and employing it in a risk-sensitive capacity expansion model.

■ TC42

H - Gwynn Room - 4th Floor

Information Value Chains

Sponsor: Information Systems Society

Sponsored Session

Chair: Jason Kuruzovich, Assistant Professor of Management Information Systems, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States of America, kuruzj@rpi.edu

1 - Peer Influence and Learning in Crowdfunding
Vandana Ramachandran, David Eccles School of Business, University of Utah, Salt Lake City, UT, United States of America, vandana@business.utah.edu

Crowdfunding platforms such as Kickstarter and Sellaband enable the funding of entrepreneurial ventures using small amounts contributed by a large number of online individuals. We examine whether and how crowdfunders are influenced by the on-site contribution behaviors of their peers, and if these influences are limited within a project, or spillover across projects. Findings can help platforms and project owners to devise appropriate incentives and campaigning strategies, respectively.

2 - Tweeting for Good: An Empirical Investigation of Micro-Blogging and Pro-Social Behaviors
Dobin Yim, PhD Student, University of Maryland, Robert H. Smith School of Business, 3300 Van Munching Hall, College Park, MD, United States of America, dyim@rhsmith.umd.edu, Siva Viswanathan

Online social media such as Facebook and Twitter are increasingly used by social entrepreneurs to recruit volunteers and raise money for social causes. We examine how different patterns of communication on Twitter influence charitable giving, focusing on the communication mode and informational content of tweets. We discuss the implications of our findings for online fundraising strategies of nonprofit organizations.

3 - Tiger Blood: Availability Cascades, New Firm Formation, and the Acquisition of Venture Capital
Brad Greenwood, PhD Candidate, University of Maryland, Van Munching Hall, College Park, MD, United States of America, wood@umd.edu, Anand Gopal

Availability cascades have been discussed in depth in the extant literature however they lack rigorous empirical investigation. We explore conditions under which discourse increases impact not only the entrepreneur's decision to enter the market but their ability to acquire VC. Moreover, we argue this will impact the quality of entrepreneurs who enter the market. We position this paper as one where cascades effect the ability of entrepreneurs, VCs, and investors to rationally evaluate risks.

4 - Cloud Computing and the Entrepreneur
Jason Kuruzovich, Assistant Professor of Management Information Systems, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States of America, kuruzj@rpi.edu, William Tracy

Firm creation has long been viewed as a process in which entrepreneurs search a competitive landscape as a way of identifying viable business models. Cloud computing provides dramatically lower initial infrastructure costsóa significant component of the search costs for Internet based businesses. We utilize a simulation modelóbased on the N-K Landscapeóas a way of formalizing the implications of lower search costs for the entrepreneur.

■ TC43

H - Suite 402 - 4th Floor

Regulatory Issues and Uncertainty in Energy Supply

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Ekundayo Shittu, Tulane University, A.B. Freeman School of Business, New Orleans, United States of America, eshittu@tulane.edu

1 - Voluntary Energy Efficiency Standards and Firms' Product Line Decisions
Sebastien Houde, Stanford University, 450 Serra Mall, Stanford, CA, 95305, United States of America, shoude@stanford.edu

Energy efficiency standards are the main tools used to address externalities associated to durables. For appliances, in addition to minimum energy efficiency standards, the ENERGY STAR program sets voluntary standards for manufacturers. In this paper, I evaluate the program accounting for firms' endogenous response to voluntary standards. I model the market as a multiproduct oligopoly. Using a dataset of the US refrigerator market, I estimate the model and quantify the welfare gains/losses.

2 - Two-stage Robust Optimization for Security Constrained Unit Commitment Problems
Jinye Zhao, New England ISO, One Sullivan Rd, Holyoke, MA, 01040, United States of America, JZhao@iso-ne.com, Dimitris Bertsimas, Eugene Litvinov, Xu Andy Sun, Tongxin Zheng

Unit commitment in electric power system operations faces new challenges as the supply and demand uncertainty increases dramatically. To meet these challenges, we propose a two-stage robust unit commitment model and a practical solution methodology. We present a numerical study on the real-world large scale power system operated by the ISO New England. Computational results demonstrate the economic and operational advantages of our model over the traditional reserve adjustment approach.

3 - Hydrogen Production Facility Network Design from Stochastic Green Energy Supply Source
Jorge Barnett Lawton, MIT-Zaragoza International Logistics Program, Calle de Bari 55, Portal 5, PLAZA, Zaragoza, 50197, Spain, jbarnett@zlc.edu.es, Mozart Menezes, Jarrod Goentzel

Hydrogen has been identified as a clean alternative to store energy produced from volatile sources. We analyze the profit maximization problem for a firm generating electricity from wind and producing hydrogen by electrolysis, in the presence of stochastic energy prices and supply. We characterize the firm's optimal response to any possible price-supply relation, and then formulate and propose solution approaches to the single and multiple facility location and capacity optimization problems.

4 - Emissions Trading in Forward and Spot Markets of Electricity
Yihsu Chen, Assistant Professor, University of California Merced, Science and Engineering Building, Room 262, Merced, CA, United States of America, yihsu.chen@ucmerced.edu, Makoto Tanaka

Tradable permits have received considerable attention in recent years. This paper extends the model of Allaz and Vila (1993) by endogenizing the permit price and allows firms to behave strategically in forward and spot markets. We focus on the effects of forward position and initial permit allocation on the equilibrium outcomes. We find that firms with a dirty portfolio would have stronger incentives to take a long position in the forward market to raise electricity price.

■ TC44

H - Suite 406 - 4th Floor

Effects of and Responses to Disruptions in Supply Chains

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Thomas Sharkey, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, United States of America, sharkt@rpi.edu

1 - Reliable Supply Chain Network Design

Hakan Yildiz, Assistant Professor, Michigan State University, N341 N. Business Complex, East Lansing, MI, 48823, United States of America, yildiz@bus.msu.edu, David Closs, Srinivas Talluri

Risk management in supply chains has been receiving increasing attention in the last few years. We present formulations for the strategic supply chain network design problem with two objectives, which usually conflict with each other: minimizing cost and minimizing total risk. We provide preliminary results that show a trade-off between reliability and cost.

2 - Modeling and Mitigating the Effects of Supply Chain Disruption on Wargames

Jie Xu, University at Buffalo, SUNY, Buffalo, NY, United States of America, jxu24@buffalo.edu, Zigeng Liu, Jun Zhuang

We study a novel supply chain risk management problem in a setting of a government-terrorist game in war zones (such as Afghanistan and Iraq). The outcomes of the wargames depend on the government's resources delivered through military supply chains, which are subject to natural and man-made disasters. We examine and compare the government's optimal pre-disruption preparation strategies, including inventory protection, capacity backup protection and the combination of the two strategies.

3 - Parallel Resource Network-based Scheduling: Complexity Analysis and Dispatching Rules

Sarah Nurre, Graduate Student, Rensselaer Polytechnic Institute, 110 8th Street CII 5015, Troy, NY, 12180, United States of America, nurres@rpi.edu, Thomas Sharkey

We examine a new class of integrated network design and scheduling problems with applications in restoring infrastructure systems and supply chains. †These problems focus on allocating resources to selected network components that will be restored. Objectives of these problems include capturing how well a network performs over time and also how long it takes to achieve a desired performance. We propose novel dispatching rules that produce promising computation results on realistic data sets.

■ TC45

H - Suite 407 - 4th Floor

Auctions and Their Applications

Cluster: Auctions

Invited Session

Chair: Ravi Bapna, Professor, University of Minnesota, 4600 Washburn Avenue South, Minneapolis, MN, 55410, United States of America, rbapna@umn.edu

1 - Simple Supply Auctions

Bin Hu, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, hub@umich.edu, Damian Beil, Izak Duenyas

We consider the canonical problem of a newsvendor facing a number of potential suppliers who hold private information about their production costs. We show that a variation of the standard open-descending auction for a fixed-quantity contract is an optimal mechanism for the buyer. Compared to other existing optimal mechanisms in the literature, this mechanism is distinguished by its simplicity and familiarity for the suppliers.

2 - Drafts as Proxy Auctions: Allocating Courses without Money

Mike Ruberry, PhD Candidate, Harvard University, Maxwell-Dworkin, 33 Oxford St., Cambridge, Ma, 02138, United States of America, mruberry@seas.harvard.edu, Jonathan Ullman, Scott Kominers

Courses are scarce goods allocated by a variety of manipulable assignment schemes. Harvard Business School, for example, uses a draft mechanism. While manipulable, prior work has demonstrated that in practice this mechanism results in superior social welfare to the strategyproof alternative. We present a new analysis of the draft as a proxy auction, clarifying the efficacy of observed manipulations and suggesting a less manipulable mechanism that preserves the draft's positive formal properties.

3 - A Structural Model of Multi-unit Sequential Dutch Auctions

Wolf Ketter, Assistant Professor, Rotterdam School of Management, Burgemeester Oudlaan 50, T9-07, Rotterdam, 3062PA, Netherlands, WKetter@rsm.nl, Alok Gupta, Yixin Lu, Eric van Heck, Jan van Dalen

We develop a structural model of multi-unit sequential Dutch auctions where multiple units of identical products are auctioned in sequential rounds by means of a downward ticking auction clock. It serves as the basis for statistical estimation of winning prices, quantities sold, and revenues. The proposed model differs from existing models by incorporating more features of the real-world bidding environment, hence it contributes to the growing literature of structural models of auction data.

4 - Does Sniping Pay on eBay: An Empirical Analysis

Ravi Bapna, Professor, University of Minnesota, 4600 Washburn Avenue South, Minneapolis, MN, 55410, United States of America, rbapna@umn.edu, Alok Gupta, Zhuojun Gu

Using a unique dataset we examine whether there are above average returns to sniping as a bidding strategy on eBay. While this appears to be the conventional evidence, there is no systematic empirical analysis of returns to sniping. A key econometric challenge is distinguishing between higher bidder surplus due to preferences or prices.

■ TC46

H - Suite 403 - 4th Floor

Rejuvenating the OR Curriculum: New Approaches for New Audiences

Sponsor: INFORM-ED

Sponsored Session

Chair: Mihai Banciu, Assistant Professor of Operations and Decision Sciences, Bucknell University, 119 Taylor Hall, Lewisburg, PA, 17837, United States of America, mmb018@bucknell.edu

1 - The POET Project: Understanding and Overcoming Difficulties with Mathematical Optimization Modeling

Sung-Hee Kim, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, kim731@purdue.edu, Tuyin An, Aiman Shamsul Iwardi, Mohan Gopaladesikan, Nelson Uhan, Amit Hundia, Rachael Kenney, Ji Soo Yi

The goal of this project is to better understand the difficulties undergraduate engineering students face with formulating optimization models from verbal problem statements, and to provide them with tools to overcome these difficulties. As a first step, we created a taxonomy of problem types and identified common student mistakes by analyzing quiz responses. To help students overcome these mistakes, we have designed a web-based visual interactive tool that provides feedback for self-assessment.

2 - Decision Analysis Made Visual

Robert Bordley, Booz-Allen, 101 West Big Beaver Suite #505, Troy, MI, 48085, United States of America, Bordley_robert@bah.com

Decision analysis uses special software to construct decision trees from arcs and nodes. Numerical probabilities are attached to the arcs and numerical utilities are attached to the nodes. This paper presents three alternative approaches to creating decison trees: (1) Using blocks and shading to eliminate numerical values (2) Using elimination to eliminate special software (3) Using shaded circles to eliminate both numerical values and special software.

3 - Sustainability and O.R. Education at Le Moyne College

Thaddeus Sim, Assistant Professor of Business Administration, Le Moyne College, 1419 Salt Springs Road, Syracuse, NY, 13214, United States of America, simtk@lemoyne.edu, Ronald Wright

In the summer of 2010, we revised our introductory O.R. course to include an increased focus on sustainability. We still teach the same O.R. topics as in previous years but the examples now emphasize sustainable management practices. Student enthusiasm and participation has increased substantially presumably because of the realistic issues discussed in class. We will provide an overview of our course, and discuss the sustainability example used when teaching Monte Carlo simulation.

4 - Teaching OR/MS in a Liberal Arts University: Quantitative Reasoning for Managers

Alia Stanciu, Visting Assistant Professor of Management, Bucknell University, 322 Taylor Hall, Lewisburg, PA, 17837, United States of America, acs023@bucknell.edu, Matt Bailey, Mihai Banciu

Traditionally, an introductory OR/MS class starts with deterministic models and then moves to stochastic extensions. At Bucknell University, we are introducing a management gateway course that emphasizes decision making under risk and uncertainty, while building solid modeling skills. We present our philosophy and teaching approach.

■ TC47

H - Dunn Room - 3rd Floor

Ocean and Hinterland Intermodal Container Transportation

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Jan C. Fransoo, Professor, Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, Pav F4, Eindhoven, 5600 MB, Netherlands, j.c.fransoo@tue.nl

1 - Inbound Container Storage Price Competition between the Container Terminal and Remote Container Yard

Mingzhu Yu, Hong Kong University of Science and Technology, Department of IELM, HKUST, Clear Water Bay, Kowloon, Hong Kong - PRC, julieyu@ust.hk, Chung-Yee Lee

This paper proposes inbound container storage pricing game models between the container terminal and a remote container yard. Two cases are considered: (1)the inbound container's dwell time is random and independent of the storage prices; (2)the inbound container's dwell time is sensitive to the storage prices. The primary objective is to analyze the storage pricing behavior and competition outcomes of the two players. A number of insights and analysis are provided.

2 - An Empirical Investigation of Transit Time Performance in Global Ocean Transportation

Basak Kalkanci, Postdoctoral Associate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, kalkanci@mit.edu, Bruce Arntzen, Chris Caplice, Jan C. Fransoo

Due to decentralization of the supply chains across different locations, ocean transportation is merging as an extremely important component of global operations. In this study, we investigate transit time performance in ocean transportation using an empirical approach: we analyze a detailed data set on global shipment transactions of ocean carriers working with a major US company. We examine the variability in the transit times across different legs and regions and identify underlying factors.

3 - Impact of Business Models on Intermodal Network Service Design

Rob Zuidwijk, Erasmus University, Department of Decision and Information S, Rotterdam, Netherlands, rzuidwijk@rsm.nl

In ongoing research, we study the impact of business models on network service design for intermodal container transport. In particular, we study pricing of intermodal services in conjunction with network service design, various levels of information services, and the offering of premium services to market segments as opposed to providing a commodity service.

4 - Coordination and Analysis of Barge Container Hinterland Networks

Kristina Sharypova, Eindhoven University of Technology, School of Industrial Engineering, P.O. 513, Eindhoven, 5600 MB, Netherlands, k.sharypova@tue.nl, Tom Van Woensel, Jan C. Fransoo

We analyze the container hinterland supply chain from the joint perspective of the inland terminal operator and of the shipper. In the hinterland supply chain, the interests of capital-intensive terminal operators and the interests of the shippers do not coincide. Therefore, we investigate the influence of joint decision making on the total relevant costs of the parties of the hinterland supply chain. We consider the direct and the tour coordination policies.

■ TC48

H - Graham Room - 3rd Floor

ITS and Traffic Simulation

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Kien Doan, Graduate Student, Purdue University, 550 Stadium Mall, West Lafayette, IN, 47907, United States of America, kdoan@purdue.edu

1 - Simulation Based Multi-Objective Optimization: An Application in Metal Casting

Cem Celal Tutum, Assistant Professor, Technical University of Denmark, Produktionstorvet 425, Kgs. Lyngby, 2800, Denmark, cctu@mek.dtu.dk, Himanshu Jain, Kalyanmoy Deb, Jesper Thorborg, Petr Kotas, Jesper Hattel

In this paper, a multi-objective optimization problem is defined for a steel cast part where the riser and the chill design is being optimized based on thermal simulations. The two objectives are maximization of the casting yield and minimization of the shrinkage porosity. Consequently, a postoptimality study is manually performed to find out some common design principles among multiple design solutions.

2 - Comparative Investigation of Novel Control Strategies with an Agent Based Model

Adbul Aziz, PhD Student, Purdue University, 150 Arnold Dr., Apt #15, West Lafayette, IN, 47906, United States of America, haziz@purdue.edu, Satish Ukkusuri, Kien Doan

This work presents an implementation of adaptive signal control schemes in an agent based traffic flow model. Java based simulation tool Repast-S has been used to develop signal control framework within an agent based traffic flow model that considers approximate predictive dynamic user equilibrium. Different adaptive signal control algorithms are implemented with real world test networks and results are compared with other available simulators: Green-Light-District (agent based) and VISSIM.

3 - A RP/SP Combined Framework for Quantifying the Qualitative Benefits of Real-time Travel Information on Individual Travelers

Dong Yoon Song, Research Assistant, Purdue University (Nextrans Center), 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, song50@purdue.edu, Srinivas Peeta

In this study, we seek to identify and quantify the qualitative benefits of real-time travel information provided through Advanced Traveler Information Systems (ATIS) on individual drivers in addition to the commonly analyzed quantitative benefits (e.g., travel time savings). Stated and revealed preference data will be utilized in behavioral analysis to address psychological impacts on different groups of travelers as well as the corresponding quantitative impacts of information.

4 - A Heuristic Scheme for the Heterogeneous Vehicle Routing Problem on Trees based on Generalized Assignment and Bin-packing Upper Bounds

Roshen Kumar, University of Texas at Austin, Austin, TX, United States of America, roshan@mail.utexas.edu, Avinash Unnikrishnan, Travis Waller

A heuristic method for solving the Heterogeneous Vehicle Routing Problem on Tree networks (HTVRP) is presented here. The Generalized assignment problem and the bin-packing problem are sub-problems of the HTVRP. A heuristic that exploits this relation and the tree structure of the problem is proposed. Numerical experiments are conducted to evaluate the efficiency of the proposed heuristic.

5 - Traffic Metering for a Better Urban Network Management

Ali Hajbabaie, Graduate Research Assitant, University Of Illinois at Urbana Champaign, 205 N mathwes Avenue, room 3150, Urbana, IL, 61801, United States of America, ahajbab2@illinois.edu, Rahim Benekohal

In this study we show how traffic metering in urban transportation networks can potentially improve network efficiency in oversaturated condition. A Genetic Algorithm based method has been developed to determine near optimal signal timing parameters for different metering strategies. Network performance measures such as delay, throughput, number of trips, and fuel consumption are determined for different metering strategies, and are compared to find the best strategy.

■ TC49

H - Graves Room - 3rd Floor

Modeling and Simulation in Public Health

Sponsor: Simulation

Sponsored Session

Chair: Rafael Diaz, Old Dominion University, 1030 University Blvd, Suffolk, VA, 23435, United States of America, RDiaz@odu.edu

1 - Modeling Community Vulnerability and Medically Fragile Populations for Natural Disaster Preparedness

Joshua Behr, Old Dominion University, 1030 University Blvd, Suffolk, VA, 23435, United States of America, jbehr@odu.edu, Rafael Diaz

This research offers a process to identify, model, and simulate medically fragile populations. The product is a metric that allows the identification and ranking of neighborhoods along the three major dimensions of vulnerability (mechanical, psycho-social, and physical/medical) involved in the individual decision to either evacuate or shelter prior to an impending natural event.

2 - Simulating the Disparate Impacts of Sea Level Rise on underserved Populations
Rafael Diaz, Old Dominion University, 1030 University Blvd, Suffolk, VA, 23435, United States of America, RDiaz@odu.edu, Joshua Behr

This research enhances the understanding of how our near-term policy decisions, with regard to the extent of remediation efforts, will condition the dynamics of population health within traditionally underserved populations. We model and simulate the sensitivity of vulnerable populations to the various remediation policy options intended address contaminated sites around the Bay.

3 - Modeling the Ambulatory Healthcare Demand for Supporting Healthcare Resource Planning
Mandar Tulpule, Graduate Research Assistant, Old Dominion University-VMASC, 1030 University Blvd, Suffolk, VA, 23435, United States of America, mtulp001@odu.edu, Rafael Diaz, Joshua Behr

Estimating the trends of future healthcare requirements is a key for effective planning of public health resource requirements. The present study attempts to model the ambulatory healthcare demand in terms of patient visits per year. The model is composed of a system dynamics based population model and a statistical model for per capita healthcare utilization. The proposed model is designed as a decision support tool in deliberations concerning future public health resource requirements.

■ TC50

H - Ardrey Room - 3rd Floor

Joint Session BOM/Workforce: Bounded Rationality, Framing and Reference Points

Sponsor: Behavioral Operations Management/Workforce Engineering and Management

Sponsored Session

Chair: Kay-Yut Chen, Hewlett-Packard Labs, 1501 Page Mill Road, Palo Alto, CA, 94304, United States of America, kay-yut.chen@hp.com

1 - Bounded Rational Pricing, Demand Estimation and Profit Optimization
Guillermo Gallego, Columbia University, Department of IEOR, New York, NY, United States of America, gmg2@columbia.edu, Jay Wang, Kay-Yut Chen

We present methods to estimate demand and recommend prices, subject to sales constraints, in competitive environments where data are scarce. The key ideas are: 1) observed prices may be near equilibrium as bounded rational firms attempt to maximize profit objectives, and 2) historical prices may exhibit correlations. These ideas can be exploited to estimate demands models and recommend price changes. Analysis with real and simulated data suggests that our methods improve upon regression models.

2 - Reference Effects and the Provider's Dilemma
Christina Aperjis, HP Labs, Palo Alto, CA, 94304, United States of America, christina.aperjis@hp.com, Bernardo Huberman

A content provider can increase his revenue through advertisements and subscription fees provided that these inconveniences do not trigger a massive defection from the site. In the presence of reference effects, users tend to adapt to such inconveniences over time. One might thus expect that the provider should increase inconvenience gradually over time in order to maximize the number of long term users. However, we show that in certain cases it is optimal to perform a single change.

■ TC51

H - Caldwell Room - 3rd Floor

Transportation Network Security and Alternative Modes

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Changhyun Kwon, Assistant Professor, University at Buffalo, SUNY, 400 Bell Hall, Buffalo, NY, 14260, United States of America, chkwon@buffalo.edu

1 - A Framework for Assessing Resilience of Networks
Reza Faturechi, PhD. Candidate, University of Maryland, Department of Civil & Env. Engineering, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, reza.faturechi@gmail.com, Elise Miller-Hooks

A framework is proposed for conceptualizing resilience and its various facets, clarifying the interrelationships between these facets previously espoused as independent vulnerability measures in the literature, quantifying resilience and related measures congruously, and optimizing network performance in terms of these resilience concepts.

2 - Transit Vehicle Routing Methods for Large-Scale Evacuation
Mark Hickman, Associate Professor, University of Arizona, 1209 E. Second Street, Bldg. 72, Tucson, AZ, 85721-0072, United States of America, mhickman@email.arizona.edu, Moshe Dror

We consider a routing of public vehicles to evacuate persons during a large-scale emergency. To facilitate the evacuation, we consider a routing of vehicles along roadways to pick up people at their residences or other locations. We present an arc routing model for this case and illustrate the model on a large-scale case study.

3 - Efficient Dynamic Distribution of Security Assets in Transit Systems
Rahul Nair, University of Maryland, 1173 Glenn Martin Hall, University of Maryland, College Park, MD, 20742, United States of America, rahul@umd.edu, Elise Miller-Hooks, Jonathan Kumi, Kevin Denny

A mixed-integer, multi-stage program for the optimal deployment of security assets in transit systems is presented. The model considers a risk measure that depends on passenger volumes and fluctuates over time, as is shown for the Washington, D.C. metro system.

4 - Robust Shortest Path Problems with Two Uncertain Multiplicative Cost Coefficients
Changhyun Kwon, Assistant Professor, University at Buffalo, SUNY, 400 Bell Hall, Buffalo, NY, 14260, United States of America, chkwon@buffalo.edu, Paul Berglund, Taehan Lee

We consider a robust shortest path problem when the cost coefficient is a multiplication of two uncertain parameters. We first show that the robust problem can be solved by a line search with shortest path problems as subproblems. We propose another enumeration-based solution approach using a K-shortest paths finding algorithm that may be efficient in many real cases. An application in hazardous materials transportation is discussed and the solution methods are illustrated by numerical examples.

■ TC52

H - North Carolina - 3rd Floor

Facility Logistics III

Sponsor: Transportation Science and Logistics/Facility Logistics

Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States of America, ananth@engr.wisc.edu

1 - Modeling the Semantics of Warehouses and Their Design
Leon McGinnis, Eugene C. Gwaltney Chair in Manufacturing Systems and Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States of America, leon.mcginnis@isye.gatech.edu

In order to computerize warehouse design, we must have a formal semantic framework describing: (1) the resources and activities of a warehouse; (2) the control of the warehouse; (3) the abstractions used in the design process; and (4) the design process itself. This talk describes the development of such a framework, and speculates on the generalization to discrete event logistics systems.

2 - Road-rail Hub Design for the Physical Internet
Benoit Montreuil, Laval University, CIRRELT Research Center, 2325, rue de la Terrasse, Quebec, Canada, benoit.montreuil@cirrelt.ulaval.ca, Eric Ballot

This paper focuses on the design of road-rail bimodal hubs in a Physical Internet. Such hubs are key nodes in open mobility webs. They receive and ship modular containers in both trains and trucks. The paper introduces the Physical Internet setting, the logical network design of hubs, and provides animated design renderings. It provides analytical and simulation based throughput and space performance estimates. It shows far superior efficiency and flexibility as compared to current hub designs.

3 - Design of a Manufacturing Facility with a Closed Loop Conveyor with Shortcuts Using Queueing Theory
Vernet Lasrado, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL, United States of America, vernet.lasrado@gmail.com, Dima Nazzal

The proposed methodology uses a genetic algorithm to solve the layout design problem for a manufacturing facility with a looped conveyor material handling system with shortcuts using the work in process on the conveyor and the input (loading) stations in a manufacturing facility as the minimizing function.

4 - Grid-based Storage Systems
Kevin Gue, Associate Professor, Auburn University, Auburn, AL, United States of America, kevin.gue@auburn.edu, Onur Uludag

Grid-based storage systems receive, store, and deliver unit-sized items in a densely packed grid. Decentralized control algorithms accommodate material flows in different patterns, including flow-through and single-sided operations. We describe throughput and storage density results for a variety of configurations.

■ TC53

H - South Carolina - 3rd Floor

Joint Session DM/HAS: Quality and Statistical Decision Making in Health Care Applications II

Sponsor: Data Mining/Health Applications

Sponsored Session

Chair: Shuai Huang, Research Assistant, Arizona State University, 2343 West Main Street, Mesa, AZ, 85201, United States of America, shuang31@asu.edu

1 - Optimal Multi-Scale Basis Function Modeling of Spatiotemporal Cardiac Electrical Signals
Hui Yang, Assistant Professor, University of South Florida, 4202 E Fowler Avenue ENB118, Tampa, FL, 33647, United States of America, huiyang@usf.edu, Gang Liu

Cardiac electrical dynamics are initiated and propagated spatiotemporally. Few, if any, previous investigations were aimed at modeling such spatiotemporal cardiac exhibitions. This paper presents a new multiscale spatiotemporal basis function modeling approach to characterize not only temporal but also spatial behaviors of cardiac electrical dynamics. This proposed study is experimentally validated using real-world ECG signals acquired from different cardiac conditions.

2 - Spatiotemporal Biosurveillance: Control Limit Approximation and Spatial Correlation Impact
Mi Lim Lee, School of ISyE, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, mlee79@gatech.edu, Seong-Hee Kim, Kwok-Leung Tsui, David Goldsman

Multivariate CUSUM based scan statistics have been used over the last several years to detect emerging disease clusters in spatiotemporal biosurveillance. The control limits are calibrated by trial-and-error simulation but this task can be time-consuming and challenging as monitoring area becomes large. We introduce a method that analytically approximates control limits, and we study how spatial correlation impacts the scheme's temporal and spatial detection performance.

3 - Data Mining-based Survival Analysis and Simulation Modeling for Lung Transplantation
Asil Oztekin, Assistant Professor, University of Massachusetts-Lowell, United States of America, asiloztekin@yahoo.com, Zhenyu (James) Kong, Dursun Delen

The objective of this research is to develop a decision support methodology for the lung transplant procedure in the US by investigating the UNOS nation-wide dataset via data mining-based survival analysis and simulation-based optimization. The structural equation modeling integrated with decision trees provides a more effective matching between the donor organ and the recipient.

4 - Discovering the Patterns of Chronic Conditions Among Elder Patients Staying in an Urban Hospital
Xiuli (Shelly) Qu, Assistant Professor, North Carolina A&T State University, 1601 E. Market Street, 424 McNair Hall, Greensboro, NC, 27411, United States of America, xqu@ncat.edu, Lauren Davis, Xiaochun Jiang

The recent studies imply that the evidence-bases medical guidelines should be modified for patients with multiple chronic conditions to meet the health care needs by an aging population. The first step to address this problem is to discover the patterns of chronic conditions in an aging population. In this study, data mining techniques were used to analyze the diagnostic data of the elder patients staying in an urban hospital system to discover the patterns of chronic conditions.

■ TC54

H - Charlotte Hall - 3rd Floor

Modeling Retailer Inventory and Capacity Decisions: Strategic Perspectives

Sponsor: Junior Faculty Interest Group (JFIG)

Sponsored Session

Chair: Elizabeth Durango-Cohen, Illinois Institute of Technology, 565 W. Adams Street, Chicago, United States of America, durango-cohen@iit.edu

1 - Optimal Capacity Choice with Imminent Entry
Liad Wagman, Illinois Institute of Technology, 565 W Adams St, Suite 452, Chicago, IL, 60661, United States of America, lwagman@stuart.iit.edu, Elizabeth Durango-Cohen

We study the profit maximizing capacity choice of an incumbent producer facing an entering competitor. If building capacity is lengthy but inexpensive, the incumbent limits capacity when facing a large entrant to reduce competition. If the entrant chooses its capacity prior to entry, the incumbent raises capacity to solidify leadership. If both producers enter simultaneously, retailer profits (prices) are higher (lower). In effect, sequential entry facilitates coordination among producers.

2 - Selling the Retailer's Factory to a National Brand Manufacturer: Changes from Selling to the Enemy
Elizabeth Durango-Cohen, Illinois Institute of Technology, 565 W. Adams Street, Chicago, United States of America, durango-cohen@iit.edu, Candace Yano

Many large grocers own factories that produce some of their store-brand products, but some of these firms are considering the divestment of some of these facilities in order to focus on the retailing, rather than the manufacturing, aspect of their store brands. Among the potential buyers are major national brand manufacturers that produce competing products. We provide equilibrium results on changes in prices and market shares when such a sale takes place.

3 - Retailer's Incentive to Share Aggregate Inventory Information with Consumers
Hyoduk Shin, Assistant Professor, Northwestern University, Kellogg School of Management, Evanston, IL, 60201, United States of America, hyoduk-shin@kellogg.northwestern.edu, Ruomeng Cui

A retailer sells two vertically-differentiated products to consumers. For example, Apple retail store sells iPad of 32G and 16G versions. Customers may inquire inventory information of their preferred version before they come to the store, which is costly. Apple only shares aggregate inventory level rather than each version's separate inventory information. We discuss why a retailer may partially share its inventory information with consumers and when it is optimal to do so.

■ TC55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS: Selling Analytics: A Multi-Industry Panel Discussion

Sponsor: Analytics/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Jeff Day, Senior Anaytical Consultant, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Jeff.Day@sas.com

1 - Selling Analytics: A Multi-Industry Panel Discussion
Moderator: Jeff Day, Senior Anaytical Consultant, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Jeff.Day@sas.com, Panelists: Eric Bibelnieks, Neil Biehn, Steven Howard, Erick Wikum

The phrase 'Selling Analytics' means different things. It can mean selling software or services to external customers or selling the idea and capabilities of analytics to internal departments. Common challenges are maintaining quality, identifying target audiences, competition, prioritization, changing objectives, and sustainability. These dynamics manifest differently depending on context. The objective of this panel is to discuss the similarities and differences across industries.

■ TC56

H - Biltmore Boardroom - 2nd Floor

OR Scheduling I

Contributed Session

Chair: Sangdo(Sam) Choi, TAMU, 3131 TAMU, College Station, TX, 77843-3131, United States of America, samuel4u@tamu.edu

1 - Operating Room Scheduling: A Case Study in KSA

Abdulrahim Shamayleh, Assistant Professor, King Fahd University of Petroleum and Minerals, Deaprtment of Systems Engineering, KFUPM Box 1382, Dhahran, 31261, Saudi Arabia, shamayleh@kfupm.edu.sa

The rise in demand for healthcare is a problem that all countries are facing and the gulf area is no exception. Total health-care spending in the region will reach $60 billion in 2025, up from $12 billion today. Increase in demand for healthcare will result in increase in the hospitals expenditure which is mostly driven by the surgical theater. This paper aims to find the schedule in the surgical theater that optimize the flow of patients and to study the relation between the OR, PACU, and ICU.

2 - Stochastic Surgery Scheduling in Multiple ORs Considering PACU Capacity

Sangbok Lee, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States of America, lee309@purdue.edu

This research considers surgery scheduling of multiple operating rooms (OR) under the uncertainties in service duration and the limited capacity of post anesthesia care unit (PACU). Assuming block-booking in elective surgery admissions and fixed sequence of surgeries, our model determines the start times of operations of each OR to minimize the idle time, overtime and the flow-time.

3 - Co-availability Scheduling Models to Enable Cancer Surgical Team Coordination

James Benneyan, Northeastern University, 360 Huntington Avenue, Boston, United States of America, benneyan@coe.neu.edu, Serpil Mutlu, Ayten Turkcan, Victoria Jordan

We introduce a co-availability scheduling problem that arises in various healthcare and other contexts in which specific personnel are desired or required to work together on the same care team. Binary and constraint programming models are developed to solve a feasibility problem and maximize scheduling-rescheduling flexibility subject to other coverage, time, and load balancing constraints. A breast cancer composite surgery-reconstruction application illustrates the benefits of this approach.

4 - Use of Variability Buffers in Peri-operative Services

Sriram Venkataraman, PhD Student, Clemson University, 401 Sirrine Hall, Department of Management, Clemson, SC, 29634, United States of America, svenkat@clemson.edu, Kevin Taaffe, Lawrence Fredendall, Nathan Huynh

This paper explores how the decisions that firms make over a period of time create variability buffers in their operating systems. We examine variability buffers in a peri-operative system (POS) of one large teaching hospital. We use some of the structural and infrastructural elements proposed by Hayes and Wheelwright (1984) as a framework for our discussion. Case observations and historical data from the POS are analyzed using an econometric framework developed by Olivares et al.(2008).

5 - Master Surgical Block Scheduling

Sangdo(Sam) Choi, TAMU, 3131 TAMU, College Station, TX, 77843-3131, United States of America, samuel4u@tamu.edu, Wilbert Wilhelm

We propose analytical models to prescribe a tactical-level master surgical schedule (MSS) based on strategic-level decisions that assign specialties to specific ORs on particular days and intermediate-term forecasts of the number of surgeries to be performed by each sub-specialty within each specialty. The MSS involves decisions that prescribe the duration of the time block(s) to be scheduled for each sub-specialty and the sequence of time blocks each day for each operating room.

■ TC57

W - Providence I- Lobby Level

Understanding Tradeoffs between Congestion and Emissions in Aviation

Sponsor: Aviation Applications

Sponsored Session

Chair: Lavanya Marla, Systems Scientist, Carnegie Mellon University, 5000 Forbes Avenue, HBH 2102C, PIttsburgh, PA, 15213, United States of America, lavanyamarla@cmu.edu

1 - Simulating the Future Environmental Impact of Aviation

Antony Evans, Research Associate, University of Cambridge, 1-5 Scroope Terrace, Cambridge, CB2 1PX, United Kingdom, antony.evans@cantab.net

Significant growth is anticipated in global air transport over the coming decades, which is expected to have local and global environmental impacts. This paper describes the Aviation Integrated Modelling project, an integrated assessment model for analysis of aviation, environment and economic interactions at local and global levels. The model makes extensive use of OR methods to simulate airline operational responses to environmental policies, new technology, and system capacity constraints.

2 - Integrated Disruption Management and Flight Planning to Trade off Delays and Fuel Burn

Lavanya Marla, Systems Scientist, Carnegie Mellon University, 5000 Forbes Avenue, HBH 2102C, PIttsburgh, PA, 15213, United States of America, lavanyamarla@cmu.edu, Bo Vaaben, Cynthia Barnhart

We present a novel approach addressing airline delays and recovery, by integrating flight planning into disruption management. Flight planning allows us to adjust the speeds and paths of flights dynamically, in order to trade off block time and fuel burn. We present our integrated modeling approach and results for real-world data. Our experiments show a possible decrease in passenger disruptions of 60-79%, with a small increase in fuel burn of 0.25 % and a total cost savings of 9.0 - 9.18%.

3 - Airport Fuel Burn Estimation Using Surface Surveillance Data

Hamsa Balakrishnan, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, hamsa@mit.edu, Harshad Khadilkar

We propose a method to measure fuel burn of taxiing aircraft at airports using surface surveillance data. The fuel burn of each taxiing aircraft is estimated by applying a regression model, previously developed from Flight Data Recorder archives, to aircraft taxi tracks. By combining insights from FDR archives and surface surveillance data, our method can also be used to estimate the potential benefits of surface congestion management strategies.

■ TC58

W - Providence II - Lobby Level

Joint MAS/CPMS/Tutorial: Transforming US Army Supply Chains: Management Innovation in DoD

Sponsor: Military Applications Society/CPMS, The Practice Section of INFORMS/Tutorial

Sponsored Session

Chair: Greg Parlier, Institute for Defense Analyses, Madison, AL, United States of America, gparlier@knology.net

1 - Transforming US Army Supply Chains: Management Innovation in DoD for Improved Efficiency, Productivity, and Cost-Effective Global Operations

Greg Parlier, Institute for Defense Analyses, Madison, AL, United States of America, gparlier@knology.net

This tutorial offers a practical approach for understanding the Army's extremely complex global logistics system, one of the largest in the world. Logically structured using an operations research (OR) approach with an enterprise analytical framework, the new concept of "management innovation as a strategic technology" (MIST) is introduced and described. Cutting-edge supply chain theory, powerful analytical methods, and innovative strategic planning and management concepts are applied to this seemingly intractable national security resource challenge which has remained on the Government Accountability Office's (GAO) "high-risk" list for two decades now.

■ TC59

W - Providence III - Lobby Level

Combining Analytic Methods to Develop New (and Better) Solutions

Sponsor: Service Science

Sponsored Session

Chair: John Dulin, Concurrent Technologies Corp., 771 Fairdale Ct, Castle Rock, CO, 80104, United States of America, dulinj@ctc.com

1 - Summertime: Preference-Based Scheduling at US Air Force Academy

Jim Lowe, Professor, US Air Force Academy, 2354 Fairchild Drive, Department of Management, Colorado Springs, CO, 80840, United States of America, jim.lowe@usafa.edu, Brian LeMay

Each summer, USAFA offers nearly 100 different leadership, training and education experiences to over 3400 students. The scheduling effort provides experiences at USAFA and deployments throughout the US and the world, plus language and cultural immersions. The manual scheduling process was replaced in 2006 and this year's improvement linked the optimization to a Sharepoint site of student preferences. Asking about preferences produced surprising results.

2 - Using OR to Enhance Process Improvement in a Healthcare Setting

Ashlee Knapp, Concurrent Technologies Coporation, 100 CTC Drive, Johnstown, PA, United States of America, knappa@ctc.com, John Dulin

CPI is a widely-used and effective qualitative technique for implementing incremental changes aimed at bettering system performance. In a recent effort, we complemented CPI methodologies with OR techniques to increase the effectiveness of process changes. This resulted in significant performance improvements, demonstrated the value of using several techniques in concert with one another, and reshaped the misconception that process changes are unlikely to influence clinical decisions.

3 - A Combined MDP and Simulation Approach to Evaluate Inventory Decisions During the Product Lifecycle

Anita Vila-Parrish, NCSU, Campus Box 7906, Raleigh, NC, 27695, United States of America, arvila@ncsu.edu

Products with short lifecycles often times exhibit non-stationary demand patterns and uncertainty in demand evolution. In this research we extend the literature that considers multiple modes of supply to consider the impact of these demand patterns on inventory and supplier selection strategies. We utilize MDPs to derive the structure of the optimal policies and then model the system dynamics using simulation.

4 - Using Behavior to Shape Markov Decision Processes

Kim Mamula, Sr Operations Analyst, Concurrent Technologies Corp, 100 CTC Drive, Johnstown, PA, 15963, United States of America, mamulak@ctc.com, John Dulin

MDPs are used to determine decision policies, using probabilities associated with defined actions and states to help determine those policies. They are developed from the perspective of the decision-maker, accounting for outside influences only through stochastic effects. In many cases though,outcomes may be affected by the actions of another person or player. We are investigating the addition of game theoretic elements to MDPs, similar to Markov games, to predict outcomes of events.

■ TC60

W - College Room - 2nd Floor

Joint Session OPT-LP/Opt-IP: Mixed Integer Conic Linear Optimization

Sponsor: Optimization- Linear Programming and Complementarity/Optimization/Integer Programming

Sponsored Session

Chair: Julio C. Goez, Ph.D. Candidate, Lehigh University, Mohler Laboratory, 200 West Packer Avenu, Bethlehem, PA, 18015, United States of America, jcg207@lehigh.edu

1 - Bound Reduction Using Pairs of Linear Inequalities

Pietro Belotti, Assistant Professor, Clemson University, Clemson, United States of America, pbelott@clemson.edu

We present a bound reduction technique for Mixed Integer Nonlinear Programming (MINLP) that combines pairs of linear inequalities of the problem's linear relaxation. This technique generalizes the implied bounds procedure used in Mixed Integer Linear Programming (MILP), but it is much more time consuming. Therefore, we develop a more efficient version. We provide computational results on both MINLP and MILP problems.

2 - Co-positivstellensatz for Semialgebraic Sets

Luis F. Zuluaga, University of New Brunswick, 321 Tilley Hall, Fredericton, Canada, lzuluaga@unb.ca, Javier Peña, Juan Vera

Classical certificates of non-negativity for polynomials; such as Schm¸dgen's Positivstellensatz, are typically written in terms of sums-of-squares polynomials whose degree is not known a priori. We present a novel certificate of non-negativity for polynomials that are positive in a (not necessarily bounded) semialgebraic set that is written in terms of copositive polynomials of known degree.

3 - On Solving Mixed Integer p-order Cone Programming Problems

Alexander Vinel, Department of Mechanical and Industrial Engineering, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States of America, alexander-vinel@uiowa.edu, Pavlo Krokhmal

We consider solving mixed integer p-order cone programming problems that arise in the context of risk optimization with a certain class of risk measures. Several approaches to solving such problems are discussed, including linearization and cut generation techniques. Numerical studies on portfolio optimization and randomly generated problems are conducted.

■ TC61

W - Sharon Room - 2nd Floor

Energy Issues in Transportation

Contributed Session

Chair: Shokoufeh Mirzaei, PhD Candidate, Wichita State University, Department of Industrial and Manufacturi, Wichita State University, wichita, KS, 67260-0035, United States of America, sxmirzaei@wichita.edu

1 - Faciliating Adoption of Green Vehicles: Alternative-Fuel Station Location Decisions

Ismail Capar, Asisstant Professor, Texas A&M University, TAMU 3367, College Station, TX, United States of America, capar@tamu.edu, June Tsai, Jorge Leon

In this research, we introduce an efficient flow refueling location problem formulation for alternative-fuel vehicles (e.g., natural gas, propane, hydrogen, and electric vehicles). Using the proposed MIP formulation, we run analysis on real world and synthetic data to discuss various deployment strategies to facilitate the adoption of alternative-fuel vehicles.

2 - System Modeling and Optimization of On-Line Electric Vehicle

Young Jang, Assistant Professor, Korea Advanced Institute of Science and Technology, 291 Daehakro, Yooseong-ku, KAIST, Industrial and Systems Eng, Daegeon, 305-701, Korea, Republic of, yjang@kaist.ac.kr

I provide the theoretical framework of the infrastructure design for the on-line electric vehicle, which picks up electricity from power strips buried underground through a non-contact magnetic charging method. The Smart Road refers to the road embedded with underground recharging strips wirelessly transmitting the power to the on-line electric vehicles. In this research, we will develop a mathematical framework to optimally design the Smart Road for the on-line electric vehicle system.

3 - A Multi-class Network Equilibrium Model Considering Electric Vehicles with Charging Options

Ti Zhang, Graduate Research Assistant, University of Texas as Austin, 1 University Station C1761, ECJ 6.2, Austin, TX, 78712, United States of America, tizhang@mail.utexas.edu, Jennifer Duthie, Travis Waller

The paper aims to propose an equilibrium model for the destination and route choices which take electric vehicle (EV) travelers into account. The goals are to study how travel behavior is affected by characteristics at the destination including the availability and cost of charging stations, and to quantify the effect of implementing charging incentives.

4 - Energy Efficient Transportation Network by Considering Road Condition and Gradient

Shokoufeh Mirzaei, PhD Candidate, Wichita State University, Department of Industrial and Manufacturi, Wichita State University, wichita, KS, 67260-0035, United States of America, sxmirzaei@wichita.edu, Krishna Krishnan

Vehicle energy efficiency is often studied as a part of the mechanical design problem and not enough efforts has been devoted for energy efficient routing of a vehicle. In this paper, an optimization model presented which finds the best vehicle routing plan to minimize the objective function of energy consumption and emission production. To formulate the problem, the road gradient and condition are considered. An example will be presented to explain the model.

■ TC62

W - Independence Room - 2nd Floor

Energy Production Forecasting

Contributed Session

Chair: Lev Virine, Lead Analyst, Ziff Energy, 1117 Macleod Trail S.E, Calgary, AB, T2W5P7, Canada, lev.virine@ziffenergy.com

1 - Short-term Wind Power Forecasting Solution Based on IBM SPSS Modeler

Haifeng Wang, IBM Research -China, Diamond Building, Zhongguancun Software Park, Beijing, China, whf@cn.ibm.com, Meng Zhang, Xiaoguang Rui, Xinxin Bai, Wenjun Yin, Jun Zhang, Yuhui Fu, Jin Dong

We design a wind power forecasting solution to provide accurate forecasting results on prediction horizons up to 48 hours ahead by exploiting statistical modeling approaches based on IBM SPSS modeler. The solution is flexible to include many types of wind data, such as SCADA data and NWP (numerical weather prediction) data by DB2, and to implement and combine statistical modeling approaches by SPSS modeler. This solution can be deployed for on-line operation at wind farms for forecasting.

2 - A Goal Programming Approach in Energy Decision Making

Ebisa Wollega, Student, University of Oklahoma, 207 Wadsack Dr. Apt F, Norman, OK, 73072, United States of America, ebisa@ou.edu

In this presentation, a multi-criteria decision making goal programming approach for U.S. energy consumption forecast is used. The decision factors considered are production, import, export, demand satisfaction, conservation and minimizing environmental pollutants. The decisions are interdependent and conflicting. Their degree of importance is also different.

3 - Estimation of Crude Oil Production in United States Using Discrete and Extended Kalman Filters

Godwin Assumaning, Graduate Research Assistant, North Carolina A&T State University, 1601 E. Market street, Industrial and Systems Eng., Greensboro, NC, 27411, United States of America, gaassuma@ncat.edu, Shoou-Yuh Chang

Hubbert model has been used to estimate the crude oil production. This model does not exhibit the stochastic nature of the oil production forecasting. In this research, Discrete and Extended Kalman filters were used to estimate oil production. Field data on oil production in U.S were used as true data. Some of the parameters were estimated using Monte Carlo sampling. RMSE method was used to find the error between the techniques. The filters were closer to the true data than the Hubbert model.

4 - Electricity Demand Forecasting Based on Data Mining Algorithms

HyoungRo Lee, Ajou University, San 5, Woncheon-Dong, Yeongtong-Gu, Suwon, 443-749, Korea, Republic of, xpromise@ajou.ac.kr, Hyunjung Shin, Kanghee Park

Climatic disturbances followed by abnormal climates those occured recently makes predicting electricity demand hard. Thus, it needs model which is possible to do prediction accurately with minimum variables. In this research, we used feature selection and extraction which is DataMining techniques to simplify input variables. Then, as Support Vector Regression(SVR) shows excellent performance on prediction model, we applied SVR. It showed better performance when important variables were selected.

5 - Natural Gas Supply and Demand: Forecasting and Decision Analysis

Lev Virine, Lead Analyst, Ziff Energy, 1117 Macleod Trail S.E, Calgary, AB, T2W5P7, Canada, lev.virine@ziffenergy.com

The methodology of analysis and forecasting of natural gas supply and demand was developed. The probabilistic model includes analysis of production, demand, transportation, storage, and pricing in North America and worldwide until 2035. The forecast is used as an input for decision analysis related to large projects including pipelines, production facilities, and LNG terminals.

■ TC63

W - Tryon North - 2nd Floor

Panel Disussion: The Future of Multiple Criteria Decision Making: Where Do We Go From Here?

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Stanley Zionts, State University of New York at Buffalo, Williamsville, NY, United States of America, szionts@buffalo.edu

1 - The Future of Multiple Criteria Decision Making: Where Do We Go from Here?

Moderator: Ralph Keeney, Research Professor, Duke University, Fuqua School of Business, 101 Lombard Street Suite #704W, San Francisco, CA, 94111, United States of America, KeeneyR@aol.com, Panelists: Stanley Zionts, Roman Slowinski, Ralph Steuer, Jyrki Wallenius

The purpose of this panel discussion is to briefly review the past developments and explore the future of Multiple Criteria Decision Making (MCDM). There have been major developments during the past 50 years in different areas of MCDM. The panel includes experts from several of the different schools of MCDM "theory". We are at a time of incredible change in computer and information technology, and how the field evolves will be heavily influenced by the changes that we see.

■ TC64

W - Queens Room - 2nd Floor

Joint Session SPPSN/CPMS/LAW: Fairness and Equity in OR Models

Sponsor: Public Programs, Service and Needs/CPMS, The Practice Section of INFORMS/Law, Law Enforcement and Public Policy

Sponsored Session

Chair: Laura McLay, Assistant Professor, Virginia Commonwealth University, Richmond, VA, 23284, United States of America, lamclay@vcu.edu

1 - Consequences that Matter but Not to Your Client

John Hall, Division Director—Fire Analysis, NFPA, 1 Batterymarch Park, Quincy, MA, 021697471, United States of America, jhall@nfpa.org

Equity is not only about efficient versus equitable distribution of goods or bads. Choosing the goods or bads to include in the analysis also affects equity. Decision-making vetted by all affected parties is an established process in providing engineered designs equivalent in performance to designs set by prescriptive codes. This paper will discuss how equity can involve the choice of outcome measurse and how equity can be supported by a broadly based decision-making process.

2 - Frankenstein, the Mayflower Madam, and the Race Question: Recognizing Ethical Issues

Doug Samuelson, President, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

Is there ever any reason a scientific investigation should not be done? When do we have an ethical concern? Can we do better at spotting such issues in advance and protecting ourselves against getting enmeshed in them? A number of real policy-related examples illustrate the main principles: maintain situation awareness, think more about possible implications, and seek and value alternative viewpoints. And it's hard, but necessary.

3 - Optimally Satisfying Hunger Need through Equitable Food Distribution

Julie Ivy, Associate Professor, North Carolina State University, 400 Daniels Hall, College of Engineering, North Carolina State University, Raleigh, NC, 27695, United States of America, jsivy@ncsu.edu, Lauren Davis, Irem Sengul

We consider the timely delivery of supply constrained donated goods where equity and fairness rather than cost drive allocation decisions. A deterministic network flow model is developed to equitably allocate supply of a regional Feeding America affiliate to the counties it serves. To quantify equity we consider measures of variation in the proportion of the supply distributed per person in poverty with the objective of minimizing the weighted sum of the within and between cluster variation.

4 - Equity vs. Efficiency? A Dilemma in Defensive Resource Allocations against a Strategic Attacker
Xiaojun Shan, University at Buffalo, SUNY, Buffalo, NY, United States of America, xshan@buffalo.edu, Jun Zhuang

We modify an established game-theoretic model by adding an equity constraint within the context of the attacker-defender game. The defender can choose five types of equity constraints, in which equal allocation is proportional to target valuation, population, density, etc. We conduct sensitivity analysis against equity type, budget, and cost-effectiveness of defense. We find that the cost of equity in terms of increases in loss increases convexly in the equity coefficient.

■ TC65

W - Kings Room - 2nd Floor

Industry Specific Service Topics

Contributed Session

Chair: Chihwen Wu, Assistant Professor, National Chung Hsing University, 250 Kuo kuang Road, Deaprtment of Marketing, Taichung, 402, Taiwan - ROC, chihwwu@dragon.nchu.edu.tw

1 - Capacity Planning for Highly Available IaaS Cloud
Rahul Ghosh, Duke University, 130 Hudson Hall, Department of ECE, Durham, NC, 27708, United States of America, rahul.ghosh@duke.edu, Vijay Naik, Francesco Longo, Kishor Trivedi

Server failures are normal part of managing cloud operations. Providers must account for failures in planning for capacity to meet availability objectives. In this paper, we address the following problem: what is the optimal number of physical servers that minimizes total cost without violating downtime requirements set by service level agreements? For the analysis we assume an IaaS cloud with physical servers with multiple states of readiness having different failure-repair characteristics.

2 - Dispatching Strategies for Optimization of IT Services
Victor Cavalcante, Researcher, IBM Research, Rd Jornalista Fco Aguirre Proença, km 09 (SP101), Chàcaras Assay, Hortol,ndia, SP, 13186900, Brazil, victorfc@br.ibm.com, Marco Netto, Claudio Pinhanez, Cleidson de Souza, Maira Gatti

Dispatching policies may drastically impact operations underlying the delivery of services, affecting both internal productivity and the clients' perceptions of service quality. This work addresses a dispatching optimization problem in a large IT service organization by proposing heuristic strategies based on suitable dispatching rules. Experiments reported on real world data are used to compare the strategies implemented and qualitative analysis are validated with dispatching experts.

3 - Salesforce Compensation under Operational Constraints
Tinglong Dai, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, dai@cmu.edu, Kinshuk Jerath

A firm needs to decide the compensation contract for a sales manager whose job is to exert effort to increase the level of demand. We find that the variable compensation rate of the sales manager can increase with increasing demand uncertainty, which is a result contrary to classical salesforce compensation theory but is observed empirically. Also, we endogenously derive a quota-bonus contract as an optimal contract for the sales manager when inventory constraints are incorporated.

4 - The Empirical Study Among Brand Equity, Brand Commitment, Satisfaction, and Brand Loyalty
Chihwen Wu, Assistant Professor, National Chung Hsing University, 250 Kuo kuang Road, Deaprtment of Marketing, Taichung, 402, Taiwan - ROC, chihwwu@dragon.nchu.edu.tw

This study explores the influences of brand equity, brand satisfaction and brand commitment on loyalty in the Taiwan fashion chain store. This research reveals the constructs of brand satisfaction and a correlation between brand satisfaction, brand commitment, brand loyalty. It is increasing understood that to succeed, the reasons influencing brand satisfaction, brand perceptions and the process through which customers become loyal to an automotive brand must be examined.

■ TC66

W - Park Room - 2nd Floor

Workforce Teams and Schedules

Cluster: Workforce Engineering and Management

Invited Session

Chair: David Nembhard, Pennsylvania State University, 310 Leonhard Bldg., University Park, PA, 16827, United States of America, dan12@psu.edu

1 - Develop A Team Selection Protocol from a Human-in-the-Loop Simulation
Gretchen Macht, Pennsylvania State University, 310 Leonhard Bldg., University Park, PA, 16802, United States of America, gam201@psu.edu

A simulation was established to detect the interaction of a dyad's communication and performance during a complex situation. Dyads were selected from a human based metric system to determine the success during the completion of the task. The results impact human based formulation to improve in team performance.

2 - Optimal Worker Task Schedule Within Independent Jobs and Independent Stations Systems with Learning
Frank Bentefouet, Research Assistant, Pennsylvania State University, Industrial and Manufacturing Department, 244 Leonhard Building, University Park, PA, 16802, United States of America, fub3@psu.edu, David Nembhard

Learning/forgetting models within worker-task assignment problem produce a Nonlinear Program (NLP) problem. Our methodology converts the NLP problem into a Linear Program (LP) that maintains optimality and ensures effectiveness with respect to computation time. The methodology assumes general productivity model, holds with forgetting and unequal level of workforce and stations.

3 - Acquisition and Valuation of Workforce Agility for Stochastically Diffused Conditions
Ruwen Qin, Missouri University of Science and Technology, 600 W. 14th Street, 223 EMGT Building, Rolla, MO, 65409, United States of America, qinr@mst.edu, David Nembhard

Workforce training is an effective approach to obtaining workforce agility, a strategy that facilitates profitability in rapidly changing, and highly uncertain production environments. This paper shows that the value of workforce agility and the optimal training decisions are dependent of the stochastic movement of market. Open research questions on workforce agility are also discussed in the paper.

■ TC67

W - Grand A - 2nd Floor

Social Computing

Sponsor: Artificial Intelligence

Sponsored Session

Chair: Ahmed Abbasi, Assistant Professor, University of Virginia, McIntire School of Commerce, Charlottesville, VA, 22908, United States of America, abbasi@comm.virginia.edu

1 - Finding Useful Documents in Online Knowledge Communities: A Text Categorization Approach
Alan Wang, Virginia Tech, Blacksburg, VA, United States of America, alanwang@vt.edu, Weiguo Fan, Xiaomo Liu

In this paper we seek to develop an automated categorization approach to intelligently assessing the usefulness of user postings in online communities. Guided by the Knowledge Adoption Model, we identify 8 feature sets to measure the argument quality and source credibility of postings. We build a machine learning-based categorization engine using these 8 feature sets. Our experiments using a real world online community data show that all feature sets improve the text categorization performance.

2 - Cyber-security in the Health 2.0 Era: Identifying Fake Medical Websites Using the Network Stack
Siddharth Kaza, Towson University, 8000 York Road, Towson, MD, 21252, United States of America, skaza@towson.edu, Jason Koepke, Ahmed Abbasi

In the Health 2.0 era, people are increasingly using online services for their medical needs and are susceptible to malicious websites. Capturing a website's network stack signature, including server signatures and responses to Hyper Text Transfer Protocol requests, provides detailed features for identification of fake websites. We use learning techniques to identify malicious websites and obtain promising results that can lead to high accuracies in preventing fraud in this problem domain.

3 - Location-sensitive Friend Recommendation in Online Social Networks

Jiaxi Luo, University of Wisconsin-Milwaukee, Sheldon B. Lubar School of Business, Milwaukee, WI, United States of America, Huimin Zhao

Friend recommendation as a service provided by an online social network has the potential to facilitate network growth and consequently information diffusion. It helps new users to overcome the "cold start" problem and build their own initial networks more quickly. It also encourages old users to further expand their personal networks. As the number of users of GPS-enabled mobile devices, such as smart phones and tablets, has been fast growing in recent years, online social networks have started to provide location-sensitive services (e.g. Facebook check-in deals) to mobile users. In this study, we further investigate the utility of the location information collected by an online social network at the check-in of a mobile user in friend recommendation using machine learning techniques. Our empirical evaluation using data of a real social network shows that incorporating the location information improves recommendation quality.

■ TC68

W - Grand B - 2nd Floor

Competition in Supply Chain

Contributed Session

Chair: Ajay Pal Singh Rathore, Professor, Malaviya National Institute of Technology, Malaviya Nagar, Jaipur, India, apsr100@yahoo.co.in

1 - The Role of Price and Service Mechanisms in Managing the Competition from Gray Markets

Foaad Iravani, Doctoral Candidate, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095-1481, United States of America, firavani@anderson.ucla.edu, Reza Ahmadi, Sriram Dasu

The diversion of goods from authorized distribution channels to gray markets has become a challenge for many companies. The existing literature mostly focuses on pricing decisions in the presence of gray markets. In reality, however, demand is greatly influenced by non-price factors. In a game setting, we explore the price and service decisions of a manufacturer facing gray market and examine the effect of market and service parameters on the optimal strategy and the emergence of the gray market

2 - Controlling Speculation in a Two-stage Supply Chain

Tianke Feng, Mr., University of Florida, 323 University Village APT 8, Gainesville, FL, 32603, United States of America, fengtk@ufl.edu, Joseph Geunes

We study the role and influence of speculators in a two-stage, manufacturer-retailer supply chain. Speculators create artificial shortages of popular products (e.g., toys) by removing them from store shelves in hordes and then selling them at inflated prices on sites such as eBay. We identify the impact of speculation on supply chain decisions and the profits of supply chain players. We also discuss managerial measures that can regulate the degree of such speculation.

3 - Competing with Bandit Supply Chains

Meng Li, The university of texas at dallas, 7650 Mccallum Blvd, Dallas, United States of America, meng.li@utdallas.edu, Jun Zhang

Bandit products have captured significant market shares in China and begun expanding to the rest of the world. In this paper we examine the bandit phenomenon by studying the competition between an integrated supply chain and a decentralized supply chain. Due to the free riding effect,bandit supply chains may become high-quality providers. A mainstream firm's profit as a function of the free riding effect is U-shaped; free riding by bandit supply chains may consequently benefit mainstream firms.

4 - Supply Chain Coordination and Product Design with Multiple Attributes

Bing Liu, University of Alabama, Operations Management Program, Tuscaloosa, AL, 35401, United States of America, bing.liu@ua.edu, Charles Sox

This paper studies the supply chain coordination on partially substitutable products which are differentiated by the retail price and another product attribute. We conduct an analysis on double marginalization issue. Then we present a coordination contract and investigate the impact of another attribute on the price only strategy. It is expected that such an analysis can help the manufacturer find an optimal value for the attribute under investigation.

5 - On Competitiveness Indicators for Indian Auto Component Industry

Ajay Pal Singh Rathore, Professor, Malaviya National Institute of Technology, Malaviya Nagar, Jaipur, India, apsr100@yahoo.co.in, Deepika Joshi, Bimal Nepal

Growing involvement of Indian auto component business into global supply chain has made it a critical and highly complicated challenge in competitiveness building. This paper presents an empirical study on determinants of competitiveness for Indian automotive component industry in special context to supply chain activities. The study was conducted focusing on twenty four diverse elements of competitiveness. Next, an ANP technique is used to prioritize the competitiveness factors.

■ TC69

W - Grand D - 2nd Floor

Product Design, New Product Introduction and Sustainability

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Eda Kemahlioglu Ziya, Assistant Professor, University of North Carolina-Chapel Hill, Kenan- Flagler Business School, McColl 4707, Chapel Hill, NC, United States of America, Eda_KemahliogluZiya@unc.edu

1 - The Impact of a Competing Remanufacturer on a Firm's Product Quality Choice

Adem Orsdemir, Kenan-Flagler Business School, 743 E Franklin St., Chapel HilL, NC, 27514, United States of America, adem_orsdemir@unc.edu, Eda Kemahlioglu Ziya, Ali Parlakturk

We study how the existence of an independent remanufacturer (IR) affects an OEM's product-quality decisions and the social surplus. We show that when remanufacturing cost advantage is low, OEM can deter the IR's entry. This reduces the social surplus compared to the no-competition case. When IR barely enters the market, OEM still serves high-valuation consumers and surplus is smaller than the no-competition case. High remanufacturing cost advantage increases surplus.

2 - Replacement Decisions for Potentially Hazardous Substances

Feryal Erhun, Stanford University, MS&E, Stanford, CA, United States of America, feryal.erhun@stanford.edu, Robert Carlson, Tim Kraft, Dariush Rafinejad

As public awareness of environmental hazards increases, a growing concern for firms is the potential negative impact of their products and the chemicals those products contain. We analyze the optimal decisions of firms when a substance within a product is identified as potentially hazardous. When replacement costs are expected to be millions of dollars, regulation is uncertain, and consumer and NGO pressures exist, a carefully developed plan that balances costs and risks is critical for a firm.

3 - Designing and DiffUsing Environmentally-friendly Innovations: An Exploratory Case Study

Cheryl Druehl, George Mason University, Fairfax, VA, United States of America, cdruehl@gmu.edu, Michael Naor, Ednilson Bernardes

Diffusion of environmentally-friendly innovations is often slow and uncertain. Customer interest in sustainability does not always translate into purchases and incentives, albeit important, may not be sufficient. Other barriers to diffusion, both functional and psychological, remain. We explore how design innovations and strategic action using the encroachment framework can facilitate diffusion of these innovations in the context of an Israeli electric vehicle infrastructure company.

4 - You Say Tomato, I Say Baseball: understanding the Food Supply Chain

Deishin Lee, Assistant Professor, Harvard Business School, Soldiers Field Road M483, Boston, MA, 02163, United States of America, dlee@hbs.edu, Baris Ata, Mustafa Tongarlak

We compare two food supply chain paradigms: industrial and "local". The industrial supply chain leverages economies of scale and producer specialization. Local food supply chains cannot compete on volume, but can offer improved freshness and regional distinctiveness. We explore why the industrial model is so dominant in existing food supply chains. We examine what levers can be effective for improving the competitiveness of the local food supply chain.

Tuesday, 4:30pm - 6:00pm

■ TD01

C - Room 201A

Pricing/Competition in Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Ming Hu, University of Toronto, Rotman School of Management, Toronto, ON, Canada, Ming.Hu@Rotman.Utoronto.Ca

1 - Supply Chain Intermediation: A Three Tier Competition Model
Elodie Adida, Assistant Professor, University of Illinois at Chicago, Mechanical and Industrial Engineering, 842 W. Taylor St. (MC 251) Room 3025 ERF, Chicago, IL, 60607, United States of America, elodie@uic.edu, Nitin Bakshi, Victor DeMiguel

We study the effect of intermediaries between multiple competing retailers acting as leaders and multiple competing suppliers in the supply chain. We determine the influence of the presence of intermediaries on the supply chain equilibrium. We also identify conditions under which retailers benefit from the presence of intermediaries. Finally, we analyze the effect of intermediaries on the supply chain efficiency.

2 - Risk Premiums in the Newsvendor Model
Guillaume Roels, Assistant Professor, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90066, United States of America, groels@anderson.ucla.edu

We consider the price-setting newsvendor model and characterize the sign, sensitivity, and magnitude of the risk premiums, under an additive-multiplicative demand model. Our characterization of the risk premium generates insights into the role of pricing as a hedge against demand uncertainty.

3 - Supplier Development in Competitive Supply Chains with Uncertain Demand
Sean Zhou, Chinese University of Hong Kong, Hong Kong - PRC, zhoux@se.cuhk.edu.hk, Qiying Hu

Two supply chains offer substitutable products. Each chain consists of a supplier and a manufacturer facing random market demand. The manufacturer can invest in its supplier to help reduce its production cost. We characterize the equilibrium solutions and examine the impact of competition and channel structures on supplier development and each firm's profitability.

4 - Reorder Flexibility and Price Competition for Differentiated Products with Market Size Uncertainty
Ming Hu, University of Toronto, Rotman School of Management, Toronto, ON, Canada, Ming.Hu@Rotman.Utoronto.Ca, Philipp Afeche, Yang Li

We study a two-stage procurement-pricing problem faced by competing suppliers of seasonal products with uncertain market size. How many units to order, at a lower unit cost, prior to knowing the market size? Once the market size is known, how to price the product and how many units to reorder at a higher cost? We characterize equilibrium order/reorder and pricing strategies. We find that reorder flexibility may increase or hurt firms' profits and provide specific conditions for these outcomes.

■ TD02

C - Room 201B

Customers and Retailers

Contributed Session

Chair: Wenjing Shen, Drexel University, 101 N. 33rd Street, Philadelphia, United States of America, ws84@drexel.edu

1 - Providing Personalized Services for Customers Based on Usage Data from Connected Devices
Fei Liu, IBM Research China, Diamond Building A, Zhongguancun Software Park, Beijing, 100193, China, liufeilf@cn.ibm.com, Changrui Ren, Jinfeng Li, Miao He, Jin Dong

A tremendous amount of devices become connected, as can be illustrated by recent proliferation of smart phones, pads, TVs. By analyzing data exposed from devices, like device status and usage history, manufacturers and service providers now have chance to gain a deep understanding of devices and customers. In this paper, we will first present a conceptual framework of providing personalized services based on the understanding. Then a formulation of personalized warranty design will be developed.

2 - Contract Design in Anticipation of Retailers' Noncompliance Risk
Xuemei Su, California State University, Long Beach - CBA, 1250 Bellflower Blvd, Long Beach, CA, 90840, United States of America, xsu@csulb.edu, Xiachang Yue

This research captures dynamic relationships of a supply chain populated by a dominant retailer and a number of fringe retailers. Linear Quantity Discount contract and Grove Wholesale Price contract are usually used to coordinate the supply chain. However, these contracts also invite channel-flow-diversion type of gray trading between the dominant retailer and the fringe retailers. The paper focused on how the manufacturer can minimizes the negative impact of retailers' noncompliance activities.

3 - Lateral Transhipment with Customer Switching
Wenjing Shen, Drexel University, 101 N. 33rd Street, Philadelphia, United States of America, ws84@drexel.edu, Xinxin Hu, Yi Liao

We consider a lateral transshipment problem between two retailers where an uncertain fraction of the unfulfilled demand may switch to another retailer with inventory. We show that the firm with surplus inventory may not transship all request inventory and identify conditions when full, partial or no transshipment takes place. We provide sufficient conditions for a unique Nash equilibrium and evaluate the impact of customer switching behavior on inventory decisions and equilibrium profits.

■ TD03

C - Room 202A

Substitution and Inventory Characterization

Contributed Session

Chair: Kai Hoberg, University of Cologne, Albertus-Magnus Platz, Cologne, Germany, kai.hoberg@uni-koeln.de

1 - Managing Inventories with One-way Substitution: A Newsvendor Analysis
Yannick Deflem, K.U.Leuven, Naamsestraat 69, Leuven, Belgium, yannick.deflem@econ.kuleuven.be, Inneke Van Nieuwenhuyse

This research aims at investigating the optimal design of a 2-item inventory system with one-way substitution, in which the flexible item is used as a backup of the regular item when it stocks out. We study a newsvendor approach which allows to derive optimality conditions for the base-stock policy.

2 - The Role of Innovation Efficiency and Labor Productivity in Inventory Turnover Performance
Jianer Zhou, Boston College, Fulton Hall 454C, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States of America, jianer.zhou@bc.edu, Hsiao-Hui Lee, Po-Hsuan Hsu

This paper associates firms' inventory turnover (IT) with their capabilities of utilizing intangible innovation and human resources, approximated by innovation efficiency (IE) and labor productivity (LP), respectively. We empirically show that IT increases with both measures and there exists a lagged and declining effect of IE on IT. Furthermore, firms with more innovations appear to be more sophisticated in managing inventory performance and hence have smaller room for further improvement.

3 - Does It Swing? An Empirical Analysis of Inventory Volatility in Supply Chains
Kai Hoberg, University of Cologne, Albertus-Magnus Platz, Cologne, Germany, kai.hoberg@uni-koeln.de, Sebastian Steinker

We use quarterly firm-level data of US companies to analyze the volatility of inventories. Based on a comprehensive literature review and economic theory hypotheses are developed. Then, a performance measure for inventory volatility is derived that is used to identify the level of volatility in companies. Next, the determinants of inventory volatility are identified and linked to different drivers. Finally, the financial impact of volatile inventories for a company is investigated.

■ TD04

C - Room 202B

Metaheuristic Methods and Applications

Sponsor: Computing Society/Optimization: Surrogate and Derivative-free Optimization(Joint Clusters)

Sponsored Session

Chair: Michele Samorani, Leeds School of Business, University of Colorado at Boulder, UCB 419, Boulder, CO, 80309, United States of America, michael.samorani@colorado.edu

1 - Improving Performance by Strategic Manipulations of Tabu Search Memory Structures

Michele Samorani, Leeds School of Business, University of Colorado at Boulder, UCB 419, Boulder, CO, 80309, United States of America, michael.samorani@colorado.edu, Manuel Laguna

Tabu search relies on short and long term memory strategies to create a balance between search intensification and diversification. For instance, attribute-based short-term memory operates by forbidding specific attribute values for a number of iterations. We investigate new policies for handling historical information recorded in tabu search structures and show how these mechanisms improve performance in several classes of problems.

2 - Solving a Sequencing Problem with Two Dimensional Setup Costs

Subhamoy Ganguly, University of Colorado at Boulder, 419 UCB, Boulder, CO, 80309, United States of America, Subhamoy.Ganguly@Colorado.edu, Manuel Laguna

We study a problem encountered in closed-loop production facilities where parts of several shapes must be painted with different colors to satisfy a given demand. Costs are incurred to switch between colors and to switch between shapes. We present integer programming formulations that minimize costs and work reasonably well for small instances of the problem. For industrial scale instances, we develop heuristic procedures based on the GRASP and VNS methodologies and compare their performances.

3 - Tabu Search for the Uncapacitated Single p-hub Median Problem

Mary Beth Kurz, Associate Professor, Clemson University, 104A Freeman Hall, Clemson, SC, 29634, United States of America, MKURZ@clemson.edu

The uncapacitated single p-hub median problem (USApHMP) is concerned with locating a set of hubs and allocating non-hub nodes to the hubs in a network. We consider USApHMP with a discount factor for flows which are directly transferred between hubs. Due to the complexity in computing an objective evaluation, caching is applied to speed up the algorithm. An effective tabu search with caching is implemented to improve performance with respect to solution and computational time.

4 - A Metaheuristic Approach for Risk Minimization in Supply Chain Network Design Problems

AliReza Madadi, PhD Student, Clemson University, 202B Freeman Hall, Clemson, SC, 29634, United States of America, amadadi@Clemson.edu, Mary Beth Kurz

Supply chain disruptions, while rare, may have catastrophic consequences. For instance, in healthcare, disruption may put lives in danger. Minimizing cost may result in a fragile supply chain (susceptible to disruption). We attempt to minimize the risk of disruption in a supply chain in which a subset of unreliable capacitated facilities (that can be inspected) can be used to manufacture a product. We develop metaheuristics to solve resulting models using a Conditional Value-at-Risk approach.

■ TD05

C - Room 203A

Optimizing Cancer Screening Using Partially Observable Markov Decision Processes (POMDPs)

Cluster: Tutorials

Invited Session

Chair: Oguzhan Alagoz, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, alagoz@engr.wisc.edu

1 - Optimizing Cancer Screening Using Partially Observable Markov Decision Processes (POMDPs)

Oguzhan Alagoz, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, alagoz@engr.wisc.edu

We show how to apply partially observable Markov decision processes (POMDPs) for optimizing cancer screening decisions. We use a previously developed POMDP model for mammography screening to demonstrate the development and application of a POMDP model for cancer screening. In addition, we describe challenges for applying POMDPs to model other cancer screening problems as well as possible future research directions.

■ TD06

C - Room 203B

Scheduling Integrated with Other Issues

Contributed Session

Chair: Mesut Yavuz, Shenandoah University, 1460 University Drive, Winchester, VA, US, 22601, United States of America, myavuz@su.edu

1 - Integrated Production and Distribution Problem with Product Lifespan and Truck Service Time Limits

Su Gao, Clark Atlanta University, 223 James P. Brawley Drive, Atlanta, United States of America, speed.gao@gmail.com

In many industries, the operations of production and delivery must be highly coordinated. This is particularly important for the make-to-order processes where products have relatively short lifespan. We study a variation of the IPDP with individual customer due dates, product lifespan and truck service time limits. Similar problems are renowned for being hard to solve due to the lack of good structural properties, thus we propose two efficient heuristics upon lower bound approaches.

2 - A Scheduling Model with Dynamic Electricity Price and Local Generator

Anna Danandeh, PhD Student, University of South Florida, 4202 East Fowler Avenue,, ENC 1203, Tampa, 33620-5350, United States of America, annadanandeh@mail.usf.edu, Bo Zeng, Mehrnaz Abdollahian

Electricity price changes over time in the deregulated market. In this paper a scheduling model is developed for a set of jobs to minimize energy cost, with consideration of local generation, job precedence and preemption. The numerical result is presented to demonstrate the effectiveness of this model.

3 - Exact and Heuristic Algorithms for the Combined Car Sequencing & Level Scheduling Problem

Mesut Yavuz, Shenandoah University, 1460 University Drive, Winchester, VA, US, 22601, United States of America, myavuz@su.edu

The combined car sequencing & level scheduling problem (CS&LSP) is an NP-Hard optimization problem arising in just-in-time production systems. The problem is constrained by product options so much so that even finding a feasible solution is challenging. This study develops an iterated beam search (IBS) method for the CS&LSP that can be used as a heuristic or an exact method. A computational study on a testbed from the literature shows that IBS is efficient and effective.

■ TD07

C - Room 204

Joint Session LAW/Analytics/CPMS: Current Law Enforcement Models of Assignment, Mass Egress and Site Security

Cluster: Law, Law Enforcement and Public Policy/Analytics/CPMS, The Practice Section of INFORMS

Invited Session

Chair: Doug Samuelson, President, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

1 - U.S. Secret Service Agent-based Behavioral Modeling for Site Security and Egress

Doug Samuelson, President, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com, Mark Harmon

We report on work in progress to address some of the most significant challenges at present in agent-based simulations of site security, mass egress and evacuation. We focus in particular on behaviors likely to occur in crisis egress situations and the effects those behaviors are likely to have on managing egress. Of these, the most significant are associated group movements, effects of direction and instruction, effects of toxic plumes, and interaction with emergency responders' movement.

2 - Operational Security Analytics: Doing More with Less

Colleen McCue, Senior Director, Social Science & Quantitative Methods, GeoEye, 7921 Jones Branch Dr, Suite 600, McLean, VA, 22102, United States of America, McCue.Colleen@geoeye.com

Companies in the commercial sector understand the importance of being able to anticipate behavior in order to respond efficiently and effectively. Embracing this model, the public safety community is moving from a focus on "what happened" to a system that allows them to anticipate future events and optimize resources. As these agencies increasingly are asked to do more with less, the ability to anticipate crime enables information-based tactics and strategy in support of prevention and response.

3 - U.S. Secret Service Visualization Modeling for Site Security and Egress

Mark Harmon, Director, SIMLAB, U S Secret Service, Washington, DC, United States of America, mark.harmon@usss.dhs.gov, Doug Samuelson

We report on work in progress to improve visual depictions of crowd movement and reactions to law enforcement and security personnel. For modest-scale problems, it is possible to incorporate realistic behaviors and responses at the level of a good video game. This greatly facilitates the development and use of simulation-based training and planning exercises. A major set of challenges involves more efficient, less costly input and inter-model transfer of data.

■ TD08

C - Room 205

Industrial Software for Constraint Programming

Sponsor: Computing Society/ Constraint Programming and Integrated Methods

Sponsored Session

Chair: Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, United States of America, vanhoeve@andrew.cmu.edu

1 - Constraint Programming at IBM Software Group

Paul Shaw, IBM, 1681 Route Des Dolines, Valbonne, 06560, France, paul.shaw@fr.ibm.com

We present the constraint programming technology developed at ILOG and now at IBM Software Group, as embodied in the CP Optimizer engine, a key component of CPLEX Optimization Studio. We describe some of the innovative features of CP Optimizer which make it particularly suitable for industrial use, using examples to illustrate the main ideas.

2 - Constraint Programming to Solve Business Problems

Gertjan de Lange, Product Strategy AIMMS, Paragon Decision Technology, Haarlem, 2034 LS, Netherlands, g.de.lange@aimms.com, Deanne Zhang

With the new extension of CP in AIMMS, we can solve a class of business problems using logical and scheduling concepts. We are immensely surprised and excited: the CP 'language' is more approachable for many (lowering the hurdle of its use), the integrated AIMMS visualization capabilities allows for good insight and end-user acceptance, and the readily available LP and NLP solvers allow for advanced integrated solving techniques. In this presentation, we want to share some practical examples.

3 - Operations Research at Google

Laurent Perron, Google, 38 Avenue de l'Opéra, Paris, 75002, France, lperron@google.com, Luc Mercier

The Operations Research and Optimization team at Google develops both general purpose optimization tools and solutions for internal optimization problems. We will describe the tools - most of which are available at code.google.com/p/or-tools - and present a few applications, for example in the area of assigning jobs to machines. We will also share our future plans.

4 - Xpress-Kalis: Algorithm and Application Design Choices

Susanne Heipcke, Lead Scientist, FICO, Xpress Team, 54 Rue Balthazar de Montron, Marseille, 13004, France, SusanneHeipcke@fico.com, Oliver Bastert, Florent Cadoux, Fabrice Buscaylet

This talk gives a quick overview on the Constraint Programming functionality of Xpress-Kalis, highlighting recent new features. By means of application examples we demonstrate its integration and combination with other components of the FICO Xpress Optimization Suite, in particular joint use with Xpress-Optimizer (sequential and concurrent decomposition algorithms) and visualization features supporting model development and analysis.

■ TD09

C - Room 206A

Advances in Pricing Optimization

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Robert Phillips, Nomis Solutions, 1111 Bayhill Dr., San Bruno, NY, 94066, United States of America, robert.phillips@nomissolutions.com

1 - Price Optimization and Competition under the Nested Logit Model with Product-differentiated Price Sensitivity

Guillermo Gallego, Columbia University, Department of IEOR, New York, NY, United States of America, gmg2@columbia.edu, Ruxian Wang

We study the nested MNL pricing model with product-differentiated price sensitivities and general nest coefficients. Our analysis shows that optimal adjusted markups (price- cost minus reciprocal of price sensitivity) are constant across all the products in each nest. This reduces a multi-product optimization problem into a single parameter bounded optimization problem. We show under mild conditions the oligopoly game is super modular in the adjusted markups and discuss the monopolist problem.

2 - Network Pricing and the Cost of Anarchy

Ahmet Serdar Simsek, PhD Student, Columbia University, 4L Uris Hall, Columbia Business School, New York, NY, 10027, United States of America, asimsek13@gsb.columbia.edu, Robert Phillips

We consider a capacitated network of perishable resources in which products are defined by combinations of connecting legs. We analyze the effect on total network of different levels of pricing control. We show that decentralized pricing leads to a loss of network revenue relative to centralized case and we present bounds on this loss in the case of deterministic demands. We also show that decentralized solution can be arbitrarily bad relative to centralized solution as the network grows large.

3 - Dynamic Pricing with an Unknown Linear Demand Model

N. Bora Keskin, PhD Candidate, Stanford University, 53 Dudley Ln Apt 101, Stanford, CA, 94305, United States of America, Keskin_Bora@GSB.Stanford.edu, Assaf Zeevi, J. Michael Harrison

Consider a monopolist who sells a set of products over a finite time horizon. The seller initially does not know the parameters of the underlying linear demand curve, but can estimate them based on demand observations. We take as our point of departure a widely used policy called greedy iterated least squares (greedy ILS), which combines sequential estimation and myopic optimization. While greedy ILS performs quite poorly, we show how it can be modified to give near-optimal performance.

■ TD10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - American Optimal Decisions - Portfolio Safeguard (PSG): Advanced Nonlinear Mixed-Integer Optimization Package

Stan Uryasev, Consultant, American Optimal Decisions, 5214 SW 91 Way, Ste. #130, Gainesville, FL, 32608, United States of America, uryasev@ufl.edu

Portfolio Safeguard is an advanced nonlinear mixed-integer optimization package used in risk management, financial engineering, military, medical and other applications. Design and solve complex optimization problems with built-in functions (maximum, StDev, variance, probability, VaR, CVaR, cardinality, fixed-charge, recourse etc.) See real-life case studies in Windows and MATLAB at www.aorda.com/aod/psg.action.

2 - Tableau Software - Stop Wrestling with Your Data-Start Exploring it with Tableau

Sophia Kan, Tableau Software, 837 N. 34th St., #400, Seattle, WA, 98103, United States of America, skan@tableausoftware.com

Tableau Desktop is based on breakthrough technology from Stanford University that lets you drag and drop to analyze data. You can connect to data in a few clicks, then visualize and create interactive dashboards with a few more. Tableau Software transforms stubborn databases and spreadsheets into sources for easy investigations. It's so easy to use that any Excel user can learn it. Answer questions as fast as you can think of them.

■ TD11

C - Room 207A

Stochastic Models for Supply Chains and Service Centers

Sponsor: Applied Probability

Sponsored Session

Chair: Alan Scheller-Wolf, Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, awolf@andrew.cmu.edu

1 - Optimization of Server Farms

Ivo Adan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612 AZ, Netherlands, iadan@tue.nl, Sandra van Wijk, Vidyadhar Kulkarni

In a server farm with infinite servers, each server can be busy, idle, or off. Jobs arrive according to a PP and request exponential services. A new job occupies an idle server if there is one, and otherwise an off server (changing to busy). When a server becomes idle, there is the option to keep it idle or to switch it off. Costs for idling are c ptu; costs to switch to from off to on are K. We derive the heuristics and the policy minimizing the expected total discounted cost.

2 - Provisioning for Critically Loaded Loss Networks

Cathy Xia, Associate Professor, Ohio State University, 210 Baker Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, xia.52@osu.edu, Yue Tan

This talk provides new approaches to solve the provisioning problem for critically loaded multi-class Erlang loss network. We develop an asymptotic provisioning methodology to minimally satisfy the blocking probability requirements for multiple classes of customers, each of which has an associated Poisson arrival process and an arbitrary holding time distribution. While cloud computing is going mainstream, our method helps the provider to be more reliable and efficient in reserving resources.

3 - Asymptotically Optimal Policies for a Dynamic Lot Size Model with Lost Sales

Mark S. Squillante, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Rt. 134 / P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com, Yingdong Lu, David D. Yao

We study a general dynamic lot size problem with lost sales under uncertain demand and derive results to estimate and calculate shortages in the system asymptotically based on a random walk approach. Making use of these calculations, we identify asymptotically optimal solutions to various cost minimization problems under different settings.

4 - Service Center Staffing with Cross-trained Employees, Heterogenous Customers, and Quality Guarantees

Elvin Coban, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, ecoban@andrew.cmu.edu, Aliza Heching, Alan Scheller-Wolf

We model a service center with cross-trained employees serving customer requests that are heterogeneous with respect to the skills they require and their priority: Higher priority requests preempt lower priority requests and less skilled employees can only service less demanding requests, while highly skilled employees can service all requests. We model this system as a Markov chain, and apply approximation and bounding techniques to evaluate the response times of different control policies.

■ TD12

C - Room 207BC

Advances in Approximate Dynamic Programming

Sponsor: Computing Society/ Computational Stochastic Optimization

Sponsored Session

Chair: Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, enluzhou@illinois.edu

1 - Approximate Stochastic Annealing for Online Control of Markov Decision Processes

Jiaqiao Hu, State University of New York at Stony Brook, Math Tower 1-107, Stony Brook, NY, United States of America, jqhu@ams.sunysb.edu

We present an online simulation-based algorithm for solving infinite-horizon finite state-action space Markov decision processes. The algorithm estimates the optimal policy by sampling from a distribution function over the policy space, which is updated based on the Q-function estimates obtained via a recursion of Q-learning type. We establish the convergence of the algorithm under mild conditions and provide numerical examples to illustrate its performance.

2 - Lagrangian Relaxation and Constraint Generation for Large Weakly Coupled MDPs

Archis Ghate, University of Washington, Industrial and Systems Engineering, Box 352650, Seattle, WA, 98195, United States of America, archis@u.washington.edu, Yasin Gocgun

We present a hybrid Lagrangian relaxation and constraint generation method for solving weakly coupled MDPs in which each component of the multidimensional state- and/or action-space is itself exponential. Numerical results on large-scale dynamic stochastic resource allocation problems will be discussed.

3 - A Bounding Approach to Optimal Stopping under Partial Observation

Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, enluzhou@illinois.edu, Fan Ye

We study the optimal stopping problem under partial observation, and propose a bounding approach to numerically obtain asymptotically lower and upper bounds on the true value function. The approach is applied to pricing American options under partial observation of stochastic volatility, which is a more realistic model than the fully observable stochastic volatility that is often assumed in the literature on American option pricing.

■ TD13

C - Room 207D

Pricing with Inventory or Real Estate

Contributed Session

Chair: Jing Chen, Assistant Professor, Faculty of Business and Economics, the University of Winnipeg, 515 Portage Avenue, Winnipeg, MB, R3B 2E9, Canada, je.chen@uwinnipeg.ca

1 - An Integrated Estimation-optimization Approach for Dynamic Joint Inventory-pricing Problems

Sirong Luo, Assistant Professor, Shanghai University of Finance and Economics, Guoding Road 777, Shanghai, 200433, China, luo.sirong@shufe.edu.cn, Dan Zhang

We study the classical joint inventory pricing problem. Following recent advances in statistics, we model demand using the generalized additive model. We show that a dynamic programming formulation of the problem can be solved via a variable transformation technique, and the optimal policy is a BSLP policy. We show how technical assumptions made can be incorporated in the statistical model estimation step, leading to an integrated estimation optimization framework.

2 - Pricing Competition in Supplier-driven and Buyer-driven Channels

Su Zhao, Industrial and Systems Engineering, Texas A&M University, 303K Zachry, TAMU 3131, College Station, TX, 77840, United States of America, zhaos@tamu.edu, Eylem Tekin, Sila Cetinkaya

We study pricing decisions for multiple products delivered by multiple entities in a decentralized buyer-vendor system. The demands of products are price-dependent with cross effects. We design buyer-driven contracts under competition and explore the impacts of the power structure, competition structure and information asymmetry on supply chain performance.

3 - Joint Pricing and Inventory Strategy under Uncertain Demand for Competitive Products

Fei Fang, PhD/MPil in management, University of Southampton, Room 3057, Building 2, Highfield campus, University of Souampoton, University Rd, Southampton, SO171BJ, United Kingdom, ff1e08@soton.ac.uk, Yue Wu

This paper examines a joint pricing and inventory problem of perishable products (e.g. milk, bread) under uncertain demand for a multiple periods review. A mixed integer nonlinear model is presented to determine different prices and inventory levels. Computation results show the optimal results and demonstrate the effectiveness of the model.

4 - Pricing Problem of a Monopolist in the Presence of Investors

Nur Ayvaz, Columbia University, 530 w 120 room 821, New York, NY, 10027, United States of America, na2191@columbia.edu, Soulaymane Kachani, Ali Sadighian

Motivated by the problem of a real estate developer, we study the dynamic pricing problem for a monopolist serving a market with two customer streams; the first of which is "regular buyers", who purchase the unit for personal purposes, while others are "investors" who purchase with the intention of selling at a higher price later, cannibalizing some seller demand. The goal is to study seller's revenue maximization problem in various settings, in particular with or without "callable" units.

5 - An Optimal Pricing for Lease Expiration Management

Jing Chen, Assistant Professor, Faculty of Business and Economics, the University of Winnipeg, 515 Portage Avenue, Winnipeg, MB, R3B 2E9, Canada, je.chen@uwinnipeg.ca, Jian Wang

Lease expiration management (LEM) is an important practice in apartment industry. We propose an approach to setting the optimal rental rates for the scenario of single lease terms. This method will help apartments to optimally manage demand under the context of LEM such that the revenue contribution will be maximized.

■ TD14

C - Room 208A

Joint Session ENRE/Optimization: Stochastic Programming in Strategic Energy System Planning

Sponsor: Energy, Natural Resources and the Environment-Energy/Optimization – Stochastic Programming

Sponsored Session

Chair: Asgeir Tomasgard, Professor, NTNU, Alfred Getz vei 1, Trondheim, 7024, Norway, asgeir.tomasgard@iot.ntnu.no

1 - Natural Gas Infrastructure Design with a Production Perspective

Kjetil Midthun, SINTEF, SP Andersens vei 5, Trondheim, 7036, Norway, Kjetil.Midthun@sintef.no, Asgeir Tomasgard, Marte Fodstad, Lars Hellemo, Adrian Werner

We present a multistage stochastic model that evaluates investments in natural gas infrastructure, taking into account existing and planned design. The uncertainty facing the decision makers include both upstream and downstream uncertainty, such as; reservoir volumes, the composition of the gas in new reservoirs, market demand and price levels. In addition, it is important to analyze the robustness of the system to ensure a high level of security of supply.

2 - A Multi-stage Stochastic Programming Approach to Power System Expansion Planning

Morten Bremnes Nielsen, PhD candidate, NTNU, Alfred Getz vei 3, Trondheim, 7491, Norway, morten.bremnes.nielsen@iot.ntnu.no, Asgeir Tomasgard

In this work a multi-stage stochastic programming approach is applied to determine optimal investment in generation and transmission capacity. The model was developed to find how best to include a large share of renewable generation in an existing system. To address the effects on investments of short term uncertainty in the availability of renewable generation capacity, the model includes both long term strategic investment decisions and short term operational planning.

3 - Parallelized Branch and Fix Coordination on Energy System Investment Problems

Gerardo Perez Valdes, Postdoctor, Norwegian University of Science and Technology, Sentralbygg I, Alfred Getz veg 3, Trondheim, Norway, gerardo.valdes@iot.ntnu.no, Asgeir Tomasgard, Adela Pages, Laureano Escudero, Marte Fodstad, Gloria Perez, Maria Araceli Garin, Maria Merino

Branch and Fix coordination helps us to solve large multi-stage stochastic mixed integer optimization problems. Parallelizing BFC is advantageous: it allows us to deal with otherwise intractable instances, and scenario cluster solution is seemingly well suited for parallel settings. We have applied BFC to energy infrastructure settings, where investment decisions are binary, and economic parameters are uncertain. Results on the implementation are presented and discussed.

4 - A System for Solving Stochastic Unit Commitment Problems for the Smart Grid

Ali Koc, IBM TJ Watson Research Center, Yorktown Heights, NY, akoc@us.ibm.com, Jayant Kalagnanam

Unit commitment lies in the heart of the future smart grid. ISOs and utilities aim to solve various forms of this problem handling such contemporary practices as renewable generation, energy storage, power purchase contracts, demand response, etc. We use stochastic programming to incorporate the uncertainties induced by these practices. We give a parallel branch-cut-price algorithm to solve this large-scale stochastic nonlinear problem and a new scenario reduction method specific to the problem.

■ TD15

C - Room 208B

Decision Analysis, Game Theory and Homeland Security I

Sponsor: Decision Analysis

Sponsored Session

Chair: Jun Zhuang, University at Buffalo, SUNY, 435 Bell Hall, Buffalo, NY, United States of America, jzhuang@buffalo.edu

1 - A Robust-optimization Defender-attacker Game with Incomplete Information

Mohammad Nikoofal, PhD Candidate, McGill University, Desautels Faculty of Management, Bronfman Building, 1001 Sherbrooke West, Montreal, QC, H3A 1G5, Canada, mohammad.nikoofal@mail.mcgill.ca, Jun Zhuang

This paper develops a robust-optimization game-theoretical model for optimal defense resource allocation of a rational defender facing a strategic attacker while the attacker's value of targets is unknown for the defender. The key features of our model include: modeling uncertainty in attacker's attributes using bounded distribution-free intervals, and, finding the robust-optimization equilibrium using concepts dealing with budget of uncertainty and price of robustness.

2 - Optimal Surveillance Patrol

Kyle Lin, Associate Professor, Naval Postgraduate School, 1411 Cunningham Rd, Monterey, CA, 93943, United States of America, kylin@nps.edu, Michael Atkinson, Kevin Glazebrook, Timothy H Chung

A patroller traverses a graph through edges to detect potential attacks at nodes. To design a patrol policy, the patroller needs to take into account not only the graph structure, but also the different attack time distributions at different nodes. We consider both random attackers and strategic attackers, and develop index-based heuristics for patrolling. Numerical experiments demonstrate the effectiveness of our heuristics.

3 - Quality-bounded Solutions for Finite Bayesian Stackelberg Games: Scaling Up

Milind Tambe, Professor, University of Southern California, PHE 410, Los Angeles, CA, 90089, United States of America, tambe@usc.edu, Manish Jain, Christopher Kiekintveld

The fastest known algorithm for solving Bayesian Stackelberg games has seen direct practical use at the LAX airport for over 3 years. As we scale up to larger domains, like protecting flights with the Federal Air Marshals, it is critical to develop newer algorithms that scale-up significantly beyond the limits of the current state-of-the-art. We present and evaluate a novel technique based on hierarchical decomposition that is orders of magnitude faster than best known previous Bayesian solvers.

4 - Hazard Prevention by Public and Private Partnership
Peiqiu Guan, University at Buffalo, 91 Springville Avenue, Buffalo, NY, 14226, United States of America, peiqiugu@buffalo.edu, Jun Zhuang

Public and private partnerships are critical in preparing for man-made and natural disasters. This research provides a game-theoretical model identifying the equilibrium partnership strategies between the government and private citizens. Government could either directly invest or subsidize private sectors. Results show that the increase in government's investment/subsidy can either lead to an increase or a decrease in private citizens' investment.

5 - Balancing Pre-disaster Preparedness and Post-disaster Relief
Fei He, University of Buffalo, SUNY, Buffalo, NY, United States of America, feihe@buffalo.edu, Jun Zhuang

Huge amounts of resources have been invested in preventing and recovering from disasters. However, the economic and efficient strategy to balance resource allocations for pre-disaster and post-disaster efforts is unclear. In this paper, a two-stage dynamic model is proposed to study this tradeoff, in order to minimize the total damage and investment costs. Both analytical and numerical results are presented; and future research directions are discussed.

■ TD16

C - Room 209A

Supply Chain Sustainability Issues

Sponsor: Energy, Natural Resources and the Environment/ Environment and Sustainability

Sponsored Session

Chair: Baris Ata, Professor, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, b-ata@kellogg.northwestern.edu

Co-Chair: Deishin Lee, Assistant Professor, Harvard Business School, Soldiers Field Road M483, Boston, MA, 02163, United States of America, dlee@hbs.edu

1 - Scenario Optimization Approach for Designing a Supply Chain and Logistics Model for Switchgrass
Sharma Bhavna, Oklahoma State University, Biosystems and Agricultural Engineering, Stillwater, OK, United States of America, bhavna.sharma@okstate.edu, C. Jones, B.R.G. Ingalls

A scenario optimization model is developed to ensure cost effective and in-time delivery of switchgrass to the biorefinery. Weather is the major factor for randomness and uncertainty in field operations. We present some results obtained from the model with different weather scenarios considered in a case study for Abengoa Bioenergy Biomass of Kansas.

2 - Ensuring Adequate Feedstock Supply: Supply Chain Management for Next-generation Biofuels
Adaora Okwo, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, aokwo@gatech.edu

Key roadblocks prevent large-scale adoption of cellulosic ethanol. We consider the challenge of ensuring adequate feedstock using a SC framework. We analyze the land allocation response of a multi-product agricultural producer to various contracts under yield uncertainty. Using a numerical example, we compare contracts by their equilibrium outcomes, perform sensitivity analysis on key parameters and discuss implications of contract structure in the context of developing next-generation biofuels.

3 - Impact of Downstream Competition on Innovation in a Supply Chain
Jingqi Wang, Northwestern University, Kellogg School of Management, Evanston, IL, United States of America, Jingqi-wang@kellogg.northwestern.edu, Hyoduk Shin

We explore the impact of downstream competition on innovation in supply chains. We find that downstream competition may either increase or decrease innovation, depending on the contract form. Our findings have implications related to First Solar's recent challenge on how to encourage component manufacturer(s) to invest more on innovation.

4 - Optimizing Organic Waste to Energy Operations
Mustafa Tongarlak, Northwestern University, Kellogg School of Management, Evanston, IL, 60208, United States of America, mtongarlak@u.northwestern.edu, Baris Ata, Deishin Lee

We determine the profit-maximizing operating strategy of a waste to energy firm that recycles organic waste with energy recovery. We show that in an urban setting, offering full geographic coverage is profit-maximizing for the firm. This strategy is naturally aligned with the social planner's desire to maximize landfill diversion. However, in a rural setting, partial coverage may be optimal. We also show how regulatory mechanisms affect the operating decisions of the firm.

■ TD17

C - Room 209B

Learning, Exploration and Exploitation

Sponsor: Decision Analysis

Sponsored Session

Chair: Canan Ulu, Assistant Professor, University of Texas at Austin, 1 University Station, B6500, Austin, TX, United States of America, canan.ulu@mccombs.utexas.edu

Co-Chair: Dorothee Honhon, Assistant Professor, University of Texas at Austin, McCombs School of Business, 1 University Station, Austin, TX, United States of America, dorothee.honhon@mccombs.utexas.edu

1 - Diagnostic Accuracy under Congestion
Saed Alizamir, Duke University, Fuqua School of Business, Durham, NC, United States of America, saed.alizamir@duke.edu, Francis de Vericourt, Peng Sun

In diagnostic services, agents typically need to weigh the benefit of running an additional test and improving the accuracy of diagnosis against the cost of congestion. Our paper analyzes how to dynamically manage this accuracy/congestion tradeoff. The diagnostic process consists of a search problem in which the agent providing the service conducts a sequence of imperfect tests to determine whether a customer is of a given type. Our analysis yields new insights into managing diagnostic services.

2 - Dynamic Pricing Strategies in the Presence of Demand Shocks
Denis Roland Saure, University of Pittsburgh, Pitssburgh, PA, 15261, United States of America, dsaure@pitt.edu, Omar Besbes

We study the problem of a retailer endowed with an initial inventory of a product that is to be sold during a finite horizon. We analyze the trade-off between inventory depletion and instantaneous revenue when the retailer expects a change in the demand environment. We study two settings: i.) the retailer has a prior belief on the change; and ii.) the retailer assumes an adversarial selection of the change. We show that for a broad class of instances, optimal price trajectories are monotonic.

3 - Learning Consumer Tastes: A Nonparametric Bayesian Model
Canan Ulu, Assistant Professor, University of Texas at Austin, 1 University Station, B6500, Austin, TX, United States of America, canan.ulu@mccombs.utexas.edu, Dorothee Honhon

We develop a nonparametric Bayesian learning model for a firm that can gather information about consumer tastes through sales of its product assortment. The firm can dynamically change its product assortment from period to period to gather better information about consumer tastes.

4 - Experiments on Learning with Censored Information
Dorothee Honhon, Assistant Professor, University of Texas at Austin, McCombs School of Business, 1 University Station, Austin, TX, United States of America, dorothee.honhon@mccombs.utexas.edu, Canan Ulu, Kyle Hyndman

Often, there are multiple sources of information available to the decision maker that vary in terms of their precision and costs. We design an "urns and balls"-type experiment in which subjects are to determine the probability that a particular urn has been chosen by gathering either uncensored, censored or no information. By varying the cost of different strategies, we study possible biases in the subjects' evaluation of uncensored versus censored information.

■ TD18

C - Room 210A

Scheduling Algorithms: Project Scheduling and Control

Cluster: Scheduling and Project Management

Invited Session

Chair: Mario Vanhoucke, Ghent University, Tweekerkenstraat 2, Gent, 9000, Belgium, mario.vanhoucke@ugent.be

1 - An Efficient Solution Method for the Resource Availability Cost Problem
Thomas De Jonghe, PhD Student, Ghent University, Tweekerkenstraat 2, Gent, 9000, Belgium, thomas.dejonghe@ugent.be, Mario Vanhoucke

The resource availability cost problem minimizes the total cost of resources required for completing a project before a specified deadline, satisfying a set of precedence relations. In this study we analyze the structure of this problem and compare the strengths and weaknesses of different possible solution strategies. Based on these insights we developed a new metaheuristic approach and demonstrate its efficiency on a dataset of construction projects.

2 - Statistical Project Control in Project Management: What Can Simulations Teach Us?
Jeroen Colin, PhD Student, Ghent University, Tweekerkenstraat 2, Gent, 9000, Belgium, jeroen.colin@ugent.be, Mario Vanhoucke

Throughout the years, different procedures have been proposed to control the variation in a project's execution phase. We believe that a Multivariate Statistical Process Control-approach, originated in on-line monitoring of batch processes, on simulated data can learn us how to accurately control a real-life project's execution. Preliminary results of this promising technique will be presented.

3 - A Genetic Algorithm Procedure for the Time-Constrained Project Scheduling Problem
Vincent Van Peteghem, PhD, EDHEC Business School, 24, Av. Gustave Delory, Roubaix, 59057, France, vincent.vanpeteghem@edhec.edu, Mario Vanhoucke

In this paper, a genetic algorithm procedure for the Time-Constrained Project Scheduling Problem is proposed. In this problem, the cost of additional resources, which can be temporarily allocated in certain periods to meet a given deadline, should be minimized. The procedure makes use of shift vector representation and a local search procedure, which shifts cost causing activities. Computational experiments are applied on modified RCPSP benchmark instances and reveal promising results.

4 - Multi-Mode Resource Constrained Multi-Project Scheduling and Resource Portfolio Problem
Gündüz Ulusoy, Professor, Sabanci University, Orhanli, Tuzla, Istanbul, 34956, Turkey, gunduz@sabanciuniv.edu, Umit Bilge, Umut Besikci

In a multi-project management environment, rather than sharing of resources by projects dedication of resources to projects might be the case. Such a multi-project environment is modeled in an integrated fashion as the Resource Portfolio Problem (RPP) and a two phased genetic algorithm employing a new improvement move, Combinatorial Auction for RPP, is proposed as a solution approach. The solution approach is tested with different problem sets and shown to be efficient.

■ TD19

C - Room 210B

Topics in Finance

Sponsor: Financial Services Section

Sponsored Session

Chair: Bruce Moore, bwmoore22@verizon.net

1 - The Carrot: Rewarding Bad Managers and Firm Innovation
Arnav Sheth, Saint Mary's College of California, Moraga, CA, 94556, United States of America, aas3@stmarys-ca.edu

We explore the effectiveness of a compensation scheme that rewards misbehaving managers for giving early payouts to firm owners. This reward mechanism might help with cost reduction and employee retention.

2 - Convertible Debt Financing and Managerial Compensation
Kyoko Yagi, Akita Prefectural University, 84-4 Ebinokuchi, Tsuchiya, Yurihonjo, Akita, 015-0055, Japan, yagi@akita-pu.ac.jp, Ryuta Takashima

This paper considers the capital structure and managerial compensation of a firm issuing convertible debt in real options framework. We explore a pay-performance sensitivity (PPS) for firms issuing either straight debt or convertible debt. We show the result is consistent with empirical evidences that argue the PPS decreases in straight debt leverage, but is higher in firms issuing convertible debt. We analyze the effect of the issue of convertible debt and managerial compensation on the PPS.

3 - All Words Are Not Made Equal: Beyond Dictionaries in Finance
Nitish Sinha, University of Illinois at Chicago, 2427 University Hall, M/C 168, 601 South Morgan, Chicago, IL, 60607, United States of America, nrsinha@uic.edu

We analyze the tone of WSJ column — Abreast of the Market — using popular text analysis techniques and compare with tags obtained via crowd sourcing. We find that the dictionary based technique performs unsatisfactorily. The under-performance stems from (a) assigning equal weight to each word in the negative/positive dictionary and (b) analyzing only at the word level rather than phrases and complete sentences. Popular text analysis tools e.g. Naive Bayes perform better.

■ TD20

C - Room 211A

Optimization Models for Network Robustness

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Vladimir Boginski, Assistant Professor, University of Florida, 1350 N Poquito Rd, Shalimar, FL, 32579, United States of America, vb@ufl.edu

1 - Recent advances in Critical Element Detection in Analyzing Graphs
Jose Walteros, University of Florida, Center for Applied Optimization, 303 Weil Hall, Gainesville, FL, 32611-6595, United States of America, jwalteros@ufl.edu, Panos Pardalos

The problem of detecting critical elements in a graph involves the identification of a subset of elements (nodes or/and arcs) whose deletion minimizes the connectivity of the resulting subgraph. This problem has attracted some attention in recent years because of its applications in several fields such as telecommunications, social network analysis, homeland security, and epidemic control. We present a review of the recent advances on the field, including exact and heuristic approaches.

2 - Evaluation of Metaheuristics for Identifying Critical Components in a Service System
Chun-Hung Cheng, Associate Professor, The Chinese University of Hong Kong, Department of Syst Eng & Eng Mgmt, Shatin, NT, Hong Kong - PRC, chcheng@se.cuhk.edu.hk, Tsz Wai Lai, Yuntao Zhu

Critical components of a service system must be protected to ensure the system's robustness. In this work, we explore models and algorithms for identifying these components in a system. Specifically, metaheuristics and their performance relative to optimal solutions are examined. Extensive computational results will be presented.

3 - Risk Management Techniques for Fixed Charge Network Flow Problems with Uncertain Arc Failures
Alexey Sorokin, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, sorokin@ufl.edu, Vladimir Boginski, Artyom Nahapetyan

We consider fixed charge network flow problems with uncertain network topology, that is, each arc in a network has a probability of failure. CVaR risk measures are used for restricting potential losses of flow due to uncertain arc failures. We demonstrate that efficient heuristics for finding good quality solutions (within less than 5% from optimality on benchmark instances) can be utilized, and present computational results for large and dense networks.

4 - Analysis and Design of Robust Low-Diameter Network Clusters
Alexander Veremyev, University of Florida, 303 weil hall, Gainesville, United States of America, averemyev@ufl.edu, Vladimir Boginski

One of the key robustness requirements is the short path connectivity between each pair of nodes, which makes a network cluster more robust with respect to potential network component disruptions. Several new compact linear 0-1 programming models for identifying such network clusters (referred to as k-clubs) will be discussed in this talk. Optimal design strategies of low diameter networks that can provably provide certain robustness characteristics will be also considered.

5 - Optimal Design of Low-Diameter Robust Clusters in Directed Graphs
Grigory Pastukhov, University of Florida, 303 weil hall, Gainesville, United States of America, gpastukhov@ufl.edu, Alexander Veremyev, Eduardo Pasiliao, Vladimir Boginski

We consider the problems of optimal design of attack-tolerant clusters in directed graphs, which have a property of maintaining low diameter after multiple component failures. Optimization problems, heuristics, and related analytical results will be discussed.

■ TD21

C - Room 211B

Joint Optimization/ ENRE: Decision Making Under Uncertainty for Energy and Environmental Systems

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Mort Webster, Assistant Professor, Massachusetts Institute of Technology, E40-235, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, mort@mit.edu

1 - Optimal Climate Change Policy: R&D Investments and Abatement under Uncertainty

Erin Baker, Associate Professor, University of Massachusetts, Amherst, Amherst, MA, United States of America, edbaker@ecs.umass.edu, Senay Solak

Given the uncertainty defined by currently available data in technological success and climate change, what are optimal investment policies that maximize social welfare? We answer this question by implementing probabilistic data collected from expert elicitations into a stochastic Integrated Assessment Model (IAM) and derive insights about the structure of optimal funding policies and how they interact with optimal abatement.

2 - An Approximate Dynamic Program for Modeling Low-carbon Energy Research Investments under Uncertainty

Nidhi Santen, PhD Candidate, Massachusetts Institute of Technology, E40-246, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, nrsanten@mit.edu, Karen Fisher-Vanden, Mort Webster, David Popp

Analyses of global climate change policy as a multi-period decision under uncertainty have been severely restricted by dimensionality and computational burden. We present a stochastic dynamic programming formulation of the ENTICE-BR climate policy model. We illustrate the application of approximate dynamic programming techniques to numerically solve for optimal low-carbon energy R&D investment, fossil energy usage, and low-carbon backstop energy usage decisions under technological uncertainty.

3 - R&D Investment Strategy for Low-Carbon Energy Technologies: Stochastic Dynamic Programming Approach

Haewon McJeon, Joint Global Change Research Institute, 5825 University Research Court, Suite 3500, College Park, MD, 20740, United States of America, hmcjeon@pnl.gov, Leon Clarke

Public R&D can accelerate the development of low-carbon technologies, substantially reducing the CO2 stabilization cost. We present a stochastic optimization model for the allocation of R&D funds among competing low-carbon technology options, explicitly incorporating the probabilities of success and the impact of technology on stabilization costs. The intertemporal model incorporates an act-and-learn strategy that further optimizes upon observations of success and failure of prior investments.

4 - Dynamic Competitive Equilibria in Stochastic Electricity Markets

Gui Wang, University of Illinois at Urbana-Champaign, 157CSL, 1308 West Main Street, Urbana, IL, 61801, United States of America, guiwang2@illinois.edu, Anupama Kowli, Matias Negrete, Ehsan Shafieepoorfard, Uday Shanbhag, Sean Meyn

We focus on competitive equilibria of electricity markets, in the face of volatility and dynamic constraints. In wide generality, we establish the standard conclusions of competitive equilibrium theory: Market equilibria are efficient, and prices coincide with marginal costs. However, these conclusions hold only on average. The dynamical characteristics of these equilibria can be highly undesirable for both consumers and suppliers. We illustrate these finding through numerical experiments.

■ TD22

C - Room 212A

Variational Inequalities and Applications

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Shu Lu, Assistant Professor, University of North Carolina at Chapel Hill, Department of Statistics and Operations Research, 355 Hanes Hall, CB#3260, Chapel Hill, NC, 27599, United States of America, shulu@email.unc.edu

1 - A Computational Framework for a Class of Equilibrium Problems

Stephen Robinson, Professor Emeritus, University of Wisconsin-Madison, ISyE/UW-Madison, 1513 University Avenue Rm 3015, Madison, WI, 53706, United States of America, smrobins@wisc.edu

We describe a unified framework for analyzing and solving a large class of problems of equilibrium type, including optimization problems as special cases. The analytic portion uses a formulation as a system of smooth, generally nonlinear, equations over a monotone graph. The computational portion employs specialized Newton methods for these problems that exploit the analytic results and the special structure. Examples illustrate the capability for fast solution of these problems.

2 - Nonconvex Cognitive Radio Games with Side Constraints

Gesualdo Scutari, Assistant Professor, State University of New York (SUNY) at Buffalo, Department of Electrical Engineering, State University of New York at Buffalo, Buffalo, NY, 14260, United States of America, gesualdo@buffalo.edu, Jong-Shi Pang

This contribution proposes a novel Nash problem for cognitive radio networks, wherein each secondary user aims to maximize his own opportunistic throughput by choosing jointly the sensing and transmission parameters, subject to aggregate interference constraints imposed by the primary users. The resulting game is nonconvex and there are bi-convex side constraints. We develop a novel optimization-based theory for studying the game and devising distributed algorithms along with their convergence properties.

3 - Confidence Regions for Stochastic Variational Inequalities

Shu Lu, Assistant Professor, University of North Carolina at Chapel Hill, Department of Statistics and Operations Research, 355 Hanes Hall, CB#3260, Chapel Hill, NC, 27599, United States of America, shulu@email.unc.edu, Amarjit Budhiraja

The sample average approximation (SAA) method is a basic approach for solving stochastic variational inequalities. We propose a method to build asymptotically exact confidence regions for the true solution that are computable from the SAA solutions, by exploiting the precise geometric structure of variational inequalities and by appealing to certain large deviations probability estimates.

■ TD23

C - Room 212B

Terminal and Airspace Optimization Models

Sponsor: Aviation Applications

Sponsored Session

Chair: Rajesh Ganesan, George Mason University, Fairfax, VA, United States of America, rganesan@gmu.edu

1 - Dynamic Airspace Configuration Using Dynamic Programming

Sameer Kulkarni, George Mason University, Fairfax, VA, United States of America, skulkar2@gmu.edu, Rajesh Ganesan, Lance Sherry

In this talk, we evaluate our sectorization algorithms for the ZFW ARTCC on a normal day with normal and severe weather conditions. We compare the results of our approach to the state-of-the art techniques in static resectorization to demonstrate the proof-of-concept for using dynamic programming approaches. Our results indicate that the state-of-the art results are achievable using dynamic programming approaches.

2 - Multistage Air Traffic Flow Management under Capacity Uncertainty: A Robust and Adaptive Optimization

Shubham Gupta, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-149, Cambridge, MA, 02139, United States of America, shubhamg@mit.edu, Dimitris Bertsimas

We study the first application of robust and adaptive optimization in the Air Traffic Flow Management problem. We introduce a weather-front based approach to model the capacity uncertainty. We prove the equivalence of the robust problem to a modified instance of the deterministic problem and solve optimally the LP relaxation of the adaptive problem using affine policies. Finally, we report empirical results from the proposed models that illuminate the merits of our proposal.

3 - An Optimization Model and Decision Support System for Integrated Arrival Traffic Scheduling

Peng Cheng, Associate Professor, Tsinghua University, Main Building 411, Beijing, 100084, China, chengp@tsinghua.edu.cn, Wenda Liu

Airlines usually have a preference to schedule their flight to land on the nearest runway to its terminal, which would significantly reduce the taxiing time.We propose a mixed integer program based model, which takes airline's preference into consideration, to provide an optimal entry fix assignment, landing sequence and runway allocation for arrival flights.A decision support system based on the above model was developed for managing arrival traffic to the Beijing Capital International Airport.

4 - Reduced-taskload Optimization Models for Conflict Resolution
Senay Solak, Assistant Professor, University of Massachusetts Amherst, Isenberg School of Management, Department of Finance & Operations Mgmt, Amherst, MA, 01003, United States of America, solak@som.umass.edu, Adan Vela, Karen Feigh

Based on the need that conflict-resolution decision support tools must account for controller taskload, we explore methodologies to introduce a subset controller taskload modeling into conflict-resolution programs through a parametric approach. Specifically, we introduce two conflict-resolution programs with the objective of managing controller conflict-resolution taskload, i.e. the number of maneuvers used to separate air traffic. Computational results demonstrate that inclusion of such parametric models can successfully regulate controller conflict-resolution taskload.

■ TD24

C - Room 213A

Computational Mixed-Integer Nonlinear Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Jim Luedtke, Assistant Professor, University of Wisconsin-Madison, 3236 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 5370, United States of America, jrluedt1@wisc.edu

1 - Valid Inequalities and Computations with Pooling Problems
Jeff Linderoth, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, & Department of Computer Sciences, 1513 University Avenue, 3226 Mechanical Engineering Bldg., Madison, WI, 53706-1572, linderoth@wisc.edu, Jim Luedtke, Claudia D'Ambrosio, Andrew Miller

The pooling problem is a bilinear program that models linear blending in a network. We study two different elementary sets arising from variations of the pooling problem. We give valid inequalities for these sets and demonstrate the utility of our inequalities for practical computations.

2 - Linearization-based Algorithms for Quasiconvex MINLPs
Mahdi Hamzeei, Research Assistant, University of Wisconsin-Madison, 3241 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, hamzeei@wisc.edu, Jim Luedtke

We present linearization-based algorithms for quasiconvex mixed-integer nonlinear programs (MINLPs). First, we review some recently developed methods, including an outer approximation algorithm that works as long as the continuous relaxation is convex (not necessarily defined by convex functions). Based on insights gained from this review, we introduce a new algorithm for quasiconvex MINLPs. The relative strengths and weaknesses of these methods are demonstrated in computational experiments.

3 - Lifted Inequalities for Bilinear Flow Constrained Sets
Akshay Gupte, Georgia Tech, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, akshayg@gatech.edu, Shabbir Ahmed, Santanu S. Dey

We study the set of feasible solutions defined by a bilinear equality constraint and a total flow balance constraint. This set often arises in chemical processing networks such as pooling problems. Valid inequalities are obtained by lifting facets that define polyhedral relaxations of restrictions of this set. Different lifting sequences and their properties are discussed.

4 - A Hierarchy of Relaxations for Convex Generalized Disjunctive Programs
Juan Ruiz, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, jpruiz@andrew.cmu.edu, Ignacio Grossmann

We propose a framework to generate alternative mixed-integer nonlin- ear programming formulations for disjunctive convex programs that lead to a hierarchy of relaxations. We prove that the tightest of these relaxations, allows in theory the solution of the disjunctive convex program as a nonlinear programming problem. We apply the theory developed to improve the computational efficiency of solution methods for nonlinear convex generalized disjunctive programs.

■ TD25

C - Room 213BC

Empirical Research in Operations Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Saravanan Kesavan, University of North Carolina, Chapel Hill, NC, United States of America, skesavan@unc.edu

1 - Empirical Analysis of the Relationship between Sourcing Strategy and Performance
Serguei Netessine, Professor, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, serguei.netessine@insead.edu, Karan Girotra, Nitish Jain

We use transactional data for US imports to analyze the relationship between import operations and performance of US public companies.

2 - An Empirical Investigation of Inventory Write-downs
Fuqiang Zhang, Professor, Washington University in St. Louis, Operations & Manufacturing Management, St. Louis, MO, United States of America, FZhang22@wustl.edu, Danko Turcic, Chad Larson

This paper studies the impact of inventory write-downs on firms' financial performance. It also examines the association between firms' sales growth, ordering behavior and the potential inventory write-down risks.

3 - The Relationship between Abnormal Inventory Growth and Earnings for U.S. Public Retailers
Saravanan Kesavan, University of North Carolina, Chapel Hill, NC, United States of America, skesavan@unc.edu, Vidya Mani

In this paper we examine the relationship between inventory levels and one-year ahead earnings of retailers using publicly available financial data. We demonstrate an inverted-U relationship between abnormal inventory growth and one-year ahead earnings per share for retailers. We also show that an investment strategy based on abnormal inventory growth yields significant abnormal returns.

■ TD26

C - Room 213D

Advancing Operations Management Through Empirical Research

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Nicole DeHoratius, University of Portland, 5000 N. Willamette Blvd, Portland, OR, United States of America, dehorati@up.edu

1 - Staffing Headaches – Who to Hire?
Rachna Shah, Associate Professor, University of Minnesota, 321 19th Avenue South, 3-150 Carlson School of Management, Minneapolis, MN, 55455, United States of America, shahx024@umn.edu, Susan Goldstein

Hiring non-permanent employees instead of permanent employees and a rebalancing of expertise and skill mix by hiring more generalist than specialists are on the rise in recent years. However, whether organizations achieve similar performance benefits from non-permanent generalist employees compared to permanent specialists is not clear. In the current study, we disentangle the organizational and individual performance outcomes of non-permanent generalist and permanent specialist employees.

2 - Workaround Culture in Hospitals
Anita Tucker, Associate Professor, Harvard University, 413 Morgan Hall, Soldiers Field, Boston, MA, 02163, United States of America, atucker@hbs.edu, Jo Ellen Holt, Mary Ann Fuchs

We developed a survey to measure workaround culture in hospitals. We pilot tested the survey at a national nursing conference. We plan on administering the survey at Raleigh Durham Hospital and Duke University Hospital. We will correlate results on workaround with incident reports and nurse "sick-call ins".

■ TD27

C - Room 214

Healthcare Operations: Patient Flow in Hospitals

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Mor Armony, Associate Professor, New York University, 44 West 4th Street, New York, NY, 10012, United States of America, marmony@stern.nyu.edu

1 - Controlling Excessive Waiting Times in an Emergency Department through Personnel Capacity

Mieke Defraeye, PhD Candidate, K.U.Leuven, Naamsestraat 69, Leuven, 3000, Belgium, mieke.defraeye@econ.kuleuven.be, Inneke Van Nieuwenhuyse

The time-varying demand for service that characterizes numerous service systems tends to complicate staffing decisions severely. We address this problem from the viewpoint of an emergency department, where a primary goal is to control excessive waiting times. In this presentation, we propose a simulation-based heuristic to determine staffing levels in a single-stage multiserver queue with time-varying arrival rates and customer impatience.

2 - The Impact of Universal Healthcare on Patient Choice

Diwas KC, Emory University, 1300 Clifton Road NE, Atlanta, GA, United States of America, Diwas_KC@bus.emory.edu

We study a natural policy experiment - the Massachusetts healthcare reform law - to examine the impact of universal healthcare on patient volume and the allocation of patients across the different emergency departments. We develop a model of patient choice to determine whether patients are influenced by service times and travel distances. We find that utility maximizing patients choose to avoid long waits at busy hospitals and expand their choice set of hospitals instead.

3 - Intensive Care Unit Patient Flow with Readmissions: A State-dependent Queueing Network

Galit Yom-Tov, Columbia University, IEOR Department, New York, NY, United States of America, gy2185@columbia.edu, Carri Chan

This work examines the queueing dynamics of an ICU where patients may be readmitted. When patient demand exceeds availability, ICU patients may be discharged early. Such a discharge increases the likelihood of readmission to the ICU. We model such an ICU as a state-dependent queueing network where service times and readmission probabilities depend on the state of the ICU. We consider how the ICU state affects system behavior and provide insight into capacity management of such systems.

4 - Queues in Hospitals: Empirical Study

Mor Armony, Associate Professor, New York University, 44 West 4th Street, New York, NY, 10012, United States of America, marmony@stern.nyu.edu, Yariv Marmor, Galit Yom-Tov, Avishai Mandelbaum, Yulia Tseytlin

We study a comprehensive dataset of patient-level movement in a hospital. Focusing on the emergency department and the internal wards, we identify important phenomena that are generally ignored in queueing models. New research opportunities are discussed.

■ TD28

C - Room 215

Service Operations with Strategic Customers

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Gad Allon, Northwestern University, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu

1 - Social Norms in Queues

Gad Allon, Northwestern University, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Eran Hanany

In many service settings customers have adopted self-enforcing priority rules. While in some cases, all customers are served according to the order in which they arrive, cutting the line is possible in other systems. We provide conditions under which these intrinsic priorities may emerge. Our results suggest that when priority rules are not centrally managed, they depend on arrival and service rates, customer heterogeneity and patience.

2 - Ignorance is Bliss: The Case of Risk Pooling

Pnina Feldman, University of California, Berkeley, Berkeley, CA, 94720, United States of America, feldman@haas.berkeley.edu, Karan Girotra

It is well known that firms facing demand-supply mismatch risks can benefit from pooling their supply. Using canonical models of product and service delivery, we illustrate that firms should be sufficiently ignorant to realize these benefits. This has three surprising implications61) such firms can hurt themselves by acquiring more demand information and 2) firms must commit to pooling their risk as soon as possible. 3) risk pooling activities must precede risk reduction activities.

3 - Managing Service in Relationships over Time

Ioana Popescu, INSEAD, 1 Ayer Rajah Avenue, Singapore, Singapore, ioana.POPESCU@insead.edu, Sam Aflaki

We investigate how a profit maximizing firm should manage contractual relationships with heterogeneous customers whose defection decisions, spending patterns and visit frequency are affected by the history of service experiences. Our results show that behavioral asymmetries limit de value of varying service on the long run.

4 - Duopoly Competition in Waiting Time with Reference Effect

Liu Yang, Tsinghua University, School of Economics and Management, Tsinghua University, Beijing, 100084, China, yangliu@sem.tsinghua.edu.cn, Francis de Vericourt, Peng Sun

We study the waiting time competition between two service firms. In particular, each firm commits to a waiting time standard by taking into considerations that customers' joining decisions depend on both firms' waiting time standards through "reference effect". We have proved the existence of a unique (Pareto optimal) Nash equilibrium. We have shown that comparing to the no reference effect case, the equilibrium waiting times are shorter.

■ TD29

C - Room 216A

Risk Allocation and Hedging

Cluster: Quantitative Finance

Invited Session

Chair: Jeremy Staum, Northwestern University, 2145 Sheridan Road, Department of IEMS, Evanston, IL, 60208-3119, United States of America, j-staum@northwestern.edu

1 - Excess-invariance and Non-negativity in Risk Measurement and Attribution

Jeremy Staum, Northwestern University, 2145 Sheridan Road, Department of IEMS, Evanston, IL, 60208-3119, United States of America, j-staum@northwestern.edu

Sometimes shortfall beneath a benchmark is important, whereas excess above a benchmark is unimportant. I introduce the class of shortfall risk measures, which are non-negative and invariant to excess. I present a method for risk attribution (decomposing a portfolio's risk into components that are attributed to individual assets) using only shortfall and ignoring excess, in a way that guarantees non-negative risk components.

2 - Superhedging and Portfolio Optimization in Markets with Transaction Costs

Birgit Rudloff, Assistant Professor, Princeton University, ORFE, Sherrerd Hall, Princeton, NJ, United States of America, brudloff@Princeton.EDU, Andreas Hamel, Andreas Loehne

It is well known how to calculate the scalar superhedging price in markets with transaction costs. In this talk, we will show how to calculate the set of superhedging prices. This leads to a sequence of linear vector optimization problems solved by Benson's algorithm. We will show that the scalar problem is equivalent to the set-valued problem by geometric duality. Furthermore, we will formulate and solve a set-valued CVaR based portfolio optimization problem in markets with transaction costs.

3 - Systemic Risk Charges

Patrick Cheridito, Princeton University, 204 Sherrerd Hall, Princeton, NJ, United States of America, dito@princeton.edu, Markus Brunnermeier

Threatened by the consequences of a collapse of the financial system, governments often do not have a choice but to bail out banks. This paper proposes a method to (i) determine the total premium for this implicit insurance and (ii) distribute the cost of the insurance across the financial sector in such a way that every institution is charged according to its contribution to the overall risk.

4 - Evaluating Callable and Putable Bonds: An Eigenfunction Expansion Approach

Dongjae Lim, Northwestern University, Department IS&MS, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, dongjae@u.northwestern.edu, Lingfei Li, Vadim Linetsky

We develop an efficient method to evaluate callable and putable bonds under a wide class of interest rate models, including the popular short rate diffusion models, as well as their time changed versions with jumps. The method is based on the eigenfunction expansion representation of the Feynman-Kac pricing semigroup, and the expansion coefficients for the pricing function are determined through a backward recursion. The method outperforms all previous approaches in the literature.

■ TD30

C - Room 216B

Risk and Uncertainty in Supply Chain

Contributed Session

Chair: Fei Qin, PhD Student, COB University of Cincinnati, 534 Carl H. Lindner Hall, Cincinnati, OH, 45221, United States of America, qinfi@mail.uc.edu

1 - A Quantitative Study on Mitigation Strategies for Inventory Risk

Berrak Dag, Postdoctoral Research Fellow, Sabanci university, Sabanci School of Management,, Sabanci University, Orhanli, Tuzla, Istanbul, -, 34956, Turkey, berrak.dag@gmail.com, Cathal Heavey

The purpose of this study is to investigate the benefits of risk mitigation strategies quantitatively from a contract manufacturer and original equipment manufacturer perspective. A risk measure (Value at risk) and median (a quantile of profit) are used to evaluate strategies. It is concluded that not every mitigation strategy reduces risk and/or increases the average profit.

2 - Redesigning Distributor Ordering Policies for Improved Supply Chain Performance

Kai-Chuan Yang, UC Berkeley, IEOR Department, Berkeley, CA, 94720-1777, United States of America, kcy@berkeley.edu, Candace Yano

This research is motivated by a manufacturer that produces many products, and needs to satisfy orders from distributors who order unpredictably. To provide a high service level, the manufacturer either has to reschedule production or hold a lot of safety stock, or both. We present an analytical model to evaluate the impacts of distributor's order policies on supply chain performance, and propose approaches to achieve better coordination, leading to lower costs and more predictable service.

3 - Inventory Allocation with Multi-sourcing under Demand Uncertainty: A Flexibility Perspective

Huan Zheng, Assistant Professor, Shanghai Jiao Tong University, Antai College of Economics and Managemen, 535 Fa Hua Zhen Road, Shanghai, China, zhenghuan@sjtu.edu.cn, Jia Shu

How to design a good multi-sourcing network? In this paper, we explore these issues in a new perspective: Graph Expander. The concept of "?-expander" is adopted to design a multi-sourcing network with high service levels in a special case when inventory costs are significantly higher than others. We also consider the tradeoff between facility operational costs and inventory holding costs in the condition that each retailer faces uncertain demand.

4 - Supply Risk in Decentralized and Competitive Supply Chain

Fei Qin, PhD Student, COB University of Cincinnati, 534 Carl H. Lindner Hall, Cincinnati, OH, 45221, United States of America, qinfi@mail.uc.edu, uday Rao, Ramesh Bollapragada, Haresh Gurnani

We consider incentives and actions in a decentralized supply chain with random supplier capacity. We model both single sourcing and dual sourcing scenarios involving reliable and non-reliable suppliers. We investigate the optimal policies for each agent in such cases. The supplier whole sale price as well as the retail pricing are endogenous in our model. Our model not only provides insights to buyer's procurement problem, but also enables the analysis of supplier's incentive to improve.

■ TD31

C - Room 217A

Joint Session HAS/SPPSN: Infectious Diseases and Interventions II

Sponsor: Health Applications/Public Programs, Service and Needs

Sponsored Session

Chair: Hamed Yarmand, North Carolina State University, 400 Daniels Hall, College of Engineering, North Carolina State University, Raleigh, NC, 27695, United States of America, hyarman@ncsu.edu

1 - Estimating the Lifetime Costs of Early versus Late Treatment of Human Immunodeficiency Virus (HIV)

Chaitra Gopalappa, Centers for Disease Control and Prevention, 8 Corporate Blvd, Atlanta, GA, United States of America, kiu0@cdc.gov

Recent clinical trials support U.S. Department of Health and Human Services guidelines for the early use of antiretroviral therapy to treat patients with HIV infection and to prevent further transmission. The lifetime costs of early versus delayed treatment are important, but cannot be estimated directly from clinical trials. We estimated these costs using PATH (Progression and Transmission of HIV/AIDS), a Monte Carlo simulation model that tracks HIV-infected individuals and their partners.

2 - Modeling the Effect of High Dead-space Syringes on the HIV Epidemic Among Drug Users

Georgiy Bobashev, RTI International, 3040 East Cornwallis Road, Research Triangle Park, Durham, NC, 27709, United States of America, bobashev@rti.org, William Zule

HIV prevalence among injecting drug users ranges from 1% to over 70% around the world. Some syringe designs retain substantially more blood, and thus more HIV, than the others. We used a system dynamics model to illustrate the potentially high impact of syringe design on HIV prevalence especially in high risk populations. For low risk population, the use of low dead space syringes could result in virtual elimination of HIV. The results have implications for needle exchange programs worldwide.

3 - A Resource Allocation Tool for HIV Prevention Interventions: A Case Study

Feng Lin, CDC, 1600 Clifton Road, Atlanta, GA, 30329, United States of America, FLin@cdc.gov, Stephanie Sansom, Ya-Lin Huang, Arielle Lasry

In 2010, CDC funded a demonstration program to develop Enhanced Comprehensive HIV Prevention Plans for 12 metropolitan statistical areas that represent 44% of the HIV epidemic. A resouce allocation tool was developed to identify the optimal combination of interventions to prevent the most new HIV infections. We tested this tool using data from Philadephia. The findings were used to improve the tool to better inform decision makers in allocating limited resources.

■ TD32

C - Room 217BC

Transportation System Timetabling and Scheduling

Sponsor: Railway Applications

Sponsored Session

Chair: Xuesong Zhou, University of Utah, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu

1 - Generating and Optimizing Cyclic Timetables Using Relational Algebra

Shiwei He, Professor, Beijing JiaoTong University, School of Traffic and Transportation, Beijing, 100044, China, shwhe@bjtu.edu.cn

This talk presents a new approach for generating and optimizing large-scale cyclic train timetables using relational algebra. The proposed approach is applicable for fast capacity analysis and timetable re-scheduling involving multiple types of trains on a rail corridor.

2 - Reduce Number of Constraints in Train Scheduling Problem: A Hypergraph Based Formulation

Xuesong Zhou, University of Utah, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu, Steven Harrod

This talk presents a hyper-graph based formulation to model conflict constraints in a train scheduling problem for both single and double-track rail lines. The proposed approach can dramatically reduce the number of constraints within an efficient Lagrangian relaxation solution framework, while a typical time-expanded graph-based formulation needs to define a large number of cliques of incompatible nodes/arcs.

3 - A Parallel Heuristic for Fast Train Dispatching During Railway Traffic Disturbance Early Results

Muhammad Zeeshan Iqbal, PhD Student, Blekinge Institute of Technology, School of Computer Science, And communication (COM), H449, Karlskrona, Bl, 37179, Sweden, Muhammad.Zeeshan.Iqbal@bth.se, Johanna Törnquist, Häkan Grahn

In railway networks with dense traffic even small disturbances may cause severe ripple effects. To effectively limit these, we propose a parallelized re-scheduling algorithm based on a greedy depth-first branch-and-bound search paradigm. Based on 20 realistic disturbance scenarios, its performance is evaluated and compared to a sequential implementation as well as the Cplex solver. The main novelty of the parallel implementation concerns solution quality, speed and size of search space explored.

4 - Concepts from Public Transit Service Planning

Mark Hickman, Associate Professor, University of Arizona, 1209 E. Second Street, Bldg. 72, Tucson, AZ, 85721-0072, United States of America, mhickman@email.arizona.edu

In this presentation, we consider basic methods for service planning for fixed-route service in public transit. Possible issues with route design, crew scheduling, vehicle scheduling, and service coordination across different routes are discussed. An informal discussion with participants will explore topics that might be transferable to rail service planning.

■ TD33

C - Room 217D

IIE Transactions

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Jianjun Shi, The Carolyn J. Stewart Chair Professor, H. Milton Stewart School of Industrial and Systems Engineering, 765 Ferst Drive, Room 214, Atlanta, GA, 30332, United States of America, jianjun.shi@isye.gatech.edu

1 - Characterization of Nonlinear Profiles Variation Using Mixed-effect Models and Wavelets

Kamran Paynabar, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, United States of America, kamip@umich.edu, Judy Jin

Nonparametric methods such as Wavelets have been effectively used in nonlinear profile monitoring. Traditionally, the profile variability is often modeled by i.i.d. random noises. Differently, this research considers both within- and between-profiles variations using a mixed effect model of transformed wavelet features. A change-point model is applied to ensure the identicalness of the profiles distribution. Finally, the performance of the model is evaluated using simulation and a case study.

2 - A Physical-Statistical Model for Density Control of Nanowires

Tirthankar Dasgupta, Harvard University, 1 Oxford St, Cambridge, MA, 02138, United States of America, dasgupta@stat.harvard.edu, Benjamin Weintraub, Roshan Joseph

A physical-statistical model was used to predict and control ZnO nanowire array density. The model incorporated available physical knowledge of the process in a statistical framework. The model facilitated a better understanding of the fundamental scientific phenomenon that explained the growth mechanism.

3 - Optimal Multivariate Bounded Adjustment

George Runger, Professor, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, George.Runger@asu.edu, Enrique Del Castillo, Zilong Lian

A bounded adjustment strategy is an important link between statistical process control and engineering process control. Here, the optimal bounded adjustment strategy for a multivariate process (of arbitrary dimension) is presented that exploits a symmetry relationship to obtain a closed-form solution. A numerical method is developed to analyze the strategy for an arbitrary number of dimensions. Both infinite- and finite-horizon solutions are presented along with a numerical illustration.

■ TD34

C - Room 218A

Emergency Services

Sponsor: Health Applications

Sponsored Session

Chair: Shane Henderson, Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu

1 - A Mixed-integer Programming Model for Enforcing Priority List Policies in Markov Decision Processes

Laura McLay, Assistant Professor, Virginia Commonwealth University, Richmond, VA, 23284, United States of America, lamclay@vcu.edu

Optimal dispatching policies for server-to-customer systems can be identified using Markov decision process models and algorithms, which indicate the optimal server to dispatch to each customer type in each state. Restricted policies that use a priority list policy for each type of customer are desirable for use in practice. This research demonstrates how the optimal priority list policy can be identified by formulating constrained Markov decision processes as mixed integer programming models.

2 - Model Specification and Data Aggregation for EMS Station Location

Armann Ingolfsson, University of Alberta, Alberta, QC, Canada, armann.ingolfsson@ualberta.ca, Geoff Holmes, Ray Patterson, Erik Rolland

We explore the relative impacts of aggregation errors and model choice errors, and their interaction, for an EMS station location model. We compare two model choices (probabilistic and deterministic) using a year of call data from the Edmonton EMS service. We demonstrate that model choice error dominates aggregation error.

3 - Some Approximate Dynamic Programming Ambulance Redeployment Policies are Compliance Table Policies

Shane Henderson, Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu, Matthew Maxwell, Huseyin Topaloglu

Nested compliance table (NCT) policies are commonly used by emergency medical service providers to dynamically reposition ambulances. We define a class of approximate dynamic programming (ADP) policies for ambulance redeployment and show that it is equivalent to the class of NCT polices. For an NCT policy it is not always clear how to return a system to compliance, but we show that ADP policies return the system to compliance without dispatcher intervention.

■ TD35

C - Room 218B

Reliability in Smart Grid and Distributed Generation

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Tongdan Jin, Assistant Professor, Texas State University, 601 University Drive, San Marcos, TX, 78666, United States of America, tj17@txstate.edu

Co-Chair: Zhigang Tian, Assistant Professor, Concordia University, Institute for Information Systems Engine, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca

1 - Wind Farm Maintenance Considering Varying Lead Time and Turbine Type

Zhigang Tian, Assistant Professor, Concordia University, Institute for Information Systems Engine, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca, Abeer Amayri

We study a CBM approach for wind turbine systems considering the economic dependency of different wind turbine types. And different components in a wind turbine are assumed to have different lead times. The CBM policy and the corresponding cost evaluation algorithm are developed. Using the CBM policy, decisions can be made on whether a maintenance team should be sent to the wind farm, which turbines should be maintained and which components should be maintained.

2 - Reliability and Cost Assessment of Solar Photovoltaic Based Microgrid Systems

Tongdan Jin, Assistant Professor, Texas State University, 601 University Drive, San Marcos, TX, 78666, United States of America, tj17@txstate.edu, Naveen Nalajala, Heidi Taboada, Jose Espiritu

As smart grid initiatives, solar photovoltaics (PV) is emerging as a clean and sustainable energy resource to meet the growing electricity demand. This study investigates the reliability and cost of designing and operating a PV-based microgrid system considering weather uncertainty and maintenance cost. We perform cost comparisons between using batteries as energy backup and selling surplus electricity through net metering.

3 - Cascading Line Outages on Power Grid

Rong Pan, Associate Professor, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85287, United States of America, Rong.Pan@asu.edu, Muhong Zhang, Xiaotian Zhuang

Cascading transmission line overloads and outages are the primary cause of widespread blackouts. In this talk we review the cause and process of cascading failure, the method for finding the critical points in a complex power grid network, and the self-organization property of some line upgrade policies. We also propose the use of the new emerging small-scale power generation network for reducing the cascading failure probability.

4 - Modeling and Simulation of Wind Energy Systems Operations in DEVS

Eduardo Perez, Postdoctoral Research Associate, Texas A&M University, 3131 Tamu, College Station, TX, 77840, United States of America, eduardopr@neo.tamu.edu, Lewis Ntaimo, Eunshin Byon, Yu Ding, Yan Wang

Wind turbines experience stochastic loading due to the variation of wind speeds which makes their degradation and failure prediction complex. Existing maintenance optimization models for wind energy systems are based on stationary conditions. In this work we present a discrete event system specification (DEVS) modeling and simulation approach for predicting the status of wind turbine components and for assessing maintenance decisions. Results based on a realistic wind farm will be presented.

5 - Planning and Optimizing Distributed Generation Systems with Intermittent Wind Power

Clara Novoa, Assistant Progessor, Texas State University, 601 University Dr, San Marcos, TX, 78666, United States of America, cn17@txstate.edu, Tongdan Jin

This work presents a stochastic model to minimize lifecycle cost of distributed generation systems penetrated by renewable wind technology under the loss-of-load probability criterion. Model determines wind turbine capacity and placement to minimize capital, operational and environmental costs by effectively using statistical moments to characterize wind power volatility and load uncertainty. A case study demonstrates model application and performance of selected heuristic solution techniques.

■ TD36

C - Room 219A

Medical Decision Making and Informatics

Sponsor: Health Applications

Sponsored Session

Chair: Jingyu Zhang, Philips Research North America, 345 Scarborough Rd, Briarcliff Manor, NY, 10510, United States of America, jingyu.zhang@philips.com

1 - Activity Recognition and 3D Lower Limb Tracking with an Instrumented Walker

Pascal Poupart, Associate Professor, University of Waterloo, 200 University Avenue West, Waterloo, Canada, ppoupart@cs.uwaterloo.ca

Wheeled walkers are popular mobility aids used by older adults to improve balance control. We will describe supervised and unsupervised techniques based on HMMs and CRFs to recognize walker related activities as well as particle filtering techniques to estimate 3D poses of the lower limbs based a structured light camera (Kinect). A comprehensive evaluation with control subjects and walker users from a retirement community will be presented.

2 - Guiding Assessment of New Medical Treatments: The Cost-effectiveness of Tissue Engineering

Sean Carr, Ph.D. Student, North Carolina State University, 916 W. Cabarrus St., Raleigh, NC, 27603, United States of America, smcarr2@ncsu.edu, Stephen Roberts

The prospect of engineered organs including skin, bladders, and the vital organs is increasing. While applications of tissue engineering are progressing, there is still much uncertainty regarding their costs and clinical effectiveness. The framework described here uses computer simulation and probabilistic cost-effectiveness analysis to assist organizations in making future decisions regarding product selection, capital investment, and product development.

3 - Patient Testing and Treatment Strategies in the Presence of Preparation Lead Times

Reza Skandari, University of Florida, Gaineville, FL, 32608, United States of America, skandari@gmail.com, Steven Shechter, Nadia Zalunardo

Periodic laboratory tests help clinicians measure the progress of a disease and forecast when a treatment should start. Forecast accuracy is particularly important when there is a lead time to prepare patients for treatment. We present a decision model to investigate the optimal time to start preparing a type of vascular access for chronic kidney disease patients who will need dialysis. The model balances costs of being ready too early/late along with the costs of obtaining lab readings.

4 - Long Term Planning for Palliative Chemotherapy for Late Stage Cancer Patients

Grisselle Centeno, Associate Professor, University of South Florida, 4202 E. Fowler Avenue ENB118, Tampa, FL, 33620, United States of America, gcenteno@usf.edu, Ludwig Kuznia, Brian Decker, Bo Zeng

Palliative chemotherapy is given without curative intent and aims to increase life expectancy and quality of life. This is a long term, multi-period decision process. In this work, Markov Decision Processes modeling is use to define the optimal treatment strategy. To determine the patient state space as well as state transition probabilities data were obtained from a large oncology practice in the mid-west.

■ TD37

C - Room 219B

Statistical Process Control for Image and High-Dimensional Data

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Kaibo Wang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, China, kbwang@tsinghua.edu.cn

Co-Chair: Fadel M. Megahed, PhD Candidate, Virginia Tech, 250 Durham Hall, Blacksburg, 24061, United States of America, fmegahed@vt.edu

1 - A Spatiotemporal Method for the Monitoring of Image Data

Fadel M. Megahed, PhD Candidate, Virginia Tech, 250 Durham Hall, Blacksburg, 24061, United States of America, fmegahed@vt.edu, Lee J. Wells, Jaime A. Camelio, William H. Woodall

We show how image data can be monitored using a spatiotemporal framework based on the use of a GLR control chart. The performance of our method is evaluated through computer simulations and experimental work. The results show that our GLR control chart quickly detects the emergence of a fault while providing useful diagnostic information through estimating both the change-point and the size/location of the fault. Finally, we highlight some application opportunities.

2 - Discovering Nonlinear Variation Patterns in High-Dimensional Data

Dan Apley, Associate Professor, Northwestern University, Evanston, IL, United States of America, apley@northwestern.edu, Joon-Ku Im

In complex, high-dimensional data, such as images or point cloud surface measurements, sources of variation are often manifested as nonlinear patterns. By nonlinear, we mean patterns that cannot be represented via a linear factor analysis model, in which case linear PCA is not an effective tool for identifying the patterns. We discuss the use of kernel PCA and manifold learning methods for discovering and visualizing the nature of the variation patterns for root cause identification.

3 - A Spatial Variable Selection Method for Monitoring Product Surface in Semiconductor Manufacturing

Kaibo Wang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, China, kbwang@tsinghua.edu.cn

This paper discusses monitoring product surface in wafer testing of a semiconductor manufacturing process. Due to the spatial characteristics of wafer defects, a variable selection method is proposed using the fused LASSO algorithm to identify spatial clusters on the surface. Monte Carlo simulations have been conducted to compare the proposed method with industry benchmark and other competitive statistical process control (SPC) methods.

4 - An SPC Procedure Based on Multisensor Metrology Data Fusion
Paolo Cicorella, PhD Student, Politecnico di Milano, via La Masa, 1, Milano, 20156, Italy, paolo.cicorella@mail.polimi.it, Massimo Pacella, Bianca M. Colosimo

In the last years, we are assisting to a continuous drive toward the use of hybrid metrology systems, which can combine noncontact and contact sensors to take advantage of the speed of 3-D optical sensors and of the accuracy of traditional contact solutions. We show how approaches for multisensor data fusion can be combined to control charting in order to detect (and distinguish between) out-of-control states due to the measurement and/or to the manufacturing processes.

■ TD38

H- Johnson Room - 4th Floor

Energy Facility Location Issues

Sponsor: Location Analysis

Sponsored Session

Chair: Michael Lim, Assistant Professor, University of Illinois at Urbana-Champaign, 1206 S. 6th st., Champaign, IL, 61820, United States of America, mlim@illinois.edu

1 - Competitive Formation of Distribution Networks and Design Strategies
Tolga Seyhan, PhD Candidate, Lehigh University, Industrial and Systems Eng. Department, 200 W Packer Avenue, Bethlehem, PA, 18015, United States of America, tolgaseyhan@lehigh.edu, Larry Snyder

We consider a game where competing firms build their own distribution systems on a given network. We propose two mixed integer programming models. For simultaneous move game, we find the equilibrium strategies. For Stackelberg game, we reformulate leader's problem by replacing the follower's response by a reasonable heuristic and embedding it into leader's constraints. The method allows us to solve the initially bilevel structure as a single level program and yields near optimal results.

2 - Infrastructure Planning for Electric Vehicles with Battery Swapping
Ho-Yin Mak, Assistant Professor, Honk Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong - PRC, hymak@ust.hk, Ying Rong, Z. Max Shen

To address the "range anxiety" regarding electric vehicles, i.e., the limited travel range on one full charge, battery swapping has been proposed as a range-extension solution. We consider the problem of deploying battery swapping stations in a freeway network and equipping them with sufficient battery stocks. With adoption levels not precisely known at the planning stage, the major challenge is to develop tractable optimization models that produce robust solutions.

3 - Competitive Supply Chain Design for an Emerging Industry
Yun Bai, University of Illinois Urbana at Champaign, Department of Civil Environmental Engineering, Urbana, IL, United States of America, yunbai1@illinois.edu, Yanfeng Ouyang, Jong-Shi Pang

We study a competitive supply chain design problem where an emerging industry makes facility location and pricing decisions to compete for feedstock resource supply with existing markets. The complex interactions and competitive behavior of the new industry, existing suppliers, and local markets are integrated into a Stackelberg leader-follower game model. A Lagrangian relaxation based solution approach is developed to decompose and solve the DC-MPEC model.

4 - An Integrated Supply Chain Model for Hazardous Materials
Z. Max Shen, Professor, University of California Berkeley, Department of IEOR, Berkeley, CA, United States of America, shen@ieor.berkeley.edu, Yong Liang

Natural disasters and operational mistakes have caused disruptions in the supply chain of hazardous material (hazmat) which greatly jeopardized their neighboring ecosystem. Energy related industries, such as nuclear power and crude oil mining, are particular endangered by disruptions. We study a joint location, inventory and routing model for hazmat and show some operational insights for decision makers.

■ TD39

H - Morehead Boardroom -3rd Floor

Software Business Models and Platform Dynamics

Sponsor: E-Business

Sponsored Session

Chair: Marius Florin Niculescu, Georgia Institute of Technology, 800 West Peachtree NW, Atlanta, GA, United States of America, Marius.Niculescu@mgt.gatech.edu

1 - The Future is Cloudy: Optimal Organizational Structure and Incentives for Information Technology
Joseph Vithayathil, University of California, Irvine, SB 335, The Paul Merage School of Business, Irvine, CA, 92697, United States of America, jvithaya@uci.edu, Vidyanand Choudhary

Cloud computing is a growing option for IT products and services and is likely to impact organizational structure and incentives of the IT department. While the question of profit center vs. cost center has been debated, the impact of cloud computing on IT governance has not been examined. This research examines the question of when and under what conditions is it optimal for IT to be organized as a profit center or a cost center, and how this is affected by the adoption of cloud computing.

2 - Interaction between Platform and Application
Ashish Agarwal, Assistant Professor, University of Austin at Texas, CBA 5.234, Austin, TX, 78759, United States of America, Ashish.Agarwal@mccombs.utexas.edu

When a platform also participates in the application market, it has to decide on its pricing strategy for its products and the level of compatibility with the applications. We find that a platform vendor can bundle its application with the platform even if it is of lower quality and make higher profits. However, it should choose to be compatible with a competing higher quality application. We also find that compatibility results in socially excessive bundling.

3 - The Economic Role of Consumer Rating Behavior in Mobile App Market
Lin Hao, University of Washington Seattle, Foster School of Business, Seattle, WA, United States of America, linhao@uw.edu, Xiaofei Li, Yong Tan, Jiuping Xu

This paper explores the fundamental influence of consumer rating behavior on mobile app market. We develop an analytical model which integrates the rating behavior with consumer utility. Based on rating-dependent utility function we characterize the market equilibrium and show how changes in consumer rating behavior would affect the developers' optimal choices of app price and quality level, the platform owner's optimal revenue sharing policy and the social welfare.

4 - Influence of Software Process Maturity and Customer Error Reporting on Software Release and Pricing
Marius Florin Niculescu, Georgia Institute of Technology, 800 West Peachtree NW, Atlanta, GA, United States of America, Marius.Niculescu@mgt.gatech.edu, Terrence August

Software producers are making greater use of customer error reporting toward the end of software development processes and throughout the maintenance lifetime of their products. We study how software development differences among software producers and software class and functionality differences affect how these producers coordinate software release timing and pricing to optimally harness error reporting contributions from users.

■ TD40

H - Walker Room - 4th Floor

Innovation and Social Institutions

Sponsor: Technology Management

Sponsored Session

Chair: Jaegul Lee, Assistant Professor, Wayne State Univ, 320 Prentis, 5201 Cass Avenue, Detroit, MI, 48202, United States of America, jaegul.lee@wayne.edu

1 - The "DANCE" of Regulation and Innovation: Technology-Forcing in the U.S. Auto Industry, 1970-1995
Jaegul Lee, Assistant Professor, Wayne State Univ, 320 Prentis, 5201 Cass Avenue, Detroit, MI, 48202, United States of America, jaegul.lee@wayne.edu

This research examines the interaction between government and industry in shaping the technology-forcing regulatory process and the resulting technological outcomes. Using archival data associated from U.S. automotive safety and emission control regulation, we found that the government logic is significantly related to the direction of dominant technologies and the industry logic potentially impedes the regulatory process by introducing contestation among potential technological options.

2 - The Dynamics of Social Contagion in Digital Service Platforms: A Comparative Analysis of Two Social Networking Sites

Kalle Lyytinen, Director, DM Programs, Case Western Reserve University, 10900 Euclid, Cleveland, OH, 44106, United States of America, kalle@case.edu

Results of ethnographic interviews with technology executives and users of two social networking sites that have experienced dramatically different growth patterns suggest that fast growth of a digital service platform through social contagion requires the facilitation and balancing of three co-processes: co-valuation, co-production and co-creation. Our findings indicate the motivation of users to participate in co-creation of content is driven by voyeurism and exhibitionism and that the value of co-created content supersedes the economic value created by services.

3 - Generative Tension and the Management of Infrastructural Innovation

Nicholas Berente, Assistant Professor, University of Georgia, 303 Brooks Hall, Athens, GA, 30602, United States of America, berente@uga.edu, Jennifer Claggett

Through an exploratory field study of ten high-performance computing centers, we identified a variety of "generative tensions" associated with a particular form of innovation we describe as "infrastructural innovation." We develop a process model of dialectical modes of leadership and resource scarcity which result in organizational persistence and different forms of innovation.

4 - The Impact of Enterprise Architecture (EA) Assimilation on Organizational Performance

George Makiya, Doctor of Management Candidate, Case Western Reserve University, 18204 Country Place Drive, Conroe, TX, 77302, United States of America, gmakiya@csc.com, Kalle Lyytinen

This research examines the relationship between factors that influence Enterprise Architecture (EA) assimilation and the impact of EA assimilation levels on organizational performance. It addresses two questions: 1) what organizational and environmental factors influence the level of EA assimilation? 2) Does the level of EA assimilation affect an organization's performance?

■ TD42

H - Gwynn Room - 4th Floor

The Socioeconomic Dynamics of Information Systems

Sponsor: Information Systems Society

Sponsored Session

Chair: Young-Jin Lee, Assistant Professor, University of Wisconsin Green Bay, 2420 Nicolet Drive, Green Bay, WI, 54311, United States of America, leey@uwgb.edu

1 - User Participation Dynamics in Microblogging

Yi-Chun Ho, PhD Student, University of Washington, Foster School of Business, Seattle, United States of America, chadho@uw.edu, Yong Tan

The work posits to model, analyze and test the user participation dynamics in online social networking and microblogging. We propose an econometric framework to identify latent participation states and examine the extent to which individual participation persists over time. In addition, we investigate the effect of user reputation on their blogging activities. The model is calibrated using a longitudinal data set collected from a microblogging site.

2 - Efficient Network Structures for the Diffusion of New Technology

Daeheon Choi, University of Portland, Pamplin School of Business Administratio, Franz Hall 322C, Portland, OR, 97203, United States of America, choi@up.edu

We study what structures of network are most effective in the diffusion process of the network technology across organizations. We consider it with selection model of information transfer operating through a social network. Different structures and positions make certain potential adopter to receive more or less information than others, and then they have different points of timing to adopt. Using the experimental study, we seek efficient network structure in the timing–cost frame of adoption.

3 - Online Product Reviews: Implications for Retailer and Competing Manufacturers

Young Kwark, PhD candidate, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080-3021, United States of America, youngk082@utdallas.edu, Srinivasan Raghunathan

Online product reviews homogenize consumer valuations by reducing variance and shifting its mean towards the common valuation of reviews. If the difference in reviews between two products is small, reviews hurt the manufacturers and benefit a retailer by intensifying price competition between manufacturers while enabling a retailer to charge a higher retail price. An increase in review difference mitigates competition induced by reviews, and reduces a retailer's benefit and manufacturers' loss.

4 - A Profiling Model for Readmission of Patients with Congestive Heart Failure

Jeong-Ha (Cath) Oh, University of Texas-Dallas, SM 42, 800 West Campbell Road, Richardson, TX, United States of America, Jhoh@utdallas.edu, Indranil Bardhan, Zhiqiang Zheng

This study seeks to build a patient profiling model that can predict 1) the propensity of readmission for a patient and 2) the timing of readmission. We develop a new model termed as BG/Erlang-2 Hurdle model that can simultaneously estimate both the propensity and timing of readmissions, testing on a unique dataset that tracks individual patient across 72 hospitals in the North Texas. Patient profiles derived from our model can serve as the building block for a healthcare information systems.

■ TD43

H - Suite 402 - 4th Floor

Energy & Environmental Policy Modeling in the Energy Sector

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Yihsu Chen, Assistant Professor, University of California Merced, Science and Engineering Building, Room 262, Merced, CA, United States of America, yihsu.chen@ucmerced.edu

1 - Modeling the Interaction of a Microgrid, a Utility and a Regulator

Chiara Lo Prete, PhD Student, The Johns Hopkins University, 3400 North Charles Street, Baltimore, United States of America, clopret2@jhu.edu, Benjamin Hobbs

The introduction of a microgrid in an electric network could lead to an increase in social welfare. However, an incumbent utility would not welcome microgrid access. The regulator should align his goal (social welfare maximization) to the one of the utility (profit maximization) by designing an appropriate incentive mechanism.

2 - Long-run Analyses of Combining Climate Policies in the United States Using MARKAL

Kemal Sarica, Postdoctoral Research Associate, Purdue University, Agricultural Economics Department, West Lafayette, United States of America, ksarica@purdue.edu, Yihsu Chen, Andrew Liu

The coexistence of multiple greenhouse gas reduction policies without coordination would likely lead to some unintended consequences, even, individually, the policies have proved to be effective. We analyzed the long-run implications of combining climate and energy policies in the US using MARKAL. We report the preliminary results on the simulations of the proposed federal emission trading programs and renewable portfolio standards.

3 - Interaction of Climate and Renewable Energy Policies and Their Impact on Electricity Market Prices

Pedro Linares, Universidad Pontificia Comillas, Aguilera, 23, 28015 Madrid, pedro.linares@upcomillas.es

The interest for reducing climate emissions, but at the same time keep down the cost and increase the acceptability of the policies required, has made many countries combine climate policies such as carbon trading and renewable energy policies. This presentation will look at the many interaction of these policies, and will focus particularly on the impact of renewable energy policy on electricity market prices.

4 - Market Power in Emissions Trading: Strategic Manipulation of Permit Price through Fringe Firms

Yihsu Chen, Assistant Professor, University of California Merced, Science and Engineering Building, Room 262, Merced, CA, United States of America, yihsu.chen@ucmerced.edu, Makoto Tanaka

Emission permits have received considerable attention recently. This paper develops a model in which Cournot firms can manipulate the permit price through fringe firms. The simulation of the California electricity market shows that Cournot firms can significantly raise both power price and permit price, which results in a great loss in social welfare.

■ TD44

H - Suite 406 - 4th Floor

Impact of Supply Chain Disruptions

Cluster: Managing Disruptions in Supply Chains

Invited Session

Chair: Hugh Medal, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hmedal@uark.edu

1 - International Economic Impacts of Supply Chain Disruptions

Cameron MacKenzie, PhD Candidate, University of Oklahoma, School of Industrial Engineering, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, cmackenzie@ou.edu, Kash Barker

We explore the international economic ramifications of major supply chain disruptions and decisions made in advance of such disasters. If companies lose business because of supply shortages, how do these losses impact the economies in which these companies operate? To answer this question, we model the economic interdependencies among different countries along with preparedness strategies, including inventory and multiple suppliers. Our model quantifies the impacts of these company decisions.

2 - Modeling Wetland Connectivity and Vulnerability to Pollution

Timothy Matisziw, Assistant Professor, University of Missouri, Civil & Environmental Engineering, Columbia, MO, 65211, United States of America, matisziwt@missouri.edu, Raymond Semlitsch, Mahabub Alam, Enos Inniss, Kathleen Trauth

The health of wetland systems is highly dependent upon their ability to support a range of biological, chemical, and hydrologic interactions. Here, a framework for evaluating the impact of potential threats (as well as best management practices to mitigate threats) to wetland connectivity and supported interactions is proposed. The developed modeling framework is applied to a range of wetland configurations to highlight theoretical as well as practical implications of this research.

3 - Supply Chain Disruptions in Multimodal Freight Networks

Gizem Aydin, PhD Candidate, University of Oklahoma, Norman, OK, United States of America, gizemaydin@ou.edu

Increased complexity in multimodal freight networks multiplies the disruption effect on systems. Continuously growing supply chains, while linking vast locations and increase profits, inherit vulnerability of the systems within. In this study, multimodal systems are modeled and freight movement disruptions are investigated. Reliability of multimodal systems is discussed.

■ TD45

H - Suite 407 - 4th Floor

Auction Design with Multi-dimensional Types

Cluster: Auctions

Invited Session

Chair: Sasa Pekec, Duke University, Fuqua School of Business, Durham, NC, United States of America, pekec@duke.edu

1 - Optimal Auctioning and Pricing with Positive Externalities

Vahab Mirrokni, Senior Research Scientist, Google Research, 111 8th Avenue, New York, NY, United States of America, mirrokni@google.com

Inspired by marketing over social networks, we study the problem of optimal auctioning and pricing in the presence of positive network externalities, where the valuation of a user depends on the set of users buying or adopting the product. We consider the Bayesian settings, and study both auctions and sequential pricing from an algorithmic perspective. We present improved approximate mechanisms in settings with threshold-based and submodular externalities.

2 - Cardinal Auctions

S. Muthukrishnan, Google Inc., 111 8th Avenue, New York, NY, United States of America, muthu@google.com, Darja Krushevskaja, Mangesh Gupte

Motivated by ads on the Internet and other scenarios, we study cardinal auctions in which we let bidders specify not only their bid but also the number of items that will be sold via the auction. There are two natural auctions for this setting, one based on Vickrey-Clarke-Groves (VCG), and the other based on minimum pay property (MPP). We perform detailed analyses of VCG vs MPP for efficiency as well as revenue in equilibrium.

3 - Approximations to Auctions for Sharable Goods

Jinxiang Pei, Northwestern University, 2145 Sheridan Road C210, Evanston, IL, 60202, United States of America, peipauj@u.northwestern.edu, Diego Klabjan

We consider the case of a sharable product, where the product can be sold to multiple buyers who experience some disutility from other firms or consumers owning the same product. We formulate the problem in a Bayesian setting and apply Bayesian optimal mechanism design. Further, we show constant approximations to an optimal single price auction in the prior-free setting including both average-case and worst-case analyses.

4 - Money for Nothing: Exploiting Negative Externalities

Changrong Deng, Duke University, Fuqua School of Business, Durham, NC, United States of America, changrong.deng@duke.edu, Sasa Pekec

We show that existence of negative externalities among buyers competing for a scarce resource, allows for emergence of the no-allocation equilibrium with positive revenues for the seller. A monopolist selling K indivisible items to many unit-demand buyers who face negative externalities when their rivals get the items, can exploit these negative externalities. Buyers may pay the seller to avoid allocating the items. We provide conditions that yield optimality of the no-allocation equilibrium.

■ TD46

H - Suite 403 - 4th Floor

Organizational Culture

Contributed Session

Chair: Doyoon Kim, Yonsei University, 134 Seodaemun-Gu, Shinchon-Dong, Seoul, Korea, Republic of, doyoon.kim@yonsei.ac.kr

1 - Empirical Research on Driven Force of Organizational Cultural Evolution

Xiaopeng Ji, PhD Candidate, Xi'an Jiaotong University, School of Management, No.28 Xianning West Road, Xi'an, 710049, China, xiaopeng.ji.xjtu@gmail.com, Yun Fan

Organizational cultural change can be divided into cultural revolution and evolution. Organizational task environmental change (OTEC), organizational inside environmental change (OIEC) and employee involvement (EI), which driving organizational cultural evolution (OCE), were identified and tested by sample of 287 organizations from China with SEM and SPSS. Results showed that OIEC positively and OTEC negatively related to OCE, while OIEC mediating positively relationship between EI and OCE.

2 - Force Development Activities: An Organizational Development Review

Dave Allen, Defence Scientist, Department of National Defence, 101 Colonel By Drive, Ottawa, ON, K1A 0K2, Canada, dave.allen@forces.gc.ca

Force development activities have become common across military organizations. The present paper reviews these types of activities within the perspective of organizational development. It is shown that the common force development approaches neglect important ingredients recommended within the scientific literature. The paper ends with a look at concept development and experimentation and how it can be incorporated within traditional organizational development methodology.

3 - The Moderating Effects of Cooperation and Status in Learning from Failure

Doyoon Kim, Yonsei University, 134 Seodaemun-Gu, Shinchon-Dong, Seoul, Korea, Republic of, doyoon.kim@yonsei.ac.kr, Dongyoub Shin

This study explores controversial theories claiming the effects of cooperation and status on organizational innovation. First, we examined cooperation might be disadvantageous on organizational search. Ambiguities in attributing performance to actors involved in cooperation decrease organization's further motivation to search. Second, organization's status might promote organizational search and risk-taking behavior despite its stability.

■ TD47

H - Dunn Room - 3rd Floor

Intermodal Issues in Transportation

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Srinivas Peeta, Purdue University, Nextrans Center, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, peeta@purdue.edu

1 - Integrated Framework to Study High-Speed Rail with the Consideration of Existing Transportation Infrastructure

Jeffrey Peters, Research Assistant, Nextrans Center, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, peters83@purdue.edu, Dan Delaurentis, Srinivas Peeta, Datu Agusdinata, En-Pei Han

This study provides a framework to study various investment, pricing, and performance characteristics of high-speed rail in the context of the existing intercity transportation infrastructure. The existing system includes highway, commercial air, and rail systems. Results will consist of sensitivity analysis based on several variables and constraints in the problem.

2 - The One Commodity Pickup-and-Delivery Traveling Salesman Problem: Feasibility and Algorithms

Binh Luong, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47907, United States of America, bluong@purdue.edu, Lanshan Han, Satish Ukkusuri, Michael Petri

In this paper we study the one commodity pickup-and-delivery traveling salesman problem (1-PDTSP), which is a recently proposed variant of the classic traveling sales problem (TSP). We first introduce a polynomial size integer programming formulation for the problem and then study the feasibility issue which is NP-complete by itself. In particular, we prove sufficient conditions for the feasibility of the problem and provide a polynomial algorithm to find a feasible solution. We also present a bound of the cost of the 1-PDTSP solution in terms of the cost of the TSP solution. Based on this bound, we provide approximation and heuristic algorithms for the 1-PDTSP. Extensive numerical experiments are performed to evaluate the efficiency of both the exact and approximation algorithms.

3 - Policy Analysis for Interdependent Infrastructure Systems

Jeffrey Peters, Research Assistant, Nextrans Center, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, peters83@purdue.edu, Srinivas Peeta

Most policies which are directed at an individual infrastructure system have impacts on other infrastructure systems as well. This study introduces potential methods to evaluate and develop policy packages to address strategic goals across several infrastructure systems with interdependencies.

■ TD48

H - Graham Room - 3rd Floor

Traffic Modeling

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Sushant Sharma, Research Associate, Purdue University, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, sharma57@purdue.edu

1 - Signal Timing Estimation Using Sample Intersection Travel Times

Hao Peng, Rensselaer Polytechnic Institute, 110 Eighth Street, Troy, NY, 12180, United States of America, haop@rpi.edu, Jeff Ban, Kristin Bennett, Qiang Ji, Zhanbo Sun

Signal timing parameters (such as cycle length and cycle-by-cycle green/red times) have been traditionally assumed to be available, e.g., from transportation management agencies. However, accessing such information for wide-area arterial networks may prove challenging in practice. We show in this talk how sample intersection travel times from mobile traffic sensors can be used to estimate signal timing parameters for signals with fixed cycle length.

2 - Network Topology Based Vehicle Sensor Locations under Dynamic Traffic Conditions

Sushant Sharma, Research Associate, Purdue University, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, sharma57@purdue.edu, Srinivas Peeta

This study addresses the network sensor location problem under dynamic traffic conditions. Traffic dynamics are captured using the dynamic link-path incidence matrix which indicates the time-dependent presence of flow on links. This information is used to identify subset of links to install sensors on, to enable maximal observability of traffic flows.

3 - Signalized Intersection Queue Length Estimation Using Probe Trajectory Data

Yang Cheng, University of Wisconsin-Madison, 1241 Engineering Hall, 1415 Engineering Drive, Madison, WI, 53706, United States of America, cheng8@wisc.edu, Xiao Qing, Bin Ran

An improved queue length estimation method for signalized intersections is presented. This method is able to provide cycle-by-cycle queue length estimates, based on reconstructing queue formation and dissipation shock waves. This approach is evaluated using several data sets under different flow and signal timing scenarios. Results indicate that this trajectory based approach is able to provide acceptable estimates even with low sample rates.

4 - An Ensemble-based Approach for Predicting Traffic Speed Using GPS Data

Wei Shen, Post-doctoral Researcher, IBM Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, wshen@us.ibm.com, Laura Wynter, Jingrui He, Qing He, Grzegorz Swirszcz, Rick Lawrence, Yiannis Kamarianakis

We discuss how to utilize GPS data with low sampling rates in real-time traffic prediction, based on our experience in the traffic prediction contest of the 2010 ICDM conference in which we finished second in the final evaluation. The major components of our solution include 1) A pre-processing procedure for map matching, 2) A K-nearest neighbor approach to identify the most similar training hours, and 3) A cross-validation framework for optimizing parameters and avoiding over-fitting.

5 - A Continuum Approximation Approach to Reliable Competitive Facility Location Design

Xin Wang, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, wangxin1@uiuc.edu, Yanfeng Ouyang

We consider two competing service providers who design facility locations to maximize their own service profit. Built facilities are subject to site-dependent probabilistic disruption, while customers patronize the nearest functioning facility for service. We formulate a Stackelberg game model based on continuum approximation and analyze the optimal facility location strategy.

■ TD49

H - Graves Room - 3rd Floor

Simulation Optimization

Sponsor: Simulation

Sponsored Session

Chair: Loo Hay Lee, National University of Singapore, 10 Kent Ridge Cresent, Industrial and Systems Engineering, Singpore, 119260, Singapore, iseleelh@nus.edu.sg

1 - A AHP-OCBA Model for Supplier Selection Problem

Ek Peng Chew, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, isecep@nus.edu.sg, Loo Hay Lee

AHP has been widely used in supply selection problem. It assigns experts to different criteria which suppliers are evaluated. Because of uncertainties in human decision making, we propose to incorporate OCBA concept so that we could achieve the highest probability of correct selection given the limited number of experts.

2 - Integration of Particle Swarm Optimization with Computing Budget Allocation Algorithm

Loo Hay Lee, National University of Singapore, 10 Kent Ridge Cresent, Industrial and Systems Engineering, Singpore, 119260, Singapore, iseleelh@nus.edu.sg, Ek Peng Chew, Si Zhang, Chun-Hung Chen

In this talk, we will present the optimal computing budget allocation approach and show that how it can be integrated with a search technique, PSO, for solving simulation optimization problem.

3 - A Simulation Based Framework for Energy Saving for a Class of Production Systems

Qianchuan Zhao, Professor, Tsinghua University, Department of Automation, Beijing, 100084, China, zhaoqc@tsinghua.edu.cn

Saving energy consumption has becoming a serious concern for companies. In this talk, we propose a simulation based energy consumption evaluation and optimization framework for a class of manufacturing plants.In this framework, we consider both energy cost for the production process and energy cost of facilities to maintain the production enviorment.

4 - Improving Patient Flow in a Hierarchical HealthCare System via Stochastic Simulation Optimization

Jie Song, Peking University, Fangzheng Building, Beijing, China, songjie@coe.pku.edu.cn, Siyang Gao, Weiwei Chen

This research is to propose a strategy to achieve rational patient flow distribution that shift patients from overcrowded hospitals to community health centers in China. We consider patients referral from community health centers have higher priority than walk-in patients when registered in hospital. Block queuing model with simulation optimization in parameters estimation were considered and the conclusions showed the average patients' waiting time and system's congestion are decrease.

■ TD50

H - Ardrey Room - 3rd Floor

Advances in Behavioral Operations

Sponsor: Behavioral Operations Management

Sponsored Session

Chair: Nelson Lau, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, Nelson.LAU@insead.edu

1 - A Behavioral Investigation of Service-based Supplier Competitions

Karen Donohue, University of Minnesota, 321 19th Avenue South, Minneapolis, MN, 55108, United States of America, donoh008@umn.edu, Elena Katok, Saif Benjaafar

This research examines two competitive schemes that have proven, in theory, to be equally effective means for eliciting high service quality from potential suppliers. Through a series of experiments, we find that human subjects are more aggressive in their service investments, and more sensitive to the type of competition offered, than theory would suggest. These differences vary with the number of suppliers engaged in the competition and the type of service costs each supplier incurs.

2 - Social Preferences Work through Emotions

Christoph Loch, Professor, INSEAD, Boulevard de Constance, Fontainebleau, France, c.loch@jbs.cam.ac.uk, Julie Urda

Humans are known to pursue social preferences (status, relationships, in-group solidarity) apart from material rewards. Evolutionary psychology predicts that emotions provide the motivation for pursuing them. This study shows that social interactions that are known to be associated with social preferences trigger emotions in a way that is consistent with the hypothesis that emotions motivate social preferences.

3 - Using Beergame Behavior to Predict Demand During the Economic Cycles: The Lehman Wave

Maximiliano Udenio, PhD Student, Technische Universiteit Eindhoven, Den dolech 2, P.O Box 513, Eindhoven, 5600MB, Netherlands, m.udenio@tue.nl, Jan C. Fransoo

We present a modeling framework based on the beer game dynamic behavior to model demand fluctuations in line with economic cycles. We validate our model using data from four different supply chains, show that our results predict sales developments well, and provide insights into how these results can be used to predict demands during strong economic cycles.

■ TD51

H - Caldwell Room - 3rd Floor

Humanitarian Relief Logistics

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Pavan Murali, Research Staff Member, IBM Research, 19 Skyline Dr, 4S-G54, Hawthorne, NY, 10532, United States of America, pmurali@usc.edu

1 - Analysis of Alternate Layout Designs for Distribution of Bulk Relief Supplies

Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States of America, ananth@engr.wisc.edu, Debjit Roy

At a disaster affected site, bulk distribution relief centers provide immediate supplies to the victims. Due to urgent and unpredictable needs of the victims, it controlling queues is challenging at these sites. This research develops queuing models to analyze alternate layouts and volunteer staffing levels with time-varying arrival rates.

2 - Locating Medical Supplies in Preparation for a Large-scale Emergency

Pavan Murali, Research Staff Member, IBM Research, 19 Skyline Dr, 4S-G54, Hawthorne, NY, 10532, United States of America, pmurali@usc.edu, Fernando Ordonez, Maged Dessouky

We discuss a capacitated facility location problem to determine the points of dispensing medicines in a bioterrorist attack. We formulate a special case of the maximal covering location problem with loss function to account for the distance-dependent coverage and chance-constraints to model demand uncertainty. We solve this problem using a locate-allocate heuristic. We illustrate the use of the model in a case study of locating facilities to address an anthrax attack in Los Angeles County.

■ TD52

H - North Carolina - 3rd Floor

Facility Logistics IV

Sponsor: Transportation Science and Logistics/Facility Logistics

Sponsored Session

Chair: Yugang Yu, Assistant Professor, Rotterdam School of Management, Erasmus University, Rotterdam, Netherlands, yyugang@rsm.nl

1 - A Solvable TSP for Minimizing the Makespan in a Two-depot Multi-aisle Automated WarehoUsing System

Yugang Yu, Assistant Professor, Rotterdam School of Management, Erasmus University, Rotterdam, Netherlands, yyugang@rsm.nl

This paper studies how to sequence storage and retrieval jobs for a two-depot multi-aisle automated storage/retrieval system (AS/RS) in order to minimize the makespan of these jobs. We formulate the sequencing problem as a special case of the travel saleman problem (TSP). An algorithm is developed to find the optimal solution in a polynomial time.

2 - Optimal Zone Boundaries for a Two-class Live-cube Compact Storage System

Nima Zaerpour, PhD Candidate, RSM Erasmus University, T10-46, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, NZaerpour@rsm.nl, Yugang Yu, Rene de Koster

This paper studies two-class live-cube storage system. Each load is accessible individually and can be moved to a lift on every level in x- and y-directions by a shuttle, comparable to 15-puzzle. A lift moves loads across different levels in z-direction. We derive the expected retrieval time of an arbitrary load. We optimize the zone boundaries by minimizing the expected retrieval time. The model is solved optimally by splitting it into several sub-models leading to closed-from solutions.

3 - Effect of Lot Splitting with RFID for the Trade-off between the Material Movement and Lead Time

Takashi Irohara, Professor, Sophia University, 7-1 Kioi-cho, Chiyoda-ku, Tokyo, 102-8554, Japan, irohara@sophia.ac.jp, Hideaki Yamashita

We propose a new material handling rule, called time based rule, which can create a best mix of shorter lead time and also less frequent material movement simultaneously. We analyze the effect of lot splitting for the trade-off between the material movement and lead time by the simulation experiment.

■ TD53

H - South Carolina - 3rd Floor

Novelty Score Algorithms and Their Applications

Sponsor: Data Mining

Sponsored Session

Chair: Seoung Bum Kim, Associate Professor, Korea University, Seoul, Korea, Republic of, sbkim1@korea.ac.kr

Co-Chair: Pilsung Kang, Assistant Professor, Seoul National University of Science & Technology, Seoul, Korea, Republic of, pskang@snut.ac.kr

1 - PCA-based Multivariate Control Charts for Monitoring Nonnormal Processes

Poovich Phaladiganon, Ph.D. Candidate, University of Texas at Arlington, United States of America, poovich@gmail.com, Victoria Chen, Seoung Bum Kim

Principal component analysis (PCA), the dimension reduction technique, can be implemented in control chart. The control limits of PCA control chart are derived from the normality assumption. When the assumption is violated, the control limits are not appropriate to implement on the chart. We proposed the bootstrap

method to overcome this issue. The simulation results show that the bootstrap method performed better than the traditional control limits, but comparable to the KDE in terms of ARL0.

2 - Integration of Novelty Score Algorithm and Control Chart Technique

Tuerhong Gulanbaier, Ph.D. Candiate, Korea University, Seoul, Korea, Republic of, gulambar@korea.ac.kr, Seoung Bum Kim

We propose a new non-parametric HNS-based multivariate control chart. EWMA version of HNS chart is proposed to increase the sensitivity of detecting small process mean shifts. We also examined the proposed HSN-based chart for autocorrelated and multivariate processes. Experimental results with simulated data demonstrated that the proposed control charts yielded better performance than the existing control chart for detecting small shifts in multivariate autocorrelated processes.

3 - Clustering Algorithm-based Control Charts

Jihoon Kang, Ph.D. Student, Seoul, Korea, Republic of, joker404@hanmail.net, Seoung Bum Kim

In the present study we propose a clustering algorithm-based control chart that overcomes the limitation posed by the distributional assumption in traditional control charts. The simulation results showed that the proposed clustering algorithm-based control charts outperformed Hotelling's T2 control charts especially when process data follow the nonnormal distributions.

4 - Keystroke Dynamics Based User Verification – Who is Typing Now?

Pilsung Kang, Assistant Professor, Seoul National University of Science & Technology, Seoul, Korea, Republic of, pskang@snut.ac.kr, Sungzoon Cho

We present user identification methodologies based on one's typing patterns. Because keystroke behavior does not require any additional hardware, it can be used as an effective and efficient biometric feature for identity verification. However, only a valid user's typing patterns are available during the model development, we adopt three novelty scoring methods to handle it. Experimental results show that most impostors can be detected successfully without a low false alarm.

■ TD54

H - Charlotte Hall – 3rd Floor

Free Website Management Tools for Subdivisions

Contributed Session

Chair: Shirley Mohr, Web Designer, Internet & New Media, INFORMS, 7240 Parkway Drive, Suite 300, Hanover MD 21076, shirley.mohr@informs.org

1 - Free Website Management Tools for Subdivisions: Learn how EZ Publish Can Revitalize Your Web Presence

Shirley Mohr,Web Designer, Internet & New Media, INFORMS, 7240 Parkway Drive, Suite 300, Hanover, MD 21076, shirley.mohr@informs.org

This special training session for INFORMS Subdivision officers and webmasters introduces EZ Publish, a hassle-free and 'EZ' tool for quickly creating and updating web sites without the need for web design experience or special software. Any community or Subdivision that wishes to utilize a ready-made INFORMS template and intuitive tools to create and maintain their website should attend. Special features you can incorporate include blogs, forums, password-protected areas, and analytics reports about your site.

■ TD55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS: Predictive Analytics

Sponsor: Analytics/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Irv Lustig, Business Unit Executive, Optimization and Supply Chain Client Technical Professionals Leader, IBM, 25 Sylvan Way, Short Hills, NJ, 07078, United States of America, irv@us.ibm.com

1 - Predictive Analytics and its Relationship to Operations Research

Manoj Chari, Sr. Director, OR R&D, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Manoj.Chari@sas.com

We will provide a brief overview of the close relationship between predictive analytics and traditional areas of operations research, and set the stage for the more comprehensive coverage of predictive analytics will follow in the subsequent talks in the session.

2 - Cloud Services for Analytics

Ishan Sehgal, Program Director, Software as a Service - SPSS, IBM, 3039 Cornwallis Road, Research Triangle Park, NC, 27709, United States of America, ishan@us.ibm.com

Data is gushing into enterprises from everywhere: from internal applications, supply chain partners, customers, the Internet, and from devices never thought of as data sources. While this data is a rich goldmine of information, analyzing it offers a challenge to organizations of any size. This talk will focus on how enterprises are turning to cloud services for analytics, with an indication of how enterprises can determine when to use it and what to look for in the analytic services they choose.

3 - No Crystal Ball Required - Predictive Analytics for Business

Udo Sglavo, Business Analytics Global Lead: Research and Development, SAS Institute Inc., 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Udo.Sglavo@sas.com

Analytics have historically served the need to understand what has happened in the business to get where we are today. Now the power of analytical models has grown to where they have direct impact on company performance. Companies are employing predictive analytics for exploring and analyzing data to help uncover patterns and insights that drive evidence-based decision making. This presentation explores the role of predictive analytics techniques, tools and case studies in this exploding arena.

■ TD56

H - Biltmore Boardroom - 2nd Floor

OR Scheduling II

Contributed Session

1 - Scheduling Elective Patients Upon Admission of Emergency Patients

Ergin Erdem, North Dakota State University, 202 Civil and Industrial Engineering Bui, Fargo, NC, 58108, United States of America, ergin.erdem@ndsu.edu, Jing Shi, Xiuli Qu

In this research, an approach for rescheduling elective patients upon arrival of emergency patients is proposed. The model integrates three different units: operating room, post anesthesia care unit, and inpatient clinic unit. A mathematical model is built to minimize total costs while considering the availability of various resources, such as time slots, surgical teams, and beds at post-operation clinic units. An evolutionary algorithm is developed for solving given problem instances.

2 - An Algorithm for Operating Room Block Assignment

Narges Hosseini, PhD Candidate, Industrial Engineering Department, Clemson University, 110-Freeman Hall, Clemson, SC, 29634, United States of America, nhossei@clemson.edu, Kevin Taaffe

Most U.S. hospitals use a hybrid scheduling method for elective surgeries in that a proportion of the operating rooms (ORs) are blocked for specific groups and a proportion are open to all surgeons. The assignment of blocks and open times to groups is an NP-hard problem but can be solved easily through the use of valid assumptions. This research introduces the NP-hard model as well as the tractable problem and results pertaining to margin contribution, block release times, and turnaround times.

3 - Robust Scheduling in Operating Rooms

Camlo Mancilla, Lehigh University, 200 West Packer Ave., Bethlehem, PA, 18015, United States of America, cam306@lehigh.edu, Robert Storer

We developed algorithms to find an initial scheduling for a multiple operating rooms enviroment. We consider disruptions from durations and emergency arrivals. We provide rescheduling methods that help to overcome disruptions. We also show the performance of our robust schedule in a brief computational experience.

■ TD57

W - Providence I- Lobby Level

Airline, Airport, and Airspace Planning and Recovery Strategies

Sponsor: Aviation Applications

Sponsored Session

Chair: Amy Cohn, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, amycohn@umich.edu

1 - Short-term Airline Maintenance Planning & Recovery

Marcial Lapp, University of Michigan, Industrial & Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, mlapp@umich.edu, Sergey Shebalov, Amy Cohn

Flight disruptions can have major effects on scheduled aircraft maintenance events. Once aircraft rotations are disrupted, plans must be updated to comply with regulations for aircraft maintenance. We address this issue by providing several strategies to stay compliant with regulations through a short-term maintenance planning optimization framework. We present results that illustrate the effectiveness of our optimization strategy and its impact on an airline's short-term planning process.

2 - Optimal Separation Policies for Continuous Descent Arrivals

Heng Chen, University of Massachusetts Amherst, Isenberg School of Management, Department of Finance & Operations Mgmt, Amherst, MA, 01003, United States of America, hchen@math.umass.edu, Senay Solak

We describe a stochastic optimization approach to determine optimal separation policies for continuous descent arrivals (CDA). The problem is modeled as a finite-horizon Markov Decision Process, where the objective is to minimize total expected fuel burn cost required to achieve desired separation under trajectory uncertainties. Some analytical and numerical results are presented.

3 - Analyzing the Impact of Airline Schedules on Airport Congestion

Shervin AhmadBeygi, Metron Aviation, Reston, VA, United States of America, Shervin.AhmadBeygi@metronaviation.com

Airports go through peak periods when demand for departures and arrivals exceeds capacity. These peaks cause congestion on both the surface and in the terminal area, and result in delays and inefficiencies in operations. We analyze the impact of these scheduling peaks and investigate the benefits of alleviating them. The results of this analysis help researchers design effective congestion management mechanisms.

■ TD58

W - Providence II - Lobby Level

Applications in Information Systems and Decision Support

Sponsor: Military Applications Society

Sponsored Session

Chair: Thomas Turner, CTC, 747 River Road, Hollis, ME, 04042, United States of America, turnert@ctc.com

1 - The Brazilian Navy Contact Prize: A Proposal with Electre-tri Multi-Criteria Decision Making Method

Marco Vieira, LtCdr., Brazilian Navy, Rua da Ponte, Ed. 23 - AMRJ, Ilha das Cobras - Centro, Rio de Janeiro, RJ, 20091-000, Brazil, marco@casnav.mar.mil.br

The Brazilian Navy (BN) has a prize for the navy ships that had reported the higher number of vessels sailing on the territorial sea. The methodology consists in register and score the reports of contacts for each Navy Ship. The winner will be the ship that reported the higher number of contacts. It does not take into account some aspects as: sailing days and area, traffic density and season. This work intends to propose a new methodology for the BN Contact Prize, making use of ELECTRE-TRI.

2 - Information System on Defense GQA & Manufacturing Engineering

Deok-Hwan Kim, Senior Researcher, Defense Agency for Technology and Quality, Cheongryang P.O. Box 276, Dongdaemun-gu, Seoul, 130-650, Korea, Republic of, thekany@hotmail.com

To acquire quality military supplies, Government should conduct a quality assurance activity. Typically, many stakeholders are involved in GQA, such as quality assurance agency, contractor, and so on. Consequently, frequent transactions of documents between the stakeholders are inevitable. In order to achieve effective and efficient GQA, corresponding information system will be helpful. This presentation introduces information system for GQA in Republic of Korea.

3 - Geographical Analysis on Piracy Activity in Maritime Transportation

Shigeki Toriumi, Assistant Professor, Chuo University, 1-23-27 Kasuga, Bunkyo-ku, Tokyo, 112-8551, Japan, toriumi@ise.chuo-u.ac.jp, Daisuke Watanabe

In this paper, we find geographical features of hot spot for sea piracy using the map which shows all the piracy and armed robbery incidents reported to the IMB Piracy Reporting Centre. First, we develop a time-space network of vessels using the LMIU's vessel movements database. Then, we analyze vessels sailing in the region where the piracy incidents occur.

4 - Decision Support for the Marine Corps Tank Fleet

Thomas Turner, CTC, 747 River Road, Hollis, ME, 04042, United States of America, turnert@ctc.com

The Marine Corps program manager for tank systems has made total life cycle management (TLCM) decisions based on subject matter expert opinion and business rules. This talk outlines a desktop decision support system designed to use a previously developed TLCM discrete event simulation to generate a wide range of output and present that output in a way that allows the decision maker to conduct "what-if" analysis of various stock rotation or maintenance policies.

■ TD59

W - Providence III - Lobby Level

Modeling Human Behavior in Service Processes

Sponsor: Service Science

Sponsored Session

Chair: Christoph Heitz, Zurich University of Applied Sciences, Rosenstrasse 3, Winterthur, Switzerland, heit@zhaw.ch

1 - Modeling Interactions between Clients and Providers in B2B Services

Jeanette Blomberg, Research Staff Member, IBM Research, 650 Harry Road, San Jose, CA, 95120, United States of America, jblomberg@almaden.ibm.com

In long term B2B service relationships recurring interactions take place across the client-provider organizational boundary. These interactions shape the experiences of clients and providers with implications for how service quality is defined and assessed. This paper reports on an effort to model recurring interactions between clients and providers in IT outsourcing services where clients and providers are globally distributed and where employees providing service number in the hundreds.

2 - What is the Right User and Algorithm Combination for Services Based on Crowd-sourcing?

Ram Akella, Professor & Director, University of California, 422 SDH (Sutardja Dai Hall), Berkeley, CA, 94720, United States of America, akella@ischool.berkeley.edu, akella@soe.ucsc.edu,, Karla Caballero, Joel Barajas, Chunye Wang

Much of the OR and OM literature concerning Services emphasizes resource management. Typical results concern tiers of service agents with varying costs and speeds, and characterize responsiveness and costs. We describe new service center problems and solutions in environments such as Cisco, SAP, IBM and AOL, where machine Learning based approaches for knowledge extraction and search play a key role, in conjunction with crowd sourcing.

3 - Development of a Service Quality Evaluation Scheme for s-Scape

Hyun-Jin Kim, POSTECH, Department of Industrial and Management, Pohang, Korea, Republic of, brightst@postech.ac.kr, Ryeok-Hwan Kwon, Kwang-Jae Kim

's-Scape' (service-Scape) is a virtual reality (VR)-based system for service testing, which is now under development. One important issue associated with its operation is how to evaluate the quality of a service tested in s-Scape. Measuring service quality in s-Scape is particularly challenging in the sense that the measurement is to be done in a VR-based laboratory environment. This talk presents the current status and future research issues for a service quality evaluation scheme for s-Scape.

4 - Customer Lifetime Value: Modeling Customer Behavior is Necessary, But is it Sufficient?

Christoph Heitz, Zurich University of Applied Sciences, Rosenstrasse 3, Winterthur, Switzerland, heit@zhaw.ch

The value of service firms is usually dominated by the value of the customer relationships. An established concept to calculate this value is the customer lifetime value (CLV). While the calculation of CLV necessarily needs a model of the future customer behavior, it also includes assumptions on the firm's behavior, often implicitely. We show that CLV cannot be defined properly without modeling the firm's future behavior.

■ TD60

W - College Room - 2nd Floor

Quadratic Optimization

Sponsor: Optimization/Linear Programming and Complementarity
Sponsored Session

Chair: Miguel Anjos, Ecole Polytechnique de Montreal, Mathematics & Industrial Engineering, Montreal, QC, Canada, :miguel-f.anjos@polymtl.ca

1 - Finding a Global Optimal Solution to the Conic Form Quadratically Constrained Quadratic Programming

Qingwei Jin, North Carolina State University, Room 443, Daniels Hall, ISE department, North Carolina State University, Raleigh, NC, 27695, United States of America, qjin2@ncsu.edu, Wenxun Xing, Cheng Lu, Zhenbo Wang, Shu-Cherng Fang

The conic form quadratically constrained quadratic programming problem (CQCQP in short) is a generalization of the commonly seen QCQP problem. Using the concept of copositive cone reformulation, we develop a sufficient condition, which is more general than the known positive semidefiniteness condition, to certify a Karush-Kuhn-Tucker point to be an optimal solution of CQCQP. We also use conic programming duality theory to study the properties of the corresponding optimal Lagrangian multipliers.

2 - On Convex Quadratic Programs with Linear Complementarity Constraints (QPCCs)

Lijie Bai, Research Assistant, Rensselaer Polytechnic Institute, 110 8th Street, Amos Eaton 430, Troy, NY, 12180, United States of America, bail@rpi.edu, John Mitchell, Jong-Shi Pang

We propose an algorithm in the spirit of Benders decomposition by which the global resolution of a convex quadratic program with linear complementarity constraints can be achieved. The problem is split into two to improve the computational performance. We also devise two refinements: (i) a parametric QP method to obtain better lower bounds from infeasible points, (ii) the addition of a penalty term to the objective function obtained by solving a semi-definite program to ensure convexity.

3 - Detect Copositivity by Cones of Nonnegative Quadratic Functions

Zhibin Deng, North Carolina State University, 2824 Avent Ferry Rd., Apt. 302, Raleigh, NC, 27606, United States of America, zdeng2@ncsu.edu, Ye Tian, Ziteng Wang

In this talk, we present a new method to detect copositivity. After transforming the copositivity decision problem into a quadratic programming problem, it is approximately solved by a sequence of QPs over the cone of nonnegative quadratic functions, which has simple LMI representations. An adaptive approximation scheme is used to generate a sequence of ellipsoids to cover the standard simplex. The lower and upper bounds are used to determine the copositivity of a given matrix.

■ TD61

W - Sharon Room - 2nd Floor

Transportation Planning

Contributed Session

Chair: Ioannis Psarros, Student, Florida AtlanticUniverity, 1675 NW 4th Avenue APT 815, Boca Raton, FL, 33432, United States of America, ipsarros@fau.edu

1 - Optimization of Seaport Transport Capacity Allocation between Railroads and Highways

Lei Bu, Ph.D., Institute for Multimodal Transportation,Jackson State University, 1230 Raymond Rd 900, Jackson, MS, 39204, United States of America, leibu04168@gmail.com, Feng Wang

Based on principles of optimization, the systemic problem of freight distribution and mode split are modeled in an attempt to maximize the total transport capacity with an optimal traffic allocation between railroads and highways.A reasonable theoretic railroad traffic share volume is determined based on the minimal transport cost principle and minimal carbon emission criteria,and the potential highway traffic volume shifted to railway transport is also calculated in this paper.

2 - International Shipment Planning and Optimization at Manhattan Associates

Aykagan Ak, Senior Science Analyst, Manhattan Associates, 2300 Windy Ridge Pkwy, Atlanta, GA, 30339, United States of America, aak@manh.com, Srinivas Nandiraju, Kim Ross

International shipment planning (ISP) problems are among the hardest transportation problems to optimize in the industry because of complex business requirements. In this talk, we will present the new ISP optimization engines currently being developed by Manhattan Associates. We will introduce the real life problems and give an overview of the novel solution approaches used which can provide savings as much as 50% for a typical shipper while automating the end-to-end shipment planning effort.

3 - A Review of Factors Seaport Capacity: System-wide Performance Management

Samsul Islam, PhD Student, University of Auckland, 11 Liverpool Street, Auckland, New Zealand, New Zealand, misl086@aucklanduni.ac.nz

It identifies fundamental reasons accelerating emerging research in capacity expansion; offers a framework to summarize the research in this field; surveys a new generation of analytical tools for capacity expansion from a system perspective. The goal of this survey is to go beyond typical sub-system based literature and to examine studies that can potentially broaden capacity management research.

4 - Optimization of Transit System Operations under Normal and Emergency Conditions

Ioannis Psarros, Student, Florida AtlanticUniverity, 1675 NW 4th Avenue APT 815, Boca Raton, FL, 33432, United States of America, ipsarros@fau.edu, Evangelos I. Kaisar

Catastrophic events in the past revealed the need for more research in the field of emergency evacuation and especially how transit can be involved in evacuating operations. On the first part of this study, after identifying the characteristics of the selected transit system operations under normal conditions, the optimization of the bus system routes, is a major objective. On the second part the reliability of the updated routes when a no-notice evacuation is required, will be examined.

■ TD62

W - Independence Room - 2nd Floor

Energy Pricing and Price Forecasting

Contributed Session

Chair: Mette Bjôrndal, Professor, Norwegian School of Economics (NHH), Helleveien 30, Bergen, 5045, Norway, mette.bjorndal@nhh.no

1 - A Short-Term Price Forecast and Profitability of Fossil-Fuel Generators of Electricity

Pawel J. Kalczynski, California State University, College of Business and Economics, Fullerton, CA, 92834-6848, United States of America, PKalczynski@fullerton.edu, Dawit Zerom

This paper presents a new approach to the price-based dynamic economic dispatch (PBDED) problem of fossil-fuel generators of electricity based on a short-term price forecast. The dispatch decisions are made or changed at every discrete time point (e.g. every hour). The objective of the dispatch-optimization process is to maximize generator's profit over a very long time period (e.g. one year). Existing price forecasts for the NYISO electricity are evaluated and a new price forecast is proposed. The results of numerical simulation experiments involving 2010 NYISO price data and a sample 400MW fossil-fuel generator are described. The optimization model as well as the forecast described in this paper can be used for dispatching different types of fossil-fuel generators operating on various deregulated markets.

2 - A Hybrid Model Development for Electricity Energy Price Prediction

Hangseok Kim, Ajou University, San 5, Woncheon-Dong, Yeongtong-Gu,Suwon, Suwon, Korea, Republic of, tdea@ajou.ac.kr, Kanghee Park, Hyunjung Shin

In this article, we propose a hybrid model for forecasting electricity price. The impact of economic conditions on fluctuations of electricity price is designed using Semi-Supervised Learning. The real value of electricity price is predicted based on the climate indices using Artificial Neural Network. The results obtained by two algorithms are combined through hybrid model.

3 - Prediction Intervals for Bankruptcy Prediction Models

Marco Lam, York College of PA, 441 Country Club Road, York, PA, United States of America, mlam@ycp.edu, Brad Trinkle

Decision makers require accurate information in order to make optimal decisions. The purpose of this paper is to improve the information quality of prediction models by using prediction intervals rather than point estimates. We test our hypotheses on a bankruptcy prediction model commonly used. The use of upper and lower bounds in concert with the point estimates yield an improvement in the predictive ability of bankruptcy prediction models.

■ TD63

W - Tryon North - 2nd Floor

Algorithms for Multi-Objective Optimization

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Jon Marquis, Raytheon, 5440 West Whitten Street, Chandler, AZ, 85226, United States of America, jonemailbox1@gmail.com

1 - Multi-Criteria Resource-Constrained Project Scheduling of Semiconductor Equipment Installation

John Fowler, Professor, Arizona State University,, Computing, Informatics & Dec. Sys. Eng., Tempe, AZ 85287, United States of America, john.fowler@asu.edu, Junzilan Cheng, Karl Kempf, Erik Hertzler, Jerry Huff

A key component of ramping a semiconductor wafer fabrication facility is to schedule the installation and qualification of multiple types of capital intensive and sophisticated manufacturing equipment. Multiple objectives are considered in practice such as resource utilization cost, project duration, total project investment, etc. We approach this problem by modeling it as a resource-constrained project scheduling problem (RCPSP) and extend it to handle multiple criteria at the same time.

2 - Quantitative Comparison of Approximate Solution Sets for Multicriteria Optimization Problems

Esma Gel, Associate Professor, Arizona State University, SCIDSE, Tempe, AZ, 85281, United States of America, esma.gel@asu.edu, Murat Koksalan, John Fowler, Jyrki Wallenius

We consider evaluating the quality of solution sets generated by heuristics for multiple-objective combinatorial optimization problems. We present and demonstrate the use of the integrated preference functional (IPF), which assigns a scalar value to a given discrete set of nondominated points. We present an exact calculation method for the IPF measure for an arbitrary number of criteria and demonstrate the use of IPF with two- and three-criteria numerical examples.

3 - Incorporating Heuristics in Multi-objective Optimization

Jon Marquis, Raytheon, 5440 West Whitten Street, Chandler, AZ, 85226, United States of America, jonemailbox1@gmail.com, Pekka Korhonen, Esma Gel, John Fowler, Murat Koksalan, Jyrki Wallenius

We incorporate problem-specific heuristics within multi-objective evolutionary algorithms and demonstrate that they reduce the computational effort required to produce a quality solution. We provide computational results for the adaptation of existing heuristics in the multi-objective knapsack problem and the multi-criteria scheduling problem.

■ TD64

W - Queens Room - 2nd Floor

Community-Based Operations Research III

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Michael Johnson, Associate Professor, University of Massachusetts Boston, 100 Morrissey Boulevard, McCormack Hall, Room 3-428A, Boston, MA, 02125-3393, United States of America, Michael.Johnson@umb.edu

1 - Comparing the Efficacy of Hot-spot Mapping Techniques for Predicting Urban Street Robberies

Autumn Linderborn, University of Baltimore, School of Criminal Justice, 1420 N. Charles St., Baltimore, MD, 21201, United States of America, autumn.linderborn@ubalt.edu, Debra Stanley, Thomas Darling

Street robbery hot-spots in a large urban area are calculated using a number of approaches and algorithms and the resulting areas compared. Next, the ability of the alternatively constructed hot-spots to predict future street robberies is evaluated based on multiple measures of predictive accuracy.

2 - Modeling for School Systems: Assigning Routes and School Start Times

Kathleen Hendrix, Georgia Institute of Technology, 765 Ferst Dr., GA, 30332, United States of America, khendrix7@gatech.edu

Gwinnett County Public Schools drives more than 5000 routes daily across 130 schools. We developed a set of heuristics to assign a set of routes to each bus, and a set of schools to each tier of start times in a way that reduced the number of buses needed by more than 10%. We show that the route assignment heuristic provided optimal or near optimal solutions. The heuristic is informed by a regression model that estimates the driving times of the buses and is implemented in a Java based tool.

3 - Identifying Sites for Community Evacuation Center Teams and Equipment in Southwestern Pennsylvania

Louis Luangkesorn, Research Assistant Professor, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15260, United States of America, lol11@pitt.edu

During disasters, the American Red Cross Southwestern Pennsylvania Chapter is charged with providing mass care, food and shelter to those impacted by the disaster. This requires prepositioning supplies as well as training evacuation center teams. Given limited resources for training and equipping these teams, these sites need to be chosen so that the potential population at risk is covered. This work applies a maximal covering location model to this problem to identify areas to teams.

4 - Exploiting 911 Data for Police Deployment and Crime Prevention: Situational Awareness Alert Model

Robin Neray, Senior Analyst, Structured Decisions Corporation, 1105 Washington Street, Suite 1, West Newton, MA, 02465, United States of America, robin.neray@gmail.com, Richard Larson, David Einstein

Collaborating with RTI and RAND, SDC is designing a software toolkit for analyzing 911 data to support public safety. SDC built a model to identify benign appearing call types having a disproportionately high probability of endangering a responding officer. Modeling call types as states in a Markov chain, and using historical data and a NaÔve Bayes Classifier, we estimate conditional transition probabilities of a benign call type transitioning to a hazardous call type and raise a warning flag.

■ TD65

W - Kings Room - 2nd Floor

Planning in Service Industries

Contributed Session

Chair: Anirudh Agrawal, Doctoral student, HEC Paris, Jouy en josas, Paris, 78350, France, agrawalan@hec.fr

1 - Effects of Operational Flexibility on Performance in Service Firms

Adelina Gnanlet, Asst. Professor, California State University - Fullerton, Department of Management, Mihaylo College of Business and Economic, Fullerton, CA, 92832, United States of America, agnanlet@fullerton.edu, Chris McDermott, Muge Yayla-Kullu

During peak demand, service firms use operational flexibility strategies such as utilizing cross-trained employees (staffing flexibility) or upgrading customers to another segment (capacity flexibility). Although cost efficient, such flexibilities may have unintended effects on the quality of service due to learning. In this paper, we study the effects of these short-term strategies on the quality of service and the financial performance with specific application to hospitals.

2 - How to Use Social Media to Make a Service Different?

Youn Sung Kim, Professor, Inha University, 253 Yonghyun-Dong Nam-Gu, Incheon, 402-751, Korea, Republic of, keziah@inha.ac.kr, Dongwon Lee, Seo Young Kim

In the smart era companies hope to use the new type of technology for the differentiation. In this paper we investigate the current cases of social media application in the fields of management practice and suggest the new way of a meaningful differentiation methods by use of social media.

3 - Service Lifecycle: Design, Marketing and Delivery

Anirudh Agrawal, Doctoral student, HEC Paris, Jouy en Josas, Paris, 78350, France, agrawalan@hec.fr

The paper aims to propose a model for the design, development, marketing and delivery of a new service. The paper will study a case to illustrate the application of the model developed in the study. The paper will take most of its theory from the literature of new product development.

■ TD66

W - Park Room - 2nd Floor

Healthcare Workforce Management

Cluster: Workforce Engineering and Management

Invited Session

Chair: Sanjay Mehrotra, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu

1 - Optimal Learning for Surgical Residents

Jonathan Turner, Healthcare Engineer Manager for Quality and Innovation, Northwestern Memorial Hospital, 211 East Ontario, Suite 13, Chicago, IL, 60611, United States of America, jturner1@nmh.org, Sanjay Mehrotra, Jian Hu, Mark Daskin

We present a multi-criteria stochastic programming model for positioning surgical residents to achieve learning goals. However, there has been much disagreement in the medical community regarding the criteria and the goals. We solve the multi-criteria problem with new methods that ensure robustness.

2 - Robust Models for Nurse Staffing

Changhyeok Lee, Northwestern University, 2145 Sheridan Road, Room C151, Evanston, Il, 60208, United States of America, changhyeoklee2014@u.northwestern.edu, Sanjay Mehrotra

Hospitals must maintain safe nurse-to-patient ratios to offer consistent patient support. With limited supply of nurses and highly fluctuating patients demand, the providers face the issue of determining the optimal nurse staffing levels. In practice, difficulties arise with estimating the future demand. We present Newsvendor-based optimization models and algorithms for the nurse staffing problem in various distributionally-robust settings.

3 - A Queueing Model to Evaluate the Impact of Patient 'Batching' on throughput and Flow Time in a Medical Facility

Hsiao-Hui Lee, Assistant Professor, University of Hong Kong, Meng Wah Complex, Room 607, Pok Fu Lam, Hong Kong - ROC, hhlee@hku.hk, Arvind Sainathan, Vera Tilson, Greg Dobson

We examine the workflow process in a medical facility, which involves an initial exam by a resident physician, a conference between the resident and the attending, and the attending physician's visit with the patient. We show that the throughput optimal policies involve dynamic batching: even without setup time, uncertain service times and the simultaneous conference make batching optimal. But given limited space, large batches could simultaneously increase flow time and decrease throughput.

4 - Use of Dedicated Wings to Optimize Institutional Objectives with Strained Bed Capacity

Burhaneddin Sandikci, University of Chicago, Booth School of Business, Chicago, IL, United States of America, Burhaneddin.Sandikci@chicagobooth.edu, Don Eisenstein, Tom Best, David Meltzer

To address adverse effects of limited capacity, an urban teaching hospital received government dispensation to partition its inpatient beds into wings. Each wing has a specific designation of the types of patients it can admit, and the number of beds it is allocated. A patient can be admitted to the hospital only if a bed is available in the appropriate wing. We present a model and numerical results based on real data for the computationally hard problem of forming wings.

■ TD67

W - Grand A - 2nd Floor

Game Theory

Contributed Session

Babak Abbasi, Royal Melbourne Institute of Technology University, 1/1 McIntosh Street, Oakleigh, VIC 3166, Melbourne, Melbourne/Oakleigh 3166, Australia, b.abbasi@gmail.com

1 - Computing a Perfect Equilibria of Finite n-Person Game with an Interior-Point Path-Following Method

Yin Chen, City University of Hong Kong, Room Y1441, Academic Building, CityU, HK, Hong Kong, Hong Kong - PRC, yinchen4@student.cityu.edu.hk, Chuangyin Dang

By introducing a parameter to combine a weighted logarithmic barrier term with each player's payoff function, a new game deforms from a trivial game to the original game as the parameter varying from 0 to 1. It is proved that a smooth interior-point path starts from the unique Nash equilibria of the trivial game and leads to a perfect Nash equilibria of the original one. A predictor-corrector method is proposed to follow the path. The numberical performance of the method is analyzed extensively.

2 - The Nonatomic Supermodular Game

Jian Yang, Associate Professor, New Jersey Institute of Technology, 323 Martin Luther King Jr. Boulevard, Newark, NJ, 07102, United States of America, yang@njit.edu, Xiangtong Qi

We introduce the nonatomic version of the supermodular game, and prove the existence of a monotone equilibrium and its monotonic trend as the player type distribution varies. Pure equilibria are identified for semi-anonymous games, i.e., those in which opponents' types as well as their actions may impact a given player's payoff. Results here complement the known nonatomic-game literature, and are applicable to price games involving diverse cost/quality parameters.

3 - The Role of Subsidies in a Social Network with Interconnected Risk

Min Gong, Columbia University, 2 Branford Street, Norwalk, CT, 06855, United States of America, mg3030@columbia.edu, Howard Kunreuther, Geoffrey Heal, David Krantz, Elke Weber

Subsidy in a laboratory coordination game promotes coordination both with deterministic and stochastic payoffs. After removing the subsidy, high coordination continues with stochastic payoffs, but declines with deterministic ones. Survey data indicates that decision justifications differ between the two settings. Temporary subsidies promote lasting coordination in risk reduction, but in a deterministic setting, subsidy may be counterproductive and crowds out other rationales for coordination.

4 - Tail Conditional Expectation for Multivariate Distributions: A Game Theory Approach

Babak Abbasi, Royal Melbourne Institute of Technology University, 1/1 McIntosh Street, Oakleigh, VIC 3166, Melbourne, Melbourne/Oakleigh, 3166, Australia, b.abbasi@gmail.com

The Tail Conditional Expectation (TCE) in risk analysis is a robust and practical measure for quantifying financial risk exposure. TCE describes the expected amount of risk that can be experienced given that a potential risk exceeds a specified value. Since TCE for continuous distribution shares coherent properties, we propose using Shapley values in allocating total risk (TCE) to each business line when there are correlated business lines.

■ TD68

W - Grand B - 2nd Floor

Supply Chain Network Design

Contributed Session

Chair: Paul Bryant, The University of Alabama, 300 Alston Hall, Box 870226, Tuscaloosa, AL, 35487, United States of America, ptbryant@crimson.ua.edu

1 - Facility Location in a Wood Products Supply Chain Using Agent Based Modelling

Saba Vahid, PhD Candidate, The University of British Columbia, 4219 - 2424 Main Mall, Forest Sciences Building, Vancouver, BC, V6T1Z4, Canada, saba_v@interchange.ubc.ca

Agent-based simulation has been used frequently in recent years to model complex supply chains. It offers more modelling flexibility compared to traditional simulation and optimization frameworks. This research develops a simulation model in which the location of new facilities in a supply chain is decided by semi autonomous agents through a combination of simulation and optimization. The results are presented for a case study of British Columbia's Coastal wood products manufacturing industry.

2 - A Nonlinear Knapsack Problem Arising in Location Problems with Safety Stocks

Krishna Jarugumilli, Student, North Carolina State University, 304 Daniels Hall, 111 Lampe Drive, Raleigh, NC, 27695, United States of America, kjarugu@ncsu.edu, Reha Uzsoy

We present a nonlinear knapsack problem arising in the context of a Multi-Product Network Design Model considering lead time and safety stock(MPNDLS). The knapsack problem arises as a sub-problem within a Lagrangian heuristic used for the location model, and has a complex non-separable objective function which precludes conventional dynamic programming methods. We discuss and compare exact and approximate solution techniques.

3 - Supply Chains with Global Outsourcing and Quick-Response Production under Demand and Cost Uncertinty

Zugang (Leo) Liu, Assistant Professor, Pennsylvania State University, 76 University Dr., Hazleton, PA, United States of America, zxl23@psu.edu, Anna Nagurney

We develop a modeling and computational framework for supply chain networks with global outsourcing and quick-response production. Our model considers multiple off-shore suppliers, manufacturers, and demand markets. Our analytical results shed light on the value of outsourcing from novel real option perspectives. The simulation studies reveal important managerial insights regarding how demand and cost uncertainty affect profits, risks, as well as decisions of supply chain firms.

4 - Multi-echelon Network Design with Direct Shipments and Lateral Transshipments

Paul Bryant, The University of Alabama, 300 Alston Hall, Box 870226, Tuscaloosa, AL, 35487, United States of America, ptbryant@crimson.ua.edu, Burcu Keskin, Sharif Melouk

We analyze a multi-echelon supply chain network to determine the location and numbers of suppliers and distribution centers to serve a set of customers with deterministic, time varying demand. Multiple sourcing is allowed including direct shipments from suppliers and lateral transshipments. Two MILP formulations are presented with three- and four-index flow variables. Findings are shown for cost/network structure and shipment decisions.

■ TD69

W - Grand D - 2nd Floor

Closed-Loop and Sustainable Supply Chain Network Design

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Ana Muriel, University of Massachusetts Amherst, 160 Governors Drive, Amherst, United States of America, muriel@ecs.umass.edu

Co-Chair: Elif Akcali, Associate Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, akcali@ise.ufl.edu

1 - Robust Design of a CLSC Network for Uncertain Carbon Regulations and Random Product Flows

Nan Gao, Iowa State University, 3004 Black Engineering, Ames, United States of America, nangao@iastate.edu, Sarah Ryan

We combine robust optimization with stochastic programming to solve a multi-period capacitated closed-loop supply chain (CLSC) network design problem considering carbon emissions caused by transportation. Uncertain carbon regulations may take the form of either tax or cap-and-trade, while demands and returns are characterized by probability distributions. Results from a detailed case study reveal implications for network configuration, product allocation, and transportation flows.

2 - A Closed-loop Supply Chain Network Design Problem under Demand and Return Uncertainty

Sung Ook Hwang, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77840, United States of America, hwang1227@neo.tamu.edu, Halit Uster

We consider the design of a multi-product closed-loop supply chain network under new and return product demand uncertainty. The problem is modeled as stochastic mixed integer linear program and a Benders decomposition based approach is developed. An analysis and computational results illustrating the efficieny of the approach are presented.

3 - Sustainable Supply Chains Network Design: Balancing Trade-Offs To Optimize Efficiencies

Amin Chaabane, Professor, Ecole de Technologie Supérieure, 1100 Notre Dame Street Ouest, Montreal, Qc, H3C1K3, Canada, Amin.Chaabane@etsmtl.ca, Marc Paquet

This research addresses the design of sustainable supply chains in the presence of environmental regulations that impose product recycling and carbon emissions reduction. The design task is formulated as a multi-objective optimization model that accounts for cost and carbon reduction, achieves a good service level and maintains good quality for products. The capability of the model is illustrated through a case study for which a set of Pareto optimal and efficient solutions are obtained.

4 - Design of the Reverse Logistics Network for Electric Vehicle Batteries

Ana Muriel, University of Massachusetts Amherst, 160 Governors Drive, Amherst, United States of America, muriel@ecs.umass.edu, Tilman Schnellenpfeil, Stephan Biller, Guoxian Xiao

We develop a profit model that includes the major factors driving costs and revenues in the handling and remanufacturing of failed electric vehicle batteries. Using this model we study alternative reverse logistics network designs and identify under what conditions each of them would be optimal.

Wednesday, 8:00am - 9:30am

■ WA01

C - Room 201A

RFID and Sourcing Decisions in Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Gary Gaukler, Texas A&M University, TAMU 3131, College Station, TX, 77843, United States of America, gaukler@tamu.edu

1 - Auto-ID Technology and Store Execution

John Aloysius, University of Arkansas, WCOB 204, Fayetteville, AR, United States of America, JAloysius@walton.uark.edu

Auto-ID technologies are a promising means of improving retail store execution. Our experiment in the field explores issues of managerial relevance including process conformance and on shelf availability.

2 - Order Expediting Based on Pipeline Visibility

Gary Gaukler, Texas A&M University, TAMU 3131, College Station, TX, 77843, United States of America, gaukler@tamu.edu

In this paper we discuss the potential impact of order tracking updates on inventory replenishment decisions. We examine a stylized global supply chain, in which a retailer faces stochastic lead times for order fulfillment from a distant supplier. The retailer may opt to expedite orders in response to information about the status of her resupply pipeline. We study the performance of the expediting policy for varying supply chain configurations.

3 - Global Sourcing Replenishments Face to Demand Forecasting Uncertainty

Hubert Thibault, Ecole Centrale Paris, Grande voie des Vignes, Ch,tenay Malabry, 92290, France, thibault.hubert@ecp.fr

Nowadays, firms have to look for farther suppliers and manage the increasingly complex SC in Global Sourcing. The literature tends to show that the suppliers temporal distance's impact the performance of the SC due to the variability in SCM. This paper proposes solutions to limit inventory level while maintaining a high service level in GS, by taking into account the forecasts and the demand variability. We show that our model works better than classical policies on a real case study.

4 - Sourcing under Supply Risks: Quantity Commitment and Dual Sourcing Options

Zhuping Liu, University of Connecticut, 2100 Hillside Road, OPIM, Storrs, CT, 06269, United States of America, liuzhuping03@gmail.com, Cuihong Li

We consider a buyer who has the option to source from one single supplier or from two suppliers. Each supplier faces supply risks but can endogenously choose his supply reliability. To encourage the supplier(s) to choose a suitable reliability level, the buyer may offer its supplier(s) quantity commitment as an incentive. We examine how the buyer may use quantity commitment and the dual sourcing option in her sourcing strategy concerning supply risks.

■ WA02

C - Room 201B

Pricing I

Contributed Session

Chair: Jing Zhou, Assistant Professor, UNC Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, jzhou7@uncc.edu

1 - Pricing of Successive Product Releases: The Impact of Prior Versions with Strategic Customers

Michael Pangburn, Associate Professor, University of Oregon, Lundquist College of Business, Eugene, OR, 97403, United States of America, pangburn@uoregon.edu, Shubin Xu

We consider a firm offering successive versions of a (software) product. The firm decides the interval between releases and price, to maximize profits. We permit consumers to be strategic when deciding whether to purchase or wait for a later version. In this context, we show that with a regular frequency of introductions, the firm optimally waits years between product releases, even with a continuously improving technology and no fixed cost of version releases.

2 - Advanced Selling and Price Discrimination Using Gift Cards in Service Supply Chains

Jing Zhou, Assistant Professor, UNC Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, jzhou7@uncc.edu, Moutaz Khouja

Services offered by a service provider (SP) can be paid for in cash or gift cards. The SP can sell gift cards exclusively and/or through an independent retailer. We examine the conditions under which it is optimal for the SP to offer gift cards at an independent retailer and identify the optimal discount from the SP to the retailer. The SP is a Stackelberg leader determining the wholesale price per $1 of gift card and the retailer follows determining the price per $1 of gift card to consumers.

■ WA03

C - Room 202A

Stochastic Demands

Contributed Session

Chair: Mustafa K. Dogru, Researcher, Alcatel-Lucent Bell Labs, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, mustafa.dogru@alcatel-lucent.com

1 - A Stochastic Inventory Model with Price Quotation

Kyoung-Kuk Kim, Assistant Professor, KAIST, 291 Daehak-ro, Yuseong-gu, Daejeon, 305-701, Korea, Republic of, catenoid@kaist.ac.kr, Chi-Guhn Lee, Jun Liu

We study a single item periodic review inventory management problem with stochastic demand, random price and quotation cost. At the beginning of each period, a decision is made whether to pay the quotation cost to get the price information, and if so, then how many units to order. In particular, (r,S1,S2) policies are considered. We look at the total cost functions and derive structural properties that are useful in devising an efficient optimization algorithm.

2 - Strategies for the Stochastic Lot Sizing Problem – A Nervousness Perspective

Huseyin Tunc, Mississippi State University, Department of Industrial and Systems Eng, Mississippi State University P.O. Box 9542, Mississippi State, MS, 39759, United States of America, ht100@msstate.edu, Armagan Tarim, Burak Eksioglu, Onur Alper Kilic

A well-known problem in coordinating supply chain inventories is known as system nervousness. It is widely accepted that cost of nervousness is difficult to measure. We argue that cost of nervousness can be evaluated by means of three well-established inventory control strategies: static uncertainty, dynamic uncertainty, and static-dynamic uncertainty. By this means, our results provide a simple yet objective measure to assess the cost of system nervousness.

3 - A Stochastic Production-inventory Control Problem with Infinite Horizon Average Cost Criterion

Jingchen Wu, University of Michigan, 2074 East Hall, 530 Church Street, Ann Arbor, MI, 48109, United States of America, wjch@umich.edu, Joseph Conlon, Xiuli Chao

We model a stochastic production-inventory control problem by diffusion processes. Assume the evolution of the inventory has two modes and the mode is the control variable. A fixed cost is incurred when the mode is changed and the holding cost is assumed to be a convex. The objective is to minimize the infinite horizon average cost. Both lost-sale and backlogging cases are considered. We show that the optimal (s,S) policy is optimal non-anticipating policies under mild assumptions.

4 - (R,S) Inventory Policies with Non-stationary Stochastic Demand and Heterogeneous Suppliers

Burak Eksioglu, Mississippi State University, Department of Industrial and Systems Eng, Mississippi State University P.O. Box 9542, Mississippi State, United States of America, beksioglu@ise.msstate.edu, Huseyin Tunc, Onur Alper Kilic, Armagan Tarim

We consider stochastic dynamic lot-sizing problems with heterogeneous suppliers differentiated by their fixed and variable costs. We present two mixed integer programming formulations both of which determine replenishment periods and corresponding order-up-to levels for each supplier. The first model minimizes total expected inventory holding, ordering, and unit costs under service level constraints. The second model assumes a linear shortage cost is incurred for each unit of backordered demand.

5 - Static-Dynamic Uncertainty Strategy for a Single-Item Stochastic Inventory Control Problem

Mustafa K. Dogru, Researcher, Alcatel-Lucent Bell Labs, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, mustafa.dogru@alcatel-lucent.com, Ulas Ozen, Armagan Tarim

We consider an inventory system facing non-stationary stochastic demand in a finite planning horizon. The replenishment times are determined and frozen once and for all the beginning while decision on the exact replenishment quantities can be deferred until the replenishment time (static-dynamic inventory policy). We consider dynamic fixed-ordering and holding costs, as well as dynamic penalty costs, or service levels. We characterize the optimal policy, and develop and test two heuristics.

■ WA04

C - Room 202B

Advances in Network Optimization

Contributed Session

Chair: Rene Janssen, Netherlands Defence Academy, Het Nieuwe Diep 8, Den Helder, 1781 AC, Netherlands, RHP.Janssen@nlda.nl

1 - A Network Simplex Algorithm for the Equal Flow Problem on a Generalized Network

David Morrison, Student, University of Illinois, 201 N. Goodwin Avenue, Siebel Center Department of Computer Science, Urbana, IL, 61801-2302, United States of America, morris50@illinois.edu, Jason Sauppe, Sheldon Jacobson

A network simplex algorithm is described for the minimum-cost flow problem on a generalized network with additional constraints that there exist sets of arcs which carry equal amounts of flow. Due to the LP structure, it is possible to solve the problem by operating directly on the network. This algorithm shows improved asymptotic performance per iteration over the standard simplex algorithm, as long as the number of side constraints is small.

2 - Solving Nonlinear Network Problems through Piecewise Linear Approximations

Grisselle Centeno, Associate Professor, University of South Florida, 4202 E. Fowler Avenue ENB118, Tampa, FL, 33620, United States of America, gcenteno@usf.edu, Aldo Fabregas

In some network problems arc costs are modeled as nonlinear increasing functions of the arc flow. When this nonlinear network lies at the core of a more complex large-scale decision model, it is desirable to simplify it without a major loss of generalization. This work shows that the resulting piece-wise linear approximation can be expressed as the maximum of k affine functions under certain conditions. The simplified linear problems generated are then approached using conventional LP solvers.

3 - Stable Networks of Uncovered Nodes

Rene Janssen, Netherlands Defence Academy, Het Nieuwe Diep 8, Den Helder, 1781 AC, Netherlands, RHP.Janssen@nlda.nl, Herman Monsuur

For a node the notion of covering captures the idea of being outperformed by another node in terms of, for example, information gathering. Networks where these subdued network positions do not exist will be called (minimal) stable. These optimal networks, which often have 'bubble-like' structures, will be characterized.

■ WA05

C - Room 203A

Topics in Optimization

Contributed Session

Chair: Elcin Kartal-Koc, Midde East Technical University, Institute of Applied Mathematics, Ankara, Turkey, kartalelcin@gmail.com

1 - The Equivalence and Generalization of Optimization Criteria

Bill Corley, Professor, The University of Texas at Arlington, IMSE Department, Arlington, TX, 76019, United States of America, corley@uta.edu

We show that all existing optimization criteria are equivalent to the maximization of a real-valued function. Hence all existing criteria are equivalent to each other. All solutions and only solutions to an optimization problem involving one criterion can be obtained in terms of any other criterion. We then axiomatize and generalize the definition of an optimization criterion. Finally, we present a new optimization criterion and apply it to game theory.

2 - Restructuring Forward Stepwise Algorithm of Multivariate Adaptive Regression Splines (MARS) by Using Self-Organizing Map(SOM).

Elçin Kartal-Koç, Midde East Technical University, Institute of Applied Mathematics, Ankara, Turkey, kartalelcin@gmail.com, Cem Iyigun

Multivariate Adaptive Regression Splines (MARS) is a spline-based nonparametric regression method which uses a stepwise procedure for knot selection. For high dimensional datasets, the examination of large set of candidate knots becomes a computational burden. In this study, the forward stepwise algorithm is improved to increase the computational efficiency by selecting proper knot points using Self-Organizing Map.

3 - Stochastic Inventory Control with Deterioration and Partial Backlogging

Yang Tan, FedEx Express World Headquarters, Pricing Science and Engineering Department, 3640 Hacks Cross Road, Memphis, TN, 38125, United States of America, ytan0920@gmail.com

A new deteriorating inventory model is studied under stochastic customer demand and partial backlogging. The system is under periodic review and there is no fixed order cost. Previous research has proved that a base stock policy is optimal under complete backlogging and non-deterioration. This paper hence adds a new branch to the current literature by studying the effects of deterioration and partial backlogging under stochastic demand. It is shown that the base stock policy is still optimal as long as the terminal value function is convex and second-order differentiable. The explicit base stock level is derived for a special case.

■ WA06

C - Room 203B

Classic Scheduling I

Contributed Session

Chair: Jeffrey Schaller, Eastern Connecticut State University, 83 Windham St., Department of Business Administration, Willimantic, CT, 06226, United States of America, schallerj@easternct.edu

1 - Scheduling Precedence-constrained Jobs on Machines to Minimize the Weighted Completion Times

Rajneesh Rajneesh, Student, North Carolina State University, Operations Research, 2152 Burlington Labs, 2500 Stinson Drive, Raleigh, NC, 27695-7913, United States of America, rrajnee@ncsu.edu, Salah Elmaghraby

We studied a problem of scheduling precedence-constrained jobs on pre-specified machines with an objective to minimize the weighted completion times. Due to strong NP-hardness, even for two machines and chain-type precedence constraints with weight and processing time of jobs as 1, we propose heuristics for the case when the precedence constraints are series-parallel. We focus on design and analysis of heuristics to establish average-case, worst-case performance bounds and computing involved.

2 - Scheduling Wafer Lots on Parallel Dedicated Machines in a Semiconductor Fabrication

Sangoh Shim, Hanbat National University, Deokmyung-Dong 16-1, Daejeon, Korea, Republic of, soshim@hanbat.ac.kr

In this research, scheduling wafer lots on workstations composed of parallel dedicated machines, each of which can process a set of specific product families is addressed. A setup operation is required between processings of wafer lots of different product families. To minimize makespan, heuristic algorithms are presented. A series of computational experiments are performed and results show that the suggested algorithms give good solutions in a reasonable amount of computation time.

3 - Scheduling Groups of Jobs on Parallel Machines to Minimize Total Earliness and Tardiness

Jeffrey Schaller, Eastern Connecticut State University, 83 Windham St., Department of Business Administration, Willimantic, CT, 06226, United States of America, schallerj@easternct.edu

This paper considers the problem of scheduling identical parallel machines with family setups when the objective is to minimize total earliness and tardiness. Heuristic procedures including a simulated annealing procedure and a genetic algorithm are proposed. These procedures are tested on a variety of randomly generated problem sets.

■ WA07

C - Room 204

Advances in Simulation Theory

Contributed Session

Chair: Jie Xu, George Mason University, Fairfax, VA, United States of America, jxu13@gmu.edu

1 - Simulation Visualization Rhetoric and it's Practical Implications

Terra Knowles Ball, Old Dominion University, 3200 Crestwood Lane, Virginia Beach, VA, United States of America, tknowles@odu.edu, Andrew Collins

Modern Modeling & Simulation (M&S) research has been focused on the underpinnings of its paradigms and its validation. While researchers dig further into the bowels of the subject, the perceptions of M&S by its users and customer have been widely ignored. This presentation will expose the community to existing research on the rhetoric of visualization, demonstrate the importance of contemplating the philosophy of visualization, and highlight current problems with simulation visualization.

2 - Absolute Precision Stopping Rules

Bahar Cavdar, School of ISyE, Georgia Tech, Atlanta, United States of America, baharca@gatech.edu, Dashi Singham, Lee Schruben, David Goldsman

Building on the work of Singham and Schruben, we discuss properties of absolute precision stopping rules for confidence intervals for simulated performance measures such as the mean. In particular, we discuss cases in which the underlying observations are are not i.i.d. normally distributed, e.g., elementary ARMA processes and i.i.d. Bernoulli random variables.

3 - Small Sample Behavior for Importance Sampling Estimators

Jihye Choi, Stanford University, Huang Engineering Center, Stanford, United States of America, jichoi@stanford.edu, Peter Glynn

Importance sampling (IS) is a widely used simulation method for computing rare event probabilities, but suffers from the defect that the sample variance can sometimes be wildly misleading as a measure of estimator accuracy. In this talk, we study the small sample behavior of IS estimators using large deviations. This work suggests new diagnostics for IS rare event simulation, and reveals new insights into asymptotic efficiency and static vs dynamic IS.

4 - A Combined Ranking and Selection Procedure for Selection of the k-Best

Andrew Kiekhaefer, University of Iowa, 2025 North Ridge Dr, Iowa City, IA, 52241, United States of America, andrew.kiekhaefer@gmail.com, Yong Chen

We present a ranking and selection procedure for the problem of selecting the k-best systems, where system means and variances are unknown and unequal. This procedure is an extension and generalization of earlier work regarding the selection of the single best system and reduces to the single best equivalent when k=1. We present the proofs associated with the theoretical guarantees as well as empirical results on the probability of correct selection and comparisons with alternative methods.

5 - Non-uniform Sampling Distribution for Discrete Optimization via Simulation

Jie Xu, George Mason University, Fairfax, VA, United States of America, jxu13@gmu.edu

Locally convergent random search (LCRS) algorithms are an important class of discrete optimization via simulation algorithms that combine convergence with competitive performance. LCRS algorithms require a sampling distribution to randomly generate solutions. We investigate the use of non-uniform sampling distributions and show through numerical experiments the improvement attainable by switching from a uniform sampling distribution to a proper non-uniform sampling distribution.

■ WA08

C - Room 205

Dynamic Issues in Production and Inventory

Contributed Session

Chair: Srinivasa Puranam, Assistant Professor, Ithaca College, 37 Uptown Rd, Ithaca, 14850, United States of America, kartys.here@gmail.com

1 - Dynamic Capacity Planning under Uncertainty Considering the Constraint of Budget

Hongyan Chen, Missouri University of Science and Technology, 600 W. 14TH ST, 223 EMGT Building, ROLLA, MO, 65409, United States of America, hcqk3@mail.mst.edu, Ruwen Qin

Budget restricts the capacity that can be built. In addition, adding capacity needs to consider the operation or maintenance costs over time after the initial investment. This paper considers the constraint of budget in dynamic capacity planning, and solves the problem using dynamic programming and finite difference method respectively.

2 - An Application of Dynamic Programming to Customer Relationship Management

Sang Jin Kweon, PhD Student, Pennsylvania State University, State College, PA, 16803, United States of America, svk5333@psu.edu, Jaehyun Lee, José A. Ventura

Customer Relationship Management involves the use of technology to improve business processes with the goal of attracting new customers and retaining those that are loyal. In this talk, we propose a dynamic programming model to allocate marketing resources to promotions for new and loyal customers with the objective of maximizing the total expected discounted profit in a finite horizon.

3 - Inventory Replenishment and Allocation Decisions under Volatile Spot Market Prices

Abhilasha Katariya, PhD Candidate, Texas A&M University, 241 Zachry, TAMU 3131, College Station, TX, 77840, United States of America, abhilashapk@tamu.edu, Eylem Tekin, Sila Cetinkaya

We consider a multiperiod, inventory replenishment & allocation problem for a capacitated supplier who participates in a contractual market with fixed price and a spot market with volatile prices. Stochastic demand from contractual market must be fulfilled before price sensitive spot market demand is observed. We study the joint effect of the contractual price and spot price variability on the optimal policy parameters & supplier's decision to participate in one or both markets.

4 - Investigating the Impact of Supply Information in a Dual Source Inventory System

Soheil Abginehchi, Aarhus University, Fuglesangs Allé 4, Aarhus V, 8210, Denmark, soha@asb.dk, Christian Larsen

In a dual source inventory model Supplier 1's leadtime is dependent on his current backlog of orders while supplier 2has a fixed leadtime. We analyse 2 scenarios. In scenario 1 the inventory system can monitor the backlog at Supplier 1 (it knows the random process that describes how the backlog evolves over time. In Scenario 2 it is first after submitting an order to Supplier 1 it knows the actual leadtime. For both scenarios we develop a Markov decision model to compute the optimal policy.

5 - Optimal Biding under Random Demand

Srinivasa Puranam, Assistant Professor, Ithaca College, 37 Uptown Rd, Ithaca, 14850, United States of America, kartys.here@gmail.com, Michael Katehakis

We consider the problem of a firm that in each period procures items by participating in N auctions and then sells the acquired items. In each period there is a fixed cost K, to enter the sequence of auctions. The objective is to maximize expected daily profit. The firm's valuations derive from the resale of acquired items and pertinent costs. Under sensible assumptions, we also establish monotonicity properties for the value function and the optimal bids. We also present computations.

■ WA10

C - Room 206B

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - AnyLogic - Fast Modeling with AnyLogic's Smart Libraries

Andrei Borshchev, General Director, AnyLogic, 53 Frontage Road, Hampton, NJ, 08827, United States of America, George Gonzalez-Rivas

Since AnyLogic is the only tool allowing you to build discrete event, agent based, or system dynamics models, it has been the features-leader among simulation software for years. Now, as we add more smart libraries to our palette we also are becoming the speed leader – simply drag and drop smart objects such as pedestrians, vehicles, or trains and take advantage of their pre-coded behavior to create models faster than ever before.

■ WA11

C - Room 207A

Stochastic Networks

Sponsor: Applied Probability

Sponsored Session

Chair: Mark S. Squillante, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Rt. 134 / P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com

1 - On the Steady-state Probability of Delay in the Halfin-Whitt Regime

David Goldberg, Professor, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, dag3141@mit.edu

We study the FCFS GI/GI/n queue in the Halfin-Whitt regime. We prove the first non-trivial bounds for the steady-state probability that an arriving customer has to wait for service. Our main proof technique is the derivation of new and simple bounds for the FCFS GI/GI/n queue. We further illustrate the utility of this methodology by deriving the first non-trivial bounds for the steady-state probability that many servers are idle.

2 - Sensitivity Analysis for Reflected Brownian Motion

Ton Dieker, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, School of ISyE, Atlanta, GA, 30332, United States of America, ton.dieker@isye.gatech.edu, Xuefeng Gao

We study optimization and sensitivity analysis for stochastic networks (e.g., to make staffing decisions). Our initial results are in heavy traffic, and we investigate changes with respect to the drift of a given reflected Brownian motion. Our main results are: (1) the process and its infinitesimal-change process jointly satisfy a dynamic linear complementarity problem, and (2) the steady-state distribution of the joint process satisfies a linear equation akin to the basic adjoint relation.

3 - Directional Derivatives of the Skorokhod Map

Kavita Ramanan, Brown University, Providence, RI, United States of America, kavita_ramanan@brown.edu

In this talk, we introduce the notion of directional derivatives of the Skorokhod map. We shall describe how they can be used to characterize diffusion approximations to time-inhomogeneous queuing networks as well as for the sensitivity of performance measures of time-homogeneous queuing networks. A part of the talk is based on work with Avi Mandelbaum.

4 - Linear Stochastic Loss Networks

Mark S. Squillante, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Rt. 134 / P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com, Petar Momcilovic

We investigate throughput and cost properties in linear stochastic loss networks. The maximum throughput under exponential service times is derived and the arrival process that maximizes throughput is established. For general service times, an asymptotically critical loading regime is identified such that the probability of an arbitrary customer being lost is strictly within (0,1) as the network size increases, deliverying throughput comparable to the maximum at a relatively low network cost.

■ WA12

C - Room 207BC

New Techniques in Stochastic Optimization

Contributed Session

Chair: Fabian Bastin, Assistant Professor, Computational Science and Operational Research Department, University of Montreal, C.P. 6128, Succ. Centre-Ville,, Montreal, H3C 3J7, Canada, bastin@iro.umontreal.ca

1 - Scenario Generation via Polynomial Optimization

David Papp, Northwestern University, 2145 Sheridan Rd C210, Evanston, IL, 60208, United States of America, dpapp@iems.northwestern.edu, Sanjay Mehrotra

We consider the scenario generation problem of stochastic programs with continuous scenario space. The generation of a scenario tree whose moments match those of the original scenario distribution can be modeled as a semi-infinite LP, and the corresponding column generation problem becomes a global optimization problem of multivariate polynomials. We compare several approaches to find an approximate solution to this subproblem, and the resulting approximations.

2 - Solving the Drift Control Problem
Melda Ormeci Matoglu, Ozegin University, Kusbakisi Cad No 2, Altunizade, Istanbul, Turkey, melda.ormeci@ozyegin.edu.tr, John Vande Vate

We model managing capacity as a Brownian drift control problem. We formulate an LP and develop a bound for the continuous problem from a dual solution to the discrete problem. Showing the equivalence between strongly feasible bases and deterministic unichain policies, we combinatorialize the pivoting process and solve the LP without computing its coefficients. We develop scheme analogous to column generation to drive the gap between the discrete approximation and the continuous problem to zero.

3 - On Bias Reduction in Stochastic Nonlinear Programming
Fabian Bastin, Assistant Professor, Computational Science and Operational Research Department, University of Montreal, C.P. 6128, Succ. Centre-Ville,, Montreal, H3C 3J7, Canada, bastin@iro.umontreal.ca

We consider stochastic nonlinear programs that can exhibit simulation bias when relying on sample average approximation. We review some bias reduction techniques, et analyse their impact on optimization bias, as well as confidence intervals on optimal values and solutions.

■ WA13

C - Room 207D

Topics in Revenue and Yield Management

Contributed Session

Chair: Yanyi Xu, Assisstant Professor, Shanghai University, 99 Shangda road, Shanghai, China, omyanyi@gmail.com

1 - Dynamic Pricing with Multiple Products and Partially Specified Demand Distribution
Arnoud den Boer, PhD Student, Centrum Wiskunde & Informatica, Science Park 123, Amsterdam, 1098 XG, Netherlands, boer@cwi.nl

We study dynamic pricing for multiple products. The demand depends on on unknown parameters, whose value can be estimated by statistical techniques. The quality of the estimates is influenced by the cumulative amount of price dispersion; however, price dispersion is costly since it means that sub-optimal prices are used. The seller thus needs to balance exploitation and exploration. In this study we propose a pricing policy for this problem and show that Regret(T) is O((T log T)^1/2).

2 - A Note on Wholesale Price-Only Contracts with Postponed or Fixed Retail Price
Yanyi Xu, Assisstant Professor, Shanghai University, 99 Shangda road, Shanghai, China, omyanyi@gmail.com, Arnab Bisi

We study the wholesale price-only contract with price-postponement in a supply chain consisting of one manufacturer and one retailer. For both additive and multiplicative demand models, we show that the profit functions are unimodal and for both manufacturer and retailer under mild conditions. We also extend existing results on the fixed retail price case and a revenue management problem.

3 - Demand Modelling of a Hotel Market by Customer Choice Sets
Alwin Haensel, VU University Amsterdam, Department of Mathematics, Amsterdam, Netherlands, alwin.haensel@vu.nl, Ger Koole

We use choice sets to model the customer's buying behavior. A demand estimation method based on MLE and the EM-algorithm is presented. The main focus is on an application case to a real hotel market, the underlying sales data is unconstrained in terms of hotel preferences and price sensitivity.

■ WA14

C - Room 208A

Multi-stage Stochastic Programming Applied to Power Systems Expansion Planning

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Ross Baldick, Professor, University of Texas at Austin, 1 University Station, Austin, TX, United States of America, baldick@ece.utexas.edu

Co-Chair: Luiz Augusto Barroso, Technical Director, PSR, Praia de Botafogo 228 sala 1701 Parte, Rio de Janeiro, RJ, 22250-906, Brazil, luiz@psr-inc.com

1 - Stochastic Dual Dynamic Programming Extensions to Power System Expansion Planning
Luiz Carlos Costa Jr, PSR, Praia de Botafogo 228 / 1701-A Botafogo, Rio de Janeiro, Brazil, luizcarlos@psr-inc.com, Nora Campodónico, Fernanda Thomé, Mario Pereira

This work presents a methodology to represent investment decision variables such as new thermal, renewable and interconnection capacity into the hydrothermal scheduling problem of energy systems. The model considers continuous investment decision variables aiming an optimal investment and operation policy with detailed hydro and thermal aspects. The problem is formulated as a multi-stage stochastic linear programming problem with inflow uncertainties, solved by the well-known SDDP algorithm.

2 - Stochastic Transmission Planning for Integration of Wind Power Using Conditional Probability
Heejung Park, tohjpark@gmail.com, Ross Baldick

This work describes large-scale transmission planning for grid integration of wind energy with a two-stage stochastic model. Using the correlation between load and wind, wind power availability is represented by the conditional expected value of wind given the load level. The objective of the problem is to minimize the total system cost while procuring wind energy that is 20% of the total energy. We provide case studies with a simplified ERCOT transmission system.

3 - Large-scale Mixed Integer Disjunctive Model for Transmission Expansion Planning under Uncertainty
Fernanda Thomé, PSR, Praia de Botafogo 228 / 1701-A, Rio de Janeiro, RJ, 22250145, Brazil, fernanda@psr-inc.com, Gerson Oliveira, Luiz Mauricio Thomé, Silvio Binato

This work is based on the development of an optimization tool for large-scale, multi-stage and multi-scenario transmission expansion planning in a georeferenced network visualization environment. A mixed integer disjunctive model determines the least-cost transmission reinforcements required to ensure physically feasible system operation, taking into account environmental impacts and transmission investment costs subjected to generation dispatch and demand uncertainties.

4 - Integrating Dynamics and Generator Location Uncertainty for Robust Electric Transmission Planning
Pearl Donohoo, Doctoral Candidate, MIT, 77 Masachusetts Avenue, E40-246, Cambridge, MA, 02139, United States of America, pdonohoo@mit.edu

Prompted by renewable energy mandates, the policy question today is whether to proactively plan and construct large interregional transmission networks or react to developments in the power system with incremental investments. Comparing proactively and reactively planned systems requires a stochastic dynamic model, but such a tool does not yet exist for wide area transmission planning. We propose to solve this stochastic dynamic program using approximate dynamic programming methods.

■ WA15

C - Room 208B

Decision Analysis, Game Theory and Homeland Security II

Sponsor: Decision Analysis

Sponsored Session

Chair: Xiaojun Shan, University at Buffalo, SUNY, Buffalo, NY, United States of America, xshan@buffalo.edu

Co-Chair: Jun Zhuang, University at Buffalo, SUNY, 435 Bell Hall, Buffalo, NY, United States of America, jzhuang@buffalo.edu

1 - What Would You Know About the Terrorist Attack? Target Information vs. Rationality of the Attacker
Mohammad Nikoofal, PhD Candidate, McGill University, Desautels Faculty of Management, Bronfman Building, 1001 Sherbrooke West, Montreal, QC, H3A 1G5, Canada, mohammad.nikoofal@mail.mcgill.ca, Mehmet Gumus

In this paper, we shed light on the value of information in the context of defender-attacker games. We consider two settings: (1) defender knows the target that is more likely to be attacked but does not know whether the attacker is rational or not; (2) defender knows the degree of attacker's rationality, but does not know which target to be chosen. We fully characterize the equilibrium defense strategy for each setting, and show that it involves a set of thresholds for each target.

2 - Game Theoretical Models for Food Supply Chain Risk Management

Cen Song, University at Buffalo, Buffalo, NY, United States of America, censong@buffalo.edu, Jun Zhuang

In food supply chain, the producers or retailers may add additives or preservatives to food, which may preserve flavor or enhance its taste and appearance, and thus increase customer demand and profit. However, some additives and preservatives may cause health problems to the customers. Government can regulate as well as tax from this business. In this paper, we present and analyze a game between government, and customers, and provide insights to food supply chain risk management.

3 - Modeling Costly Learning and Counter-learning in an Attacker-defender Game with Private Information

Jie Xu, University at Buffalo, SUNY, Buffalo, NY, United States of America, jxu24@buffalo.edu, Jun Zhuang

In asymmetric war scenarios (e.g., counter-terrorism), the adversary usually invests in a significant length of time to learn the system structure and identify vulnerable components, before launching real attacks. Traditional game-theoretic models either ignore such learning periods or ignore the costs of such learning. This paper fills the gap by analyzing the terrorist's costly learning and defender's counter-learning (e.g., using deception) strategies in a game of incomplete information.

4 - Exploiting Biases and Heuristics in Adversary Judgment and Decision Making

Richard John, Associate Professor, University of Southern California, Department of Psychology, SGM 621; MC-1061, Los Angeles, CA, 90089-1061, United States of America, richardj@usc.edu, Heather Rosoff

In real security domains, adaptive adversaries may not maximize expected values. Instead, they may rely on heuristics to simplify decision-making, which is not captured by conventional game- theoretic analysis. We utilize behavioral game theory lab experiments to explore human decision-making in game contexts. We demonstrate how to take advantage of adversary deviations from the normative model.

5 - Game-theoretic Analysis of Attack and Defense in Cyber-physical Networks

Fei He, University of Buffalo, SUNY, Buffalo, NY, United States of America, feihe@buffalo.edu, Nageswara Rao, Jun Zhuang

A number of critical infrastructures rely on cyber and physical components that are both subject to natural, incidental or intentional degradations. In this paper, the strategic interactions between an attacker and a defender of such infrastructures are studied using game theoretic models. Both analytical and numerical results are presented to illustrate the models. Our research provides insight into the survival of such infrastructures under various costs and the knowledge that players have.

■ WA16

C - Room 209A

Sustainable Environmental Policy and Natural Resource Management

Sponsor: Energy, Natural Resources and the Environment/ Environment and Sustainability

Sponsored Session

Chair: Guzin Bayraksan, University of Arizona, Systems and Industrial Engineering, Tucson, United States of America, guzinb@sie.arizona.edu

1 - Appraisal of Carbon Policies: Capacity Expansion Game with Uncertainty and Heterogeneous Players

Liang Chen, University of Calgary, Department of Economics, Canada, liangch2008@gmail.com, Janne Kettunen, Jared Carbone, Mahmoud Mazadi

In North America, both the stringency of regulations to curb CO2 emissions and the specific form that they take remain highly uncertain. Players in the power industry may choose to hedge against these uncertainties whilst their willingness and ability to do so can differ markedly due to their risk aversion and existing assets. We develop a game theoretical approach to analyze the effect these firm specific characteristics have on the cost of climate policy in the Alberta electricity market.

2 - A Systematic Optimization Model for Foodshed Localization

Guiping Hu, Iowa State University, IMSE Department, Ames, IA, 50011, United States of America, gphu@iastate.edu, Lizhi Wang, Randy Boeckenstedt, Susan Arendt

Local food production is drawing increasing attention due to environmental and health considerations. In this study, we used population, dietary and geographical information to map potential foodsheds with emphasis on minimizing total geographic distribution. We also developed innovative protocols, metrics and optimization methods to analyze the foodshed localization of geographic areas. We used data from Iowa to analyze and validate the optimization model.

3 - Climate Engineering Options

Eric Bickel, Operations Research / Industrial Engineering Center for International Energy and Environmental Policy, The University of Texas at Austin, Austin, TX, 78712, United States of America, ebickel@mail.utexas.edu

Many scientists fear that anthropogenic emissions of greenhouse gases have set the earth on a path of significant, possibly catastrophic, changes. In this paper we explore the potential of climate engineering (CE) to managing tipping points (TP). We find that a successful CE program may be able manage tipping points more efficiently than emissions reductions.

4 - Multivariate Analysis for a Multi-stage Green Building Decision Framework

Pin Kung, The University of Texas at Arlington, Department of Industrial & Manufacturing, United States of America, pin.kung@mavs.uta.edu, Victoria Chen, Anthony Robinson

Green building has become a popular environmental topic in recent years. In our research, we have organized building options into multiple stages of decisions. Using existing software, we have conducted design and analysis of computer experiments to study the impact of green building options on sustainability outcomes.

5 - Reclaimed Water Network Design under Temporal and Spatial Growth and Demand Uncertainties

Weini Zhang, University of Arizona, Systems and Industrial Engineering, Tucson, United States of America, wzhang@email.arizona.edu, Guzin Bayraksan, Gunhui Chung, Kevin Lansey

A reclaimed water distribution network for supplying treated water to public users or agricultural areas is modeled using two-stage stochastic binary optimization with random recourse. Both construction and energy costs expanded during a 20-year period are considered. The network has spatial growth and reclaimed water demands are uncertain. An algorithm is developed to exploit the structure of the network to solve the problem. Computational results are presented on a realistic problem.

■ WA17

C - Room 209B

Decision Analysis I

Contributed Session

Chair: Shardul Phadnis, PhD Candidate, Engineering Systems Division, MIT, 77 Massachusetts Avenue, E40-286, CAMBRIDGE, MA, 02139, United States of America, shardul@mit.edu

1 - IS leader's Behavior and Decision-making in Their Evaluation of Information Service

Fang Ding, Peking University, Peking University, Bejing, China, Beijing, BJ, 100871, China, dingfang@gsm.pku.edu.cn

Based on an empirical study in China, we investigate IT investment context and IS leaders' risk attitude. Then, a mathematical model is presented which describes how IS leaders analyze and assess the value of information service provided by external IT advisers. Finally, we analyze the decision-making model by comparing the increase in expected revenue with the cost of information service. Our research will help IS leaders make the decisions whether they need to buy information service.

2 - Decision Making under Uncertain Designer Preferences

Vijitashwa Pandey, Post Doctoral Researcher, Oakland University, 3171 John R Road, Rochester, MI, 48307, United States of America, vijitashwa@gmail.com, Zissimos Mourelatos

Engineering design decisions can be made to reflect decision maker preferences if his/her utility function is known. Eliciting true utility functions is difficult because decision makers are rarely consistent with their decisions. We discuss methodologies to circumvent this issue.

3 - Decisions Based on Product Review Data: Incorporating Attribute Value Uncertainty

Dennis Leber, NIST, 100 Bureau Dr, Gaithersburg, MD, 20899, United States of America, dennis.leber@nist.gov, Jeffrey Herrmann

Formal and informal reviews of products and services, which can be found in abundance, are often used by consumers to estimate the level of satisfaction that will be received. When developing a decision model based on these data there exists an uncertainty in the attribute values that current decision models fail to consider. This talk will present decision methods that consider attribute value uncertainty and apply these methods to the problem of choosing a roofer based on customer review data.

4 - Effect of Scenario Planning on Strategic Investment Decisions by Field Experts

Shardul Phadnis, PhD Candidate, Engineering Systems Division, MIT, 77 Massachusetts Avenue, E40-286, CAMBRIDGE, MA, 02139, United States of America, shardul@mit.edu, Chris Caplice, Yossi Sheffi

Scenario planning has been recommended and used for over 60 years to make strategic decisions in the public and private sectors. However, the effects of scenarios on strategic decisions have been rarely studied empirically. We report how the use of scenarios influenced the decisions of field experts to invest in segments of the US transportation infrastructure. Our study shows that experts change the confidence in their strategic decision according to the usefulness of a segment in a scenario.

■ WA18

C - Room 210A

Scheduling Algorithms: Project, Machine and Staff Scheduling

Cluster: Scheduling and Project Management

Invited Session

Chair: Mario Vanhoucke, Ghent University, Tweekerkenstraat 2, Gent, 9000, Belgium, mario.vanhoucke@ugent.be

1 - A Hybrid Heuristic for the Machine Scheduling Problem with Parallel Machines

Veronique Sels, PhD Student, Ghent University, Tweekerkenstraat 2, Gent, 9000, Belgium, veronique.sels@ugent.be, Mario Vanhoucke

We consider the unrelated parallel machine scheduling problem with a makespan objective. We discuss two heuristic approaches and the hybridization of these heuristics with a truncated branch-and-bound procedure. We compare the performances of these heuristics on standard data available in literature and examine the influence of the different heuristic parameters. The computational experiments reveal that the hybrid heuristics are able to compete with the best known results from the literature.

2 - Project Scheduling and Staffing with a Multi-skilled Workforce

Broos Maenhout, Ghent University, Tweekerkenstraat 2, Gent, 9000, Belgium, broos.maenhout@ugent.be, Mario Vanhoucke

When scheduling projects assumptions are made with respect to the personnel resource availability. In personnel scheduling problems assumptions are made with respect to the staffing requirements. We explore how to integrate these two scheduling problems for making strategic project staffing decisions. More precisely, we determine the number of personnel and required skill mix to complete a project.

3 - Combined Surgery Scheduling and Physician Rostering

Christophe Van Huele, PhD Student, Ghent University, Tweekerkenstraat 2, Gent, 9000, Belgium, christophe.vanhuele@ugent.be, Mario Vanhoucke

The assignment of a surgery to a specific operation room for a certain patient and moment in time is quite dependent of the available surgeons and nurses. In literature, the operation room scheduling and surgery scheduling problems are often addressed separately. In this presentation, an integrated model with the overall goal to minimize cost of over- and undertime, both for the operating rooms and as the staff is presented.

■ WA19

C - Room 210B

Banking and Insurance

Contributed Session

Chair: Changjian Huang, UBS AG, 399 Main Avenue, Apt 614, Norwalk, United States of America, cjjhuang@gmail.com

Co-Chair: Li Zhang, Sr. Credit & Portfolio Manager, Royal Bank of Scotland, 1000 Lafayette Blvd., Bridgeport, CT, 06604, United States of America, lieezhang@gmail.com

1 - Performance-based Pricing Optimization for Marketing Targeting and Subset Selection

Li Zhang, Sr. Credit & Portfolio Manager, Royal Bank of Scotland, 1000 Lafayette Blvd., Bridgeport, CT, 06604, United States of America, lieezhang@gmail.com, Changjian Huang

In this study, we will present the development of a performance-based pricing optimization model interfaced with forecasting models for marketing targeting, subset selection and pricing used in financial services. This model is an IP problem which maximizes the revenue with the consideration of performance, cost, resource restriction and risk control. Numerical results indicate that the developed models provide optimal and computational efficient solutions.

2 - Systemic Risk Components

Jeremy Staum, Northwestern University, 2145 Sheridan Road, Department of IEMS, Evanston, IL, 60208-3119, United States of America, j-staum@northwestern.edu, Ming Liu

Researchers are trying to establish a theory of financial system risk management analogous to portfolio risk management. One aspect is risk attribution, the process of decomposing a risk measure into components that are attributed to individual assets or entities. Portfolio risk attribution methods do not suffice for systems that have richer structure than portfolios. We investigate systemic risk attribution and show how to design systemic risk attribution schemes with some examples.

3 - Usage of Credit Scores in Insurance Classification and Pricing

Jing Ai, Assistant Professor, Shidler College of Business, University of Hawaii at Manoa, 2404 Maile Way, Honolulu, HI, 96822, United States of America, jing.ai@hawaii.edu, Linda Golden, Patrick Brockett, Bruce Kellison

The most important new development in the past decade in personal lines of insurance in the United States of America is the use by insurers of data contained in an individual's credit history file to aid in insurance risk classification and rating. This paper presents independent actuarial (statistical) justifications for the use of credit information in insurance and offers psychological and biological based explanations for the underlying mechanism.

■ WA20

C - Room 211A

Global Optimization Methods in Power Systems

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Neng Fan, Sandia National Laboratories, P.O. Box 5800, MS 1316, Albuquerque, NM, United States of America, nnfan@sandia.gov

1 - Contingency-constrained Optimization for Electric Power Systems

Ali Pinar, Sandia National Laboratories, Livermore, CA, United States of America, apinar@sandia.gov, Richard Chen, Jean-Paul Watson

In our earlier work, we developed efficient techniques for vulnerability analysis of electric power systems. We are now including our vulnerability analysis techniques into the decision making processes, such as the unit commitment problem. The key to our approach is our ability to compactly represent security constraints. In this talk, we will present our security formulations, and our results for solving the security-constrained unit-commitment problem.

2 - Local Search Methods for Transmission Network Expansion Planning

Alla Kammerdiner, Assistant Professor, New Mexico State University, P.O. Box 30001, Las Cruces, NM, 880003-001, United States of America, alla@nmsu.edu

Transmission Network Expansion Planning can be formulated as a nonlinear mixed integer programming problem. We consider the problem instances used as typical benchmarks and discuss application of local search methods for solving this difficult optimization problem.

3 - Lagrangian Duality and Branch-and-bound Algorithms for Optimal Power Flow

Dzung Phan, IBM Research, Thomas J. Watson Research Center, Yorktown Heights, NY, United States of America, phandu@us.ibm.com

This talk investigates a Lagrangian dual problem for solving the optimal power flow problem which arises from power system analysis. If strong duality does not hold for the dual, we propose two branch and bound algorithms that guarantee to solve the problem to optimality. The lower bound for the objective function is obtained by the Lagrangian duality, while the feasible set subdivision is based on the rectangular or ellipsoidal bisection. The numerical experiments are reported.

4 - A Distribution Grid Optimization Controller

Hugo Simao, Senior O.R. Engineer, Princeton University, Sherrad Hall 112, Princeton, NJ, 08544, United States of America, hpsimao@Princeton.edu, Warren Powell, Hyun Bin Jeong, Boris Defourny

Smart meters, distributed generation and storage, and plug-in electric vehicles are some of the elements that will be added to urban electricity distribution grids in the next decade or so. The real-time control of the resulting grid will require a stochastic optimization controller. We propose a model and some solution approaches to solve this problem. We will present computational results of an implementation on a simplified distribution grid, and discuss the extension to more complex grids.

5 - Blackout Analysis: Contingency and Emergency Operation
Hongsheng Xu, ISE, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, xuhongsh@ufl.edu, Neng Fan, Panos Pardalos

Power grid is vulnerable under random failures or intentional attacks. In this talk, we will investigate the interactive issue between contingency selection and emergency plan including load shedding and line switching. The evaluation measurement of the pwoer grid vulnerability is the social benefit, and in our research we use the cost of the switching, generating and load shedding for the purpose of simpilicity. In the model, both buses and lines are considered in the contingency selection.

■ WA21

C - Room 211B

Stochastic Optimization with Application to Search and Detection II

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Johannes Royset, Associate Professor, Naval Postgraduate School, Monterey, CA, United States of America, joroyset@nps.edu

1 - Designing the Texas Influenza Surveillance Network
Ned Dimitrov, Assistant Professor, Naval Postgraduate School, Monterey, CA, United States of America, ned@nps.edu, Samuel Scarpino, Lauren Meyers

In 2009, swine-origin influenza spread to the US. The Texas Department of State Health Services received a mandate to evaluate and redesign its influenza-like-illness surveillance network (ILINet). We present a novel model for designing ILINet using stochastic submodular optimization and results based on Texas hospitalizations.

2 - Multi Target Search Using Probabilistic Quadtrees
Timothy H Chung, Assistant Professor, Naval Postgraduate School, 777 Dyer Road, BU-218, Monterey, 93943, United States of America, thchung@nps.edu, Stefano Carpin

We consider the search for an unknown number of static targets inside a search area. We propose the use of Probabilistic Quadtrees, which provides a variable resolution representation where the searcher needs to choose not only where to sense, but also the sensing resolution. Via a Bayesian approach with both false positive and negative detections, a posterior about the targets' locations is propagated during the search effort. Search is optimized based on information gain and expected costs.

3 - Minimizing Collateral Damage in Network Interdiction
Alexander Gutfraind, Los Alamos National Laboratory, Theoretical Division, Los Alamos, CA, United States of America, agutfraind.research@gmail.com, Matthew Johnson

Network interdiction seeks to maximize disruption to a network under resource constraints. However, interdiction of e.g. infrastructure networks should avoid harm to innocent users. In the simplest formulation an innocent is unharmed if at least one path through the network is still available. For this and other formulations I will show algorithms and hardness results.

4 - Optimal Continuous Time and Space Search for Moving Targets Using Consistent Approximations
Joseph Foraker, US Naval Academy, United States of America, jcforake@nps.edu, Johannes Royset

We consider search for moving targets in continuous time and space, and formulate an optimal control problem whose solution yields optimal search trajectories. We develop a discretization scheme, show that it converges, and present numerical results that illustrate the approach.

■ WA22

C - Room 212A

Generalized Nash Equilibrium Problems: Models, Analysis and Algorithms

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Uday Shanbhag, University of Illinois, Department of ISE, Urbana, IL, United States of America, udaybag@illinois.edu

1 - The Impact of Illiquidity in Power Market: A Stochastic Generalized Nash Equilibrium
Yves Smeers, Université Cathoique de Louvain, CORE, Voie du Roman Pays 34, Louvain-la-Neuve, 1348, Belgium, yves.smeers@uclouvain.be, Gauthier De Maere d'Aertrycke

We assess the effect of limited liquidity in power exchanges using an equilibrium model where agents cannot hedge up to their desired level. The problem is formulated as a two stage stochastic Generalized Nash Equilibrium. We show how the risk premium and players profits are affected by illiquidity and how illiquidity in one market can affect trade in another market.

2 - Solution of Affine Generalized Nash Equilibrium Problems by Lemke's Method
Dane Schiro, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 South Mathews Avenue, Urbana, IL, 61801, United States of America, schiro1@illinois.edu, Jong-Shi Pang, Uday Shanbhag

Lemke's method is a pivotal algorithm for solving linear complementarity problems. We will explore how shared constraints and their multipliers affect Lemke's method. We will document new sufficient conditions for successful termination of the algorithm and detail the effects of problem regularization. Last, we will discuss a problem reformulation and associated solution method that is capable of expanding the types of accessible equilibria to a class not readily available via current methods.

3 - On the Existence of Equilibria in Stochastic Generalized Nash Games
Uma Ravat, University of Illinois at Urbana Champaign, Urbana-Champaign, IL, ravat1@illinois.edu, Uday Shanbhag

The variational conditions of stochastic generalized Nash games are given by a stochastic quasi-variational inequality (QVI). We present a framework for the tractable verification of existence of equilibria of such games without the evaluation of an expectation or its derivatives. Nonsmooth generalizations are also investigated and the ideas are illustrated through an example from electricity markets.

■ WA23

C - Room 212B

Scheduling and Pricing Policies in the Airline Industry

Sponsor: Aviation Applications

Sponsored Session

Chair: Gizem Keysan, Senior Analyst, United Airlines, Chicago, IL, United States of America, gizem.keysan@united.com

1 - Estimating Segmented Level Parameters Based on Aggregate Level Data - Airline Case Study
Hamed Hasheminia, PhD Candidate, Sauder School of Business, Apt 3E-199 Drake Street, Vancouver, BC, V6Z2T9, Canada, hamed.hasheminia@sauder.ubc.ca, David Gillen

Price differentiation is a commonly used strategy to reap higher profits from different segments of the market. Applying such pricing strategies requires precise knowledge about how different segments of the market can be affected by different strategic variables such as price and service levels. We developed a Statistical Methodology to estimate segmented level data based on aggregate level data and tested our models for airline industry.

2 - A Portfolio Approach to Comparing New Aircraft Designs for Airline Profit
Navindran Davendralingam, PhD Candidate, Purdue University, 701 W. Stadium Avenue, West Lafayette, IN, United States of America, davendra@purdue.edu, William Crossley

Often, aircraft are designed to perform a design mission(s) at minimum cost or weight as surrogates for airline profitability. From the airline's perspective, the best aircraft maximizes long-term profit at a given level of risk associated with uncertain future demand. To assess new aircraft designs as potential additions to a fleet, this work couples a robust mean variance portfolio problem, which "invests" in projected itineraries, with an allocation problem to meet the associated demand.

3 - Market Driven Fleet Assignment

Christophe-Mari Duquesne, Software Engineer/PhD Student, Amadeus, 485 Route du Pin Montard, Sophia Antipolis, 06902, France, chm.duquesne@gmail.com, Olivier Briant, Semi Gabteni, Denis Naddef

Given an airline schedule and demand forecasts, the fleet assignment problem consists in assigning aircraft types to flight-legs, maximizing the profit. Current model are limited by forecasts uncertainty. We propose a novel approach modeling demand as a decision variable controlled by cuts representing the market behavior. We compare ourselves to the Itinerary Based Fleet Assignment on hundreds of scenarios. Our results show in the context of moderate variability, our approach outperforms IFAM.

4 - Applying Financial Portfolio Theory to Airline Network Planning

Alex Cosmas, Lead Associate, Booz Allen Hamilton, 22 Batterymarch Street, 2nd Floor, Boston, MA, 02109, United States of America, cosmas_alex@bah.com

Current airline forecasting/demand models or market share models (e.g., Quality of Service Index) are developed from entire networks and subsequently assumed to be applicable to all markets. Our research is to leverage the fundamentals of financial portfolio theory to robust network planning. We perform an OD statistical market clustering that better accounts for the natural differences between market types to enable network planners to optimize the allocation of resources.

■ WA24

C - Room 213A

Using Cutting Planes to Efficiently Solve Hard MIPs

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Mathieu Van Vyve, Professor, Université Catholique de Louvain, CORE, Voie du Roman Pays 34, Louvain-La-Neuve, 1348, Belgium, mathieu.vanvyve@uclouvain.be

1 - Cutting Planes for Semi-continuous Network Flow Problems

Gustavo Angulo, UNTEC, Domeyko 2363, Santiago, Chile, gangulo@gatech.edu, Shabbir Ahmed, Santanu S. Dey

We consider semi-continuous network flow problems, that is, a class of network flow problems where some of the flow variables are restricted to be semi-continuous. We show that even simplified versions of such problems are NP-hard. Then we present a family of cutting planes for the single-node semi-continuous flow set with variable upper bounds, along with some structural properties of this set. Finally, we report computational results.

2 - Studying the Strength of Multi Row Cut Generators

Laurent Poirrier, University of Liège, Institut Montefiore B28, 10, Grande Traverse, Liège, 4000, Belgium, lpoirrier@ulg.ac.be, Quentin Louveaux

We consider the question of how to generate cutting planes from various multi row relaxations. In particular, we show that these cutting planes can be in general obtained by solving a cut generating linear program (CGLP) whose complexity grows with the number of rows considered. We provide some tools that help solving these CGLP. We also present computational results that compare the speed and strength of computing cuts from different relaxations.

3 - Solving the Big-bucket Multi-item Lot-sizing Problem Using Path-modular Inequalities

Mathieu Van Vyve, Professor, Université Catholique de Louvain, CORE, Voie du Roman Pays 34, Louvain-La-Neuve, 1348, Belgium, mathieu.vanvyve@uclouvain.be

Finding provably good solutions to the multi-item big-bucket lot-sizing problem remains challenging, especially when the joint capacity is tight. We reformulate the problem as a fixed-charge transportation problem on a bipartite graph with side constraints. We generalize path modular inequalities valid for path relaxation of this last problem to be applicable to trees. We report on computation results using a heuristic separation procedure for this family of inequalities applied to our problem.

4 - News from CPLEX Math Programming

Tobias Achterberg, IBM Deutschland Research & Development GmbH, Berlin, 14195, Germany, achterberg@de.ibm.com

We present new features and ingredients that have been added to IBM ILOG CPLEX Optimization Studio and give benchmark results that demonstrate the performance improvements in the recent CPLEX versions.

■ WA25

C - Room 213BC

Product Variety and Manufacturing Complexity in Assembly/Enterprise Systems

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Hui John Wang, Researcher, General Motors R&D, 30500 Mound Road, Warren, MI, 48090, United States of America, hui.wang@gm.com

Co-Chair: Jeonghan Ko, Assistant Professor, University of Nebraska, Lincoln, W338 Nebraska Hall, Lincoln, NE, 68588, United States of America, jko2@unl.edu

1 - Multi-product Manufacturing Line Design with Sequence-dependent Stochastic Inter-task Times

Jeonghan Ko, Assistant Professor, University of Nebraska, Lincoln, W338 Nebraska Hall, Lincoln, NE, 68588, United States of America, jko2@unl.edu, Ehsan Nazarian

We present optimal solutions for multi-station manufacturing system design considering stochastic inter-task times between manufacturing tasks. Our optimization model also incorporates production batch sizes and release policy in multi-model manufacturing lines. Our model simultaneously optimizes the task assignment to stations and task sequences within stations. Our approach helps improve productivity in multi-product production by reducing the impact of unexpected inter-task time variations.

2 - System Configuration Design for Assembly of Electric Vehicle Battery Packs

Sha Li, PhD Candidate, University of Michigan, Ann Arbor, MI, 48109, United States of America, lilisa@umich.edu, Jeffrey Abell, Hui Wang, S. Jack Hu, Yhu-Tin Lin

A new method for designing assembly system configurations with multiple product types is presented with applications in assembling battery packs of electric vehicles. Different from system configurations for a family of products with delayed differentiation, the proposed configuration has diverse subassemblies in the upstream required by the various battery components and the common assemblies in the downstream. The method enables efficient assembly of products with hierarchical structures.

3 - Variety Induced Complexity in Mixed-model Assembly Systems and its Impact on throughput

Hui John Wang, Researcher, General Motors R&D, 30500 Mound Road, Warren, MI, 48090, United States of America, hui.wang@gm.com, S. Jack Hu

A complexity measure is proposed for assembly systems with different configurations, including serial, parallel and hybrid. The complexity measure takes into consideration operator choices at each station and the assembly system configuration. A throughout analysis model is developed for assembly systems by incorporating the operator reaction time and fatigue effect. The complexity and throughput models are applied to comparing performance of assembly systems with different configurations.

4 - Optimal Investment Strategies for Product-Flexible Manufacturing Systems under Demand Uncertainty

Verena Hagspiel, Tilburg University, Warandelaan 2, Room K622, Tilburg, 5000LE, Netherlands, v.hagspiel@uvt.nl

This paper studies optimal investment strategies in product-flexible and dedicated capacities. The investment decision of a monopolistic firm selling two products in a market, characterized by price-dependent and uncertain demand, is modeled in a continuous time setting. The paper takes a real options approach. Besides the timing of the investment, the firm can choose the optimal capacity level and is free to undergo investment in flexible or dedicated capacity.

■ WA26

C - Room 213D

New Directions in Operations/Marketing Interface

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Mehmet Sekip Altug, Assistant Professor, George Washington University, School of Business, Washington, DC, 20052, United States of America, maltug@gwu.edu

1 - Selling Multi-generation Products: Trade-in Programs and Upfront Fees

Rui Yin, Assistant Professor, Arizona State University, Department of Supply Chain Mgmt, Tempe, AZ, United States of America, Rui.Yin@asu.edu, Christopher S. Tang

To entice customers to purchase both current and new generation products over time, many manufacturers and retailers are offering different trade-in programs including programs that require customers to pay an upfront fee. We present a two-period model to examine the impact of different trade-in programs on forward looking customers' purchasing behavior, the manufacturer's profit, and the customers' surplus.

2 - Inventory Information Disclosure in the Presence of Strategic Consumers

Tolga Aydinliyim, University of Oregon, Lundquist College of Business, Eugene, 97403, United States of America, tolga@uoregon.edu, Michael Pangburn, Elliot Rabinovich, Min Choi

We consider inventory information disclosure and pricing decisions in the presence of strategic consumers. Using an analytical model that assumes heterogeneous consumer valuations that decrease over time and an exogenous starting inventory level, we find that disclosing accurate inventory information can mitigate strategic consumer behavior. An empirical study of two online retailers supports our theoretical finding and provides evidence that demand increases at lower inventory levels.

3 - Inventory Monitoring in Micro Retailing

Garrett Van Ryzin, Professor, Columbia University, New York, NY, United States of America, gjv1@columbia.edu, Margaret Pierson

Micro-retail supply chains in developing economies face many operational challenges. One major concern of manufacturers is the lack of visibility into product availability at the store level and the consequences for lost sales. We propose a novel method for estimating out-of-stock status using only sales transaction data. The method is tested on data from a pilot project using handheld point-of-sale technology at micro-retailers in Colombia.

4 - Optimal Dynamic Return Management of Fixed Inventories

Mehmet Sekip Altug, Assistant Professor, George Washington University, School of Business, Washington, DC, 20052, United States of America, maltug@gwu.edu

We consider a retailer that sells a fixed amount of inventory over a finite horizon. We assume that return policy is a decision variable which can be changed dynamically at every period. While flexible return policies generate more demand, it also induces more returns. We characterize the optimal dynamic return policies based on two costs of return scenarios. We find out how these policies change with inventory and time. We extend our model to multiple competing retailers.

■ WA27

C - Room 214

Incentives in R&D and Product Design

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Yi Xu, University of Maryland, Smith School of Business, College Park, MD, 20742, United States of America, yxu@rhsmith.umd.edu

1 - Procurement Contracts for Co-produced Components

Saurabh Bansal, Pennsylvania State University, 405 Business Building, University Park, 16801, United States of America, sub32@psu.edu, Sreekumar Bhaskaran, Karthik Ramachandran

When new products are introduced, firms are subject to uncertainty in quality of co-produced components, which are procured from external suppliers. We study how these firms should contract with their suppliers, and how this influences the suppliers' process improvement efforts. We also examine the role of component substitution in managing this uncertainty.

2 - Licensing of University Science: The Impact of Tacitness and Governance Capability on Contract Types

Pascale Crama, Singapore Management University, 50 Stamford Road, Singapore, Singapore, pcrama@smu.edu.sg, Reddi Kotha, Tore Opsahl, Gerard George

Licensing contracts for R&D projects face incentive misalignment in an environment with hidden information. The technology and governance capabilities of the licensor, however, can influence the incentive and information structure and we study how this affects the contracts. We test our predictions on the contract choice for 1,049 technologies from a large university. The results illustrate conditions under which inventions are commercialized through different contractual structures.

3 - The Impact of Royalty Contract Revision in a Multi-stage R&D Alliance

Wenqiang Xiao, New York University, Stern School of Business, New York, NY, 10012, United States of America, wxiao@stern.nyu.edu, Yi Xu

In R&D alliances, firms often revise pre-agreed royalty contracts. This paper studies how and when firms should revise royalty contracts by investigating the impact of royalty contract revision on incentives, contract design, and profits in a two-stage (R&D stage and marketing stage) alliance between an innovator and a marketer. We characterize what kind of alliances would benefit the most from royalty revision, and what kind of alliances would not benefit from royalty revision.

■ WA28

C - Room 215

OM Problems in Service Firms

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Sechan Oh, IBM Almaden Research Center, United States of America, seoh@us.ibm.com

1 - Outsourcing and Backsourcing under Demand Uncertainty

Scott Webster, Syracuse University, Whitman School of Management, Syracuse, NY, United States of America, stwebste@syr.edu, Michel Benaroch, Burak Kazaz

We analyze how the tendency to outsource and the timing of switches between sourcing modes are affected by the degree of demand uncertainty, by relative differences in sourcing costs, and by contract flexibility permitting the switches. We develop models for finding the optimal demand thresholds for outsourcing and backsourcing, the probabilities of actual demand reaching these thresholds, the cost savings expected from switching a sourcing mode, and the expected time to making a switch.

2 - Pricing under Cost and Demand Uncertainties

Sechan Oh, IBM Almaden Research Center, United States of America, seoh@us.ibm.com, James Rhodes, Ray Strong

In this talk, we discuss a service firm's problem of pricing under cost and demand uncertainties. We show that the two uncertainties have countervailing impacts on the firm's pricing decision: cost uncertainty increases price, and demand uncertainty decreases price. This result leads to an interesting conclusion that in the presence of demand uncertainty, cost uncertainty is beneficial for the service provider's expected profit.

3 - To Sell or To Provide? A Comparison of Selling and Membership

Ioannis Bellos, PhD Candidate, Georgia Tech, 800 W. Peachtree, Atlanta, GA, 30308, United States of America, Ioannis.Bellos@mgt.gatech.edu, Beril Toktay, Mark Ferguson

We study the auto manufacturer's choice regarding whether to provide mobility service (e.g. car sharing) in conjunction with the traditional sales channel. A multinomial logit model is used to characterize the consumer's choice between purchasing a vehicle, benefiting from the mobility service or relying on an outside option (e.g. public transportation). We characterize the benefit to the manufacturer of providing mobility service and the environmental implications of this strategy.

■ WA29

C - Room 216A

Operator Methods in Finance

Cluster: Quantitative Finance

Invited Session

Chair: Rafael Mendoza-Arriaga, Assistant Professor, University of Texas at Austin, IROM, 1 University Station, CBA 5.202, B6500 (IROM), Austin, 78712, United States of America, Rafael.Mendoza-Arriaga@mccombs.utexas.edu

Co-Chair: Liming Feng, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S Mathews Avenue, Urbana, IL, 61801, United States of America, fenglm@illinois.edu

1 - Time-changed Fast Mean-reverting Stochastic Volatility Models
Matthew Lorig, Postdoctoral Scholar, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, mattlorig@gmail.com

We introduce a class of randomly time-changed fast mean-reverting stochastic volatility (TC-FMR-SV) models. Using spectral theory and singular perturbation techniques, we derive an approximation for the price of any European option in the TC-FMR-SV setting. Three examples of random time-changes are provided and are shown to induce distinct implied volatility surfaces. Features of the TC-FMR-SV framework are jumps in the price process, the leverage effect and multiple factors of volatility.

2 - A Two-sided Laplace Inversion Algorithm with Application in Financial Engineering
Steve Kou, Professor, Columbia University, 312, Mudd Building, Columbia University, New York, NY, 10027, United States of America, sk75@columbia.edu, Ning Cai

We propose a new two-sided Laplace inversion algorithm, which is useful to compute option prices and sensitivity measures in financial engineering. Theoretical truncation and discretization errors are given. Numerical examples show that the algorithm works well even for extreme strike prices.

3 - Positive Subordinate CIR Processes with Two-Sided Mean-Reverting Jumps
Rafael Mendoza-Arriaga, Assistant Professor, University of Texas at Austin, IROM, 1 University Station, CBA 5.202, B6500 (IROM), Austin, 78712, United States of America, Rafael.Mendoza-Arriaga@mccombs.utexas.edu, Vadim Linetsky

In this paper we present the SubCIR jump-diffusion process. The SubCIR's diffusion dynamics are those of a CIR process. The SubCIR's jump component includes two-sided mean-reverting (state-dependent) jumps. The process remains strictly positive if the CIR process satisfies Feller's condition. The analytical tractability of the SubCIR process makes it a richer extension to the CIR process (compared to previous models) and it is also a natural alternative for interest rates and credit models.

4 - Inverting Analytic Characteristic Functions
Liming Feng, Assistant Professor, University of Illinois at Urbana-Champaign, 104 S Mathews Avenue, Urbana, IL, 61801, United States of America, fenglm@illinois.edu

We present sinc expansion based schemes for inverting analytic characteristic functions that naturally arise in derivatives valuation problems. The schemes are simple but highly accurate, with exponentially decaying errors and explicit expressions for the error estimates. Numerical examples on pricing European vanilla options with extreme strikes and Monte Carlo simulation of Levy processes illustrate the effectiveness of the schemes.

■ WA30

C - Room 216B

Risk in Supplier Selection

Contributed Session

Chair: Arash Dadvand, CGN and Associates, 415 SW Washington St., Peoria, IL, United States of America, adadvand@cgn.net

1 - Application of AHP and Taguchi Loss Function in Supply Chain
Sharon Ordoobadi, University of Massachusetts, 285 Old Westport Road, Dartmouth, United States of America, sordoobadi@umassd.edu

Risks and benefits of using a vendor in supply chain are identified. Taguchi loss functions are used to measure performance of each supplier with respect to the risks and benefits. AHP is used to determine the relative importance of these factors to the decision maker. The weighted loss scores are then calculated for each supplier by using the relative importance as the weights. The composite weighted loss scores are used for ranking of the suppliers.

2 - Selection of Supply Portfolio in a Make-to-order Supply Chain with Disruption Risks
Tadeusz Sawik, AGH University of Science & Technology, Al. Mickiewicza 30, Krakow, Poland, ghsawik@cyf-kr.edu.pl

The supply portfolio in a make-to-order supply chain with disruption risks is selected using mixed integer programming, conditional value-at-risk and scenario analysis. Given a set of customer orders for products, the decisionmaker needs to allocate the orders among suppliers of parts to minimize total cost and to mitigate the impact of local and global supply disruptions.

3 - Strategic Supplier Selection in Manufacturer-Supplier Games with Supply Side Disruptions
Sung Hoon Chung, The Pennsylvania State University, 244 Leonhard Building, University Park, United States of America, shchung@psu.edu, Terry Friesz, Robert Weaver

We present the model of the strategic supplier choice of manufacturing firms operating in supply chains with spatial dimensions. We propose an algorithm based on fixed-point theory and show that it is computationally tractable with random variables. Numerical results indicate that supplier selection policy is to be decided by consideration of supplier competition, capacity, and network failure settings.

4 - Supplier Selection and Order Quantity Allocation under Supply Risks
Yingying Wang, PhD Candidate, North Carolina State University, 111 Lampe Drive Daniels Hall, Room 307, Raleigh, NC, 27606, United States of America, ywang19@ncsu.edu, Semra Sebnem Ahiska, Russell E. King, Don Warsing

In a single-period inventory system, we address the issue of selecting suppliers from multiple unreliable suppliers and allocating orders among them to minimize total cost. Supplier reliability is defined as the probability of order delivery, and total cost consists of item costs (proportional to delivered quantities), fixed costs (incurred upon order placement), and end-of-period costs. The importance of each parameter in the decision process is identified and a heuristic method is proposed.

5 - A New Look Into Procurement Risk Management
Arash Dadvand, CGN and Associates, 415 SW Washington St., Peoria, IL, United States of America, adadvand@cgn.net

Cost management in supplier selection and procurement strategy has been the center of many procurement decisions. Another equally-important factor in procurement decisions is the procurement risk and it's effect on both the product and overall company risk. With the growth of globalization, changing global power balance, cultural and political changes and environmental and energy concerns, more attention is required to understand procurement risk effect on overall corporate competitiveness.

■ WA31

C - Room 217A

Innovation and Health Care

Sponsor: Health Applications

Sponsored Session

Chair: Evin Jacobson, Postdoctoral Research Associate, Imperial College Business School, Tanaka Building, South Kensington Campus, London, SW7 2AZ, United Kingdom, euzun@imperial.ac.uk

1 - A Bayesian Approach to the Model of Beta-cell Mass, Insulin, and Glucose Kinetics
Zhen Liu, Engineering Management & System Engineering, University of Missouri-Rolla, Rolla, MO, 65409, United States of America, zliu@mst.edu, John Birge

The model of beta-cell mass, insulin, and glucose kinetics was proposed to model the insulin-glucose dynamics of diabetes, and overcomes the difficulty of the classical Bergman's minimal model by incorporating long-term effects. To estimate unobserved parameters, we illustrate how the reconstruction algorithm may be efficiently implemented in a Bayesian approach where posterior sampling is made by Markov chain Monte Carlo (MCMC) techniques.

2 - Collaborative Modular Architecture Framework for Design Evaluation Method of Reusable Medical Equipment
Celestine Aguwa, Southfield, MI, United States of America, caguwa2000@yahoo.com, Leslie Monplaisir, Ozgu Turgut

This research addresses the issues in reprocessing of reusable equipment such as endoscopes with the objective of infection reduction. Modular architecture methodology that involves stakeholder input and analysis, and approximate multi-objective optimization schema is applied to group the family of endoscopes into modules. Finally, adequate reprocessing procedures are developed for each module to achieve patients' safety improvement.

3 - Radiation Treatment Planning Optimization for VMAT and Rapid Arc Therapy

Kerem Akartunali, John Anderson Research Lecturer in Optimization, University of Strathclyde, Management Science Department, Glasgow, G4 0TD, United Kingdom, kerem.akartunali@strath.ac.uk, Vicky Mak-Hau

Volumetric Arc Therapy (VMAT) is a technology used for radiation treatment, where the aim is to generate a plan of radiation dosages, angles and collimator shapes. The problem is very hard to solve and has additional challenges such as time limitations. We discuss an integer programming formulation, and present a variety of solution techniques using integer and constraint programming techniques. We discuss some interesting theoretical results, and conclude with extensive computational results.

4 - Simulation Modelling for Stroke Care Delivery Analysis in Scotland

Evin Jacobson, Postdoctoral Research Associate, Imperial College Business School, Tanaka Building, South Kensington Campus, London, SW7 2AZ, United Kingdom, euzun@imperial.ac.uk

We conduct a simulation study considering Scotland as a location where geography can make the access to timely diagnostic of stroke challenging. Our aim is to develop a methodology to assist in better allocating a limited budget on interventions. We model the system using discrete-event simulation, focusing on a system-wide overview of stroke care delivery, especially the interactions between the health care resources involved in stroke care and alternative patient pathways.

■ WA32

C - Room 217BC

Human, Cultural and Ecological Interactions in Sustainability

Contributed Session

Chair: Anthony Craig, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-220, Cambridge, MA, 02139, United States of America, tcraig@mit.edu

1 - Creation of Design Methods that Facilitate Customer Decision-making on Sustainable Products

Jinjuan She, PhD Candidate, Iowa State University, 1620 Howe Hall, 2274, Ames, IA, 50011-2274, United States of America, jjshe@iastate.edu, Erin MacDonald

Many sustainable attributes of products are not obvious to consumers, and marketing messages may not be always trusted. Product design has been used to communicate information about a product through its form and function; however, doing so in the context of sustainability is difficult for designers. This research seeks to create and test design methods that enable designers to develop product attributes that readily convey sustainability to consumers and improve sustainability considerations.

2 - Transboundary Ecosystem Services Provided by Migratory Bats

Jon Cline, Postdoctoral Research Associate, The University of Arizona, School of Natural Resources and the Env, 1311 E 4th St., Tucson, AZ, 85721, United States of America, jcc1@email.arizona.edu, Laura López Hoffman, Rodrigo Medéllin, Darius Semmens, Jay Diffendorfer

Migratory species support ecosystem function in multiple areas, providing critical ecosystem services in different locations. The ability to quantify spatial subsidies associated with ecosystem services could be used to develop economic incentives that enhance cross-jurisdictional cooperative management. We will present an integrated multi-model of transboundary ecosystem services, critical cotton pest-control services, provided by migratory Mexican free-tailed bats, Tadarida brasilliensis.

3 - Compilation and Analysis of Green Input-Output Tables of China for 2007

Xinna Zhao, Peking University, 5 Yiheyuan Road, Haidian District, Beijing, 100871, China, zhaoxinna@pku.edu.cn, Ming Lei

The linkage for energy, economy and environment has received increased attention. Based on the green input-output theory, the authors compile the China green input-output tables (2007). For an applicable purpose, we use the table to analyze the national economic linkage effect, FDI induced effect and the foreign trade energy-pollution effect in the context of sustainable development in China. We aim at providing the objective for industrialization and promoting the sustainable development.

4 - A Vertical Differentiation Model of Product Carbon Labels

Anthony Craig, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-220, Cambridge, MA, 02139, United States of America, tcraig@mit.edu, Edgar Blanco, Yossi Sheffi

Eco-labels represent a method for firms to differentiate their products based on environmental quality. Carbon labels are one type of eco-label, but differ from most eco-labels in that the quality level is continuous, rather than discrete, and influenced by all firms in the supply chain. We present a vertical differentiation model of carbon labels that captures these characteristics and examine the impact of price, quality, and label choice on the firms in the supply chain.

5 - On the Merits of Greenwashing: Discourse and Natural Drift In the Supply Chain

Joe Rubleske, Research Associate, University of Georgia, Terry College of Business, Athens, GA, United States of America, rublesk@gmail.com, David Graham Hyatt, Nicholas Berente

The term "greenwashing" is used to describe tactics that firms use to appear as though they are committed to the natural environment, when in fact they are not. We adopt an evolutionary perspective to argue that greenwashing may, in certain situations, result in the authentic greening of a supply chain over time. We develop a process model that leverages the evolutionary notion of "natural drift" and organizational discourse theory.

■ WA33

C - Room 217D

Nanomanufacturing and Nanoinformatics VI: Modeling and Quality control

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Satish Bukkapatnam, Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, satish.t.bukkapatnam@okstate.edu

1 - Parameter Estimation in Particle-clustering Detection Model of Metal Matrix Nanocomposites

Heping Liu, University of Wisconsin at Madison, 3270 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, hliu235@wisc.edu, Shiyu Zhou, Xiaochun Li

To ensure that metal matrix nanocomposites (MMNCs) have enhanced properties such as high strength and light weight, nanoparticles in nanocomposites need be uniformly distributed within the metal matrix. Most of the existing references evaluate the particle distribution based on a single image. This study focuses on the parameter estimation of the clustering of particles using the count data from multiple image samples.

2 - In-Situ Structural Characterization of SWCNTs in Dispersion

Tao (Ted) Liu, Assistant Professor, Florida State University, Department Industrial&Manufacturing Eng., 2525 Pottsdamer St., Tallahassee, FL, 32310, United States of America, liutao@eng.fsu.edu, Zhiwei Xiao

Quantitative characterization of single-walled carbon nanotubes (SWCNTs) is critical for quality assurance of SWCNT dispersions and for optimizing the performance of a variety of SWCNT dispersion related applications. With an emphasis on our newly developed methods - preparative ultracentrifuge method and simultaneous Raman scattering and photoluminescence spectroscopy, in this presentation, we will give an overview on the techniques for in-situ structural characterization of SWCNT dispersions.

3 - High Speed Tip-based Ultrasonic Nanomachining Using Atomic Force Microscope

Jingyan Dong, Assistant Professor, North Carolina State University, Edward P. Fitts Department of Ind. & Sys. Eng., Raleigh, NC, 27695, United States of America, jdong@ncsu.edu

Nanomachining using the atomic force microscope (AFM) has been widely studied to achieve high resolution nanoscale structures and features. This research explores a high speed nano-machining process using AFM cantilever tip. An ultrasonic frequency vibration and is added to the cantilever and the feed is controlled by a high bandwidth nanopositioning stage. The presented process significantly improves the machining speed and material remove rate.

4 - The Adaptation of Quality Improvement Methods for Nanoparticle Production Enhancement

Paul Goethals, Department of Mathematical Sciences, United States Military Academy, West Point, NY, 10997, United States of America, pgoetha@clemson.edu, Byung Rae Cho

For nanoparticle production systems, engineering a substantial experimental yield continues to pose a significant challenge to the manufacturing community. Many researchers are seeking techniques, such as response surface methodology, for process and product improvement. Under significantly elevated degrees of quality, however, these methods require some refinement. This research specifically investigates the integration of higher-order designs into nanoparticle manufacturing systems.

■ WA34

C - Room 218A

Patient Flow

Sponsor: Health Applications

Sponsored Session

Chair: Michael Magazine, University of Cincinnati, College of Business, Department of OBA, Cincinnati, OH, 45221, United States of America, mike.magazine@uc.edu

Co-Chair: Craig Froehle, Froehle@ucmail.uc.edu

1 - Real-time Appointment Scheduling in Outpatient Clinics with Patient Dependent Show-rates

Stephen Lawrence, Associate Professor, University of Colorado, 419 UCB, Boulder, CO, 80309, United States of America, Stephen.Lawrence@Colorado.edu, Linda LaGanga, Michele Samorani

We examine the problem of outpatient scheduling in real time as patients call in for appointments. Patients who make appointments may either show for their appointments or may be no-shows. We assume that the clinic has historical and/or patient-specific data from which individual show probabilities can be estimated, from which we develop a heuristic algorithm that builds an efficient and cost-effective schedule as patient appointment requests are received.

2 - Estimating the Implied Value of the Customer's Waiting Time

Rachel Chen, Associate Professor, University of California-Davis, 3208 Gallagher Hall, Davis, CA, 95616, United States of America, rachen@ucdavis.edu, Lawrence Robinson

Almost all research in appointment scheduling has focused on the trade-off between customer waiting times and server idle times. In this paper, we present an observation-based method for estimating the relative cost of the customer waiting time, which is a critical parameter for finding the optimal appointment schedule.

3 - Who Should Emergency Physicians See Next?

Yann Ferrand, Assistant Professor, Clemson University, 101 Sirrine Hall, Clemson, SC, 29634, United States of America, yann.ferrand@gmail.com, uday Rao, Michael Magazine, Todd Glass

To improve patient flow in an emergency department, we investigate different ways to prioritize patients and the effect of adapting the care process protocol based on information about the patient. We use discrete event simulation to compare our approaches in terms of patient wait time and length of stay, and physician idleness.

■ WA35

C - Room 218B

Optimization, Quality and Reliability

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Greg Boylan, Clemson University, Department of Industrial Eningeering, Room 150 Freeman Hall, Clemson, SC, 29634, United States of America, gboylan@clemson.edu

1 - Development of Tolerance Synthesis and Optimization for a Pharmaceutical Quality Characteristic

Hsin-Li Chan, Clemson University, Department of Industrial Engineering, 103 Freeman Hall, Clemson University, Clemson, 29634, United States of America, hchan@clemson.edu, Zhe Li, Byung Rae Cho, Brian Melloy

FDA specifies benchmarks for blood concentration over time to regulate the quality of generics. The main objective of this research is twofold. First, we propose the new concept of internal tolerance limits within the FDA specified allowable ranges to further improve the quality of generics, and discuss the practical importance of the internal tolerance limits. We then propose models for determining optimal internal tolerance limits on the blood concentration, while meeting the FDA benchmarks.

2 - A Fast Approximation Method for Cold-Standby System Analysis

Chaonan Wang, PhD Student, University of Massachusetts - Dartmouth, 285 Old westport Road, N. Dartmouth, MA, 02747, United States of America, cwang2@umassd.edu, Liudong Xing

Existing approaches to analyzing cold-standby systems have various computational complexity problems. In this work, we present an approximation method based on the central limit theorem, which can compute the reliability of a large cold-standby system in a much simpler and faster manner than the existing methods. The accuracy and efficiency of the method are illustrated using three different types of distributions (Exponential, Normal, Weibull) for 1-out-of-n and k-out-of-n cold standby systems.

3 - Pharmaceutical Formulation Optimization for Scaling Up Development of Brand Name Drugs

Zhe Li, Clemson University, Department of Industrial Engineering, 204B Freeman Hall, Clemson University, Clemson, 29634, United States of America, zli2@g.clemson.edu, Hsin-Li Chan, Byung Rae Cho, Brian Melloy

The current pharmaceutical formulation optimization is conducted before the manufacturing process scale-up to find the optimal combination of ingredients of a formulation. However, process scale-up potentially results in changes of formulations. Therefore, formulation optimization is applicable to determine the optimal setting aimed at ensuring the equivalent quality for the changed formulation. This research proposes a comprehensive optimization procedure incorporating design of experiments.

4 - Examining Tradeoffs between Costs and Precision to Support Decision Making in Robust Design

Greg Boylan, Clemson University, Department of Industrial Eningeering, Room 150 Freeman Hall, Clemson, SC, 29634, United States of America, gboylan@clemson.edu, Paul Goethals, Byung Rae Cho

Most models used to determine optimal process settings assume sufficient conditions exist to obtain accurate estimates. In variable processes, many such assumptions do not hold. Thus, using the estimators could generate suboptimal recommendations. Improving quality and supporting decision making in resource-constrained environments requires tradeoff analyses that examine costs and precision. We propose several techniques supported by Monte Carlo simulation to provide options to decision makers.

■ WA36

C - Room 219A

Joint Session HAS/Homeland Security: Public Health, Homeland Security, and Disaster Response

Sponsor: Health Applications/Homeland Security - Emergency Prep

Sponsored Session

Chair: Eva Lee, Professor & Director, Georgia Insitute of Technology, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

1 - Optimizing Army Aeromedical Evacuation Response: A Scenario-based, Multi-objective Modeling Approach

Nathaniel D. Bastian, Center for Operations Research in Medicine and HealthCare, Georgia Institute of Technology; Center for AMEDD Strategic Studies, U.S. Army Medical Department Center & School, 94-277 Makapipipi St Apt 121, Mililani, HI, 96789, United States of America, ndbastian@gatech.edu

The U.S. Army's health service support system remains particularly effective by employing aeromedical evacuation helicopters to efficiently evacuate casualties from the battlefield. Military commanders in Afghanistan have faced a significant combinatorial challenge integrating these life-saving yet limited assets into a comprehensive system for the entire combat theatre. This work describes a scenario-based, multi-objective modeling approach to optimize Army aeromedical evacuation response.

2 - Vaccine Prioritization for Biological Terrorist Events or Pandemic Response

Fan Yuan, Georgia Institute of Technology, Atlanta, GA, United Arab Emirates, fanyuan@gatech.edu, Eva Lee

This work is joint with CDC Strategic National Stockpile. We study the strategies for vaccination across a large population when limited vaccines are available. Mathematical models will be described and strategies will be analyzed with respect to the susceptibility and risk factors of different groups of individuals. Results related to H1N1 stock and mass vaccination events will be analyzed.

3 - Analysis of Resource Needs for Postal and POD Mass Dispensing

Eva Lee, Professor & Director, Georgia Insitute of Technology, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu, Chien-Hung Chen

This work is joint with CDC Strategic National Stockpile and the Global Disease Detection and Emergency Response. City readiness and emergency response for biodefense/infectious disease outbreaks/radiological incidence involves multilevel strategic and operational planning. A key element involves population protection via mass dispensing of prophylactic medication. We will analyze the resource needs and cost-effectiveness for postal and/or point-of-dispensing of medical countermeasures.

■ WA37

C - Room 219B

Complex System Monitoring, Diagnosis, and Evaluation

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Qingyu Yang, Assistant Professor, Wayne State University, United States of America, qyang@wayne.edu

1 - A Weighted Decomposition Method for Analyzing Unreliable Manufacturing Systems

Hui Wang, University of Michigan, Detroit, MI, United States of America, huiwz@umich.edu, Sheng Yang, S. Jack Hu

This talk presents a weighted decomposition method for analyzing manufacturing systems with repetitive operations, batch size, rework and scrapping work. Weights are associated with the operations on each material flow to represent the system states. The system is represented as connected graphs and stochastic modeling of systems is conducted to evaluate average system throughput. This method relaxes conventional acyclic conditions for system modeling and is applicable to all ergodic systems.

2 - Uncertainty Quantification for Gear Life Prediction

Zhigang Tian, Assistant Professor, Concordia University, Institute for Information Systems Engine, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca, Fuqiong Zhao

The prediction of crack propagation in spur gear tooth root, and thus the gear life, is studied in this work. The prediction is performed based on the finite element model of the gear and the damage propagation model. Uncertainty factors in the model are considered. A method for quantifying the uncertainty associated with the gear life prediction at a certain inspection time is developed.

3 - Optimal Sensor Allocation Strategy for Monitoring and Diagnosis in a Bayesian Network

Kaibo Liu, Research Assistant, Gerogia Institute of Technology, H. Milton Stewart School of Industrial and Systems Engineering, 765 Ferst Drive, Room 331, Atlanta, GA, 30332, United States of America, kbliu@gatech.edu, Jianjun Shi

In this paper, we investigate how to optimally select partial available information for multiple mean shifts detection and diagnosis when the number of sensors deployed is less than the total number of variables in a Bayesian network. Case studies are performed on a hot forming process to illustrate and evaluate the proposed methods under different objective-oriented scenarios.

4 - Detect Warm-Up Period for Discrete-Event Simulations Using a Self-Starting Control Chart

Huan Yu, University of Iowa, MIE Department, Iowa City, United States of America, huan-yu@uiowa.edu, Yong Chen

Appropriately handling initial transients is important for unbiased estimation of steady-state parameters in a discrete-event simulation. One of the main approaches is to run the simulation for long enough and detect a warm-up period so that the data from the warm-up period will not be used in parameter estimation. We present a new method for warm-up period detection using a self-starting control chart.

5 - Service Safety Assessment Technology for Key Infrastructure

Weidong Zhang, Associate Professor, University of Science & Technology Beijing, 30 Xueyuan Road, Haidian District, Beijing, 100083, China, zwdustb@gmail.com

Service safety of key infrastructure such as bridge,pipeline,ect is very important. We can put different sensor on the infrastructure and acquire service data. With the data and model of the infrastructure we could assess the risk and evaluate life of infrastructure.

■ WA38

H- Johnson Room - 4th Floor

Applications of VRP

Contributed Session

Chair: Jiefeng Xu, Wipro Technologies, 325 Springwell Ln., Alpharetta, GA, 30004, United States of America, jiefeng.xu1@wipro.com

1 - The Waste Collection Vehicle Routing Problem with Time Windows and Driver Breaks

Allan Larsen, Associate Professor, Technical University of Denmark, DTU Transport, Kgs. Lyngby, Denmark, ala@transport.dtu.dk

We find cost optimal routes for garbage trucks such that all garbage bins are emptied and the waste is driven to disposal sites while respecting customer time windows and ensuring that drivers are given the breaks that the law requires. We propose an adaptive large neighbourhood search algorithm for solving the problem and illustrate the performance of the algorithm using a set of test instances from the literature as well as real-life instances from a Danish waste collection company.

2 - A Multiple Pickup Route Optimization Problem

Sandro Paz, Associate Professor, Pontificia Universidad Catolica del Peru, Avenida Universitaria 1801, San Miguel, Lima, Peru, spaz@pucp.edu.pe, Monica Puertas, Bo Zeng, Ruth Murrugarra

We consider a real problem involving multiple pickup routes and capacity arrangement. We build a mix integer programming model and develop a few solution strategies, including re-formulation and column generation. Computational results will be presented on a large-scale real data set.

3 - A Branch-and-Price for a Multi-trip Vehicle Routing Problem with Time Windows and Driver Work Hours

Michel Seixas, Master Student, University of São Paulo, Av. Professor Mello Moraes, 2231, São Paulo, SP, 05508-030, Brazil, michel.povlovitsch@gmail.com, André Mendes

This study considers a vehicle routing problem with time windows, heterogeneous fleet regarding capacity and speed, and accessibility restrictions on customers. Each vehicle performs multiple routes per day using the same driver. It is proposed a column generation algorithm embedded in a branch-and-bound. The pricing subproblem required a dynamic programming algorithm to deal with multiple routes and workday beginning time. A constructive heuristic and a tabu search metaheuristic were developed.

4 - Vehicle Routing Problem with a Green Objective

Jiefeng Xu, Wipro Technologies, 325 Springwell Ln., Alpharetta, GA, 30004, United States of America, jiefeng.xu1@wipro.com, Ajesh Kapoor, Amit Maheshwari

We analyze the standard VRP objective and show that it may not well represent true vehicle expense like fuel cost. We propose a new green objective that can improve the cost representation. Optimizing this objective will result in reduction in both vehicle cost and GHS emission. We formulate the new VRP mathematically, and show the standard VRP optimality cannot be maintained under the new objective. Finally, we present preliminary computational results on several well-known benchmark instances.

5 - A Hybrid DE Algorithm for Stochastic Vehicle Routing Problem with Simultaneous Pick up and Delivery

Berna Dengiz, Dean, Baskent University, Engineering Faculty Baglica Campus, Eskisehir Road 20th km.Etimesgut, Ankara, 06530, Turkey, bdengiz@baskent.edu.tr, Fulya Altiparmak, Imdat Kara, Aysegul Gultepe

In this paper, we presents a hybrid discrete differential evolution algorithm for stochastic vehicle routing problem with simultaneous pick-up and delivery (SVRP_SPD) which is a type of classical vehicle routing problem (VRP). It is known that this problem is NP-hard. The SVRP_SPD deals with optimally integrating goods distribution and collection when there are no precedence restrictions on the order in which the operations must be performed.

■ WA39

H - Morehead Boardroom -3rd Floor

Understanding Value and the Acquisition of Technology Innovation

Sponsor: E-Business

Sponsored Session

Chair: Sam Ransbotham, Assistant Professor, Boston College, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States of America, sam.ransbotham@bc.edu

1 - Geometry of Alliances: Make, Buy and Ally in the Computer Industry

Anne Fuller, California State University, Sacramento, Tahoe Hall Rm. 2017, 6000 J Street, Sacramento, CA, 95819-6088, United States of America, anne.fuller@csus.edu, Douglas Fuller

This paper investigates firm-level decisions on resources used for an identified technological need. Much of the existing literature concentrates on conducting R&D internally or externally to the firm. However if a firm goes outside for a particular R&D need, "Make, Buy or Ally" are the actual choices. The paper creates a model of a 'sourcing triangle' that highlights three distinct distance measures useful for a number of applications. The model is exemplified in the computer industry.

2 - The Market Value of Network Effects

Hemang Subramanian, Georgian Institute of Technology, Atlanta, GA, United States of America, hemang.subramanian@mgt.gatech.edu, Sabyasachi Mitra

Information Technology firms frequently exhibit strong network effects as increases in the number of users create value non-linearly. But how valuable are network effects? We examine market value creation from network effects through an in-depth examination of acquisitions of web-based software companies. We study not only the value created by the targets but also the synergistic value created through combined user bases of the buyer and target that exceed linear returns to scale.

3 - Acquiring Innovation to Fill Technology Gaps or Expand Into New Areas

Sam Ransbotham, Assistant Professor, Boston College, 140 Commonwealth Avenue, Chestnut Hill, MA, 02467, United States of America, sam.ransbotham@bc.edu, Sabyasachi Mitra

External acquisition of innovation is important, particularly in high technology. We investigate software industry market value creation (or loss) from acquisitions by examining the patent portfolios of acquirers and targets. We examine technology, not financial, driven motivations. Moreover, we view patents as a two-mode network thus offering a novel methodological framework that allows for analysis of not only the acquirers of technology, but also those who did not acquire.

■ WA40

H - Walker Room - 4th Floor

Sustainability for Business Intelligence on Technology Management and New Product Development

Sponsor: Technology Management

Sponsored Session

Chair: Hsueh Ming Stev Wang, Associate Professor, University of Alaska Anchorage, 3211 Providence Drive, ESM Department, Anchorage, AK, 99508, United States of America, afhsw1@uaa.alaska.edu

1 - An Innovated Healthcare System Engineering Program at Lehigh University

Hisham Abu-Nabaa, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, United States of America, Hisham.Abunabaa@wilkes.edu

The new program provides solutions to healthcare's complex problems. HSE attempts to attract individuals with a strong knowledge base to optimize healthcare costs, while improving quality and performance. In an increasingly diverse, dynamic, and technology driven environment, the HSE program will provide solutions, such as innovative decision systems, inventory management, resource allocation, healthcare delivery, patient safety, and quality care.

2 - Sustainable Risk Management for Arctic Offshore Oil & Gas Development

Seong Dae Kim, Assistant Professor, University of Alaska Anchorage, 3901 Old Seward Hwy, Anchorage, AK, 99503, United States of America, afsdk1@uaa.alaska.edu

Arctic offshore development projects face additional challenges that are unique to the region. Because of their uniqueness and challenges, offshore drilling projects require better understanding of the risks and proper strategies to manage them given the challenges in responding to spills and other problems, as well as the high impact of many risks. This research will search for risk response strategies that achieve sustainability in Arctic offshore oil&gas development.

3 - Analysis of Plasma Gasification Technology United States Patent Publications

Leslie Simmons, Interdisciplinary Ph.D. Graduate Student, University of Alaska, School of Engineering, 3211 Providence Drive, ENGR 201, ULBA, Room 20, Anchorage, AK, 99508, United States of America, environmentalstreams@gmail.com

Plasma gasification technology inventions are submitted to United States Patent and Trademark Office (USPTO) agency. Analysis is about steps, methods, apparatus, efficiencies, and effectiveness that convert real-time and landfilled municipal, industrial, and hazardous waste feedstocks into sustainable energy-from-waste and resource recovery.

4 - Manufacturing for Design and Sustainability

Hsueh Ming Stev Wang, Associate Professor, University of Alaska Anchorage, 3211 Providence Drive, ESM Department, Anchorage, AK, 99508, United States of America, afhsw1@uaa.alaska.edu

A systematical approach including the innovation of manufacturing technology for design to fit the markets' needs was analyzed through literature survey. The finding includes the justification of the competitive advatages of the successful new product design from the innovation of the advanced manufacturing technology. The innovation of the advacned manufacturing technologies for design link with the concepts of sustainability for the Least Rate Intial Production (LRIP).

■ WA41

H - Waring Room - 4th Floor

Productivity and Competitiveness

Contributed Session

Chair: Corey Kiassat, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, ckiassat@mie.utoronto.ca

1 - Competition, Process Improvement and Evergreening

Ram Bala, Indian School of Business, Gachibowli, Hyderabad, India, ram_bala@isb.edu, Sumit Kunnumkal, Milind Sohoni

Firms in innovation-intensive industries introduce upgrades to combat patent expiration, a strategy referred to as Evergreening. However, the upgrade may fail regulatory guidelines and fail to reach the market. To buffer against such failure, an incumbent firm may invest in process improvement in its existing product to combat competition. We analyze the impact of such investment on competitive entry and consequent market outcomes.

2 - A Study of Efficiency of CMM Level 5 Software Projects – A DEA Analysis

Dinesh Pai, Penn State Harrisburg, 777 W. Harrisburg Pike, Middletown, PA, 17057, United States of America, drp18@psu.edu

DEA is used to investigate the efficiency of a sample of 38 software development and maintenance projects, which includes projects from Fortune 500 companies, drawn from a CMM level 5 company. Benchmark projects are identified and the efficiency differences among projects belonging to different platforms, databases, and application investigated. The average overall efficiencies of the sample are relatively high and that the projects are relatively less sensitive to the frontier projects.

3 - Productivity Dilemma of Chinese Labor-intensive Manufacturing Enterprises

Xiangjin Li,Peking University, Room 218, Building 64, Changchunyuan, Beijing, China, lixiangjin@gmail.com, Dongning Yang

Base on the data from 1228 employees working in Chinese labor-intensive manufacturing enterprises, we find that the perceived corporate responsible behavior by employees can effectively reduce their turnover intention, meanwhile improve their job performance. That means social responsible effort may help corporate step out of "productivity dilemma", especially for Chinese labor-intensive manufacturing enterprises who pursuit operation efficiency through high labor division.

4 - A Mathematical Model for Personnel Assignment, Considering Operator Skill Components

Corey Kiassat, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, ckiassat@mie.utoronto.ca

A mathematical model is developed to produce the revenue maximizing personnel assignment. As inputs for its objective function, the model uses regression equations predicting production volume based on personnel's skill components. A case study is considered where regression equations are obtained and used in the mathematical programming model which yields the optimal personnel assignment. It results in a predicted revenue 5.5% superior to that of the current, first-come-first-serve assignment.

■ WA42

H - Gwynn Room - 4th Floor

Digital Media, Competitive Strategies, and Quantitative Analysis

Sponsor: Information Systems Society

Sponsored Session

Chair: Lizhen Xu, Assistant Professor, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States of America, lizhen.xu@mgt.gatech.edu

1 - Designing Twitter Based Business Intelligence System

Huaxia Rui, The University of Texas at Austin, 1 University Station B6500, Austin, TX, 78712, United States of America, ruihuaxia@gmail.com, Andrew Whinston

We design and implement a Twitter-based BI system that forecasts movie box office revenues on a daily and weekly basis. We find that incorporating information from Twitter can reduce the mean absolute percentage error (MAPE) from 9.98% to 8.83% on average when we forecast daily movie sales of 22 movies. For opening weekend revenue forecasting, using Twitter information alone can achieve MAPE of 47.1%. For the second weekend revenue prediction, the MAPE is further reduced to 34.5%.

2 - Conversion Effects of Online Advertising Vehicles

Lizhen Xu, Assistant Professor, Georgia Institute of Technology, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States of America, lizhen.xu@mgt.gatech.edu, Andrew Whinston, Shu Shen, Jianqing Chen

Advertisers spend millions of dollars on various online marketing communication vehicles. How are they worth it? This paper investigates the effects of different online advertising vehicles on the conversion of consumers, based on a dataset from a major electronic device manufacturer and seller recording all of its online advertising interactions with consumers and the associated purchases.

3 - Quantitative Analysis of Longevity Risk and Securities Pricing

Yinglu Deng, Tsinghua University, School of Economics and Management, Beijing, China, dengyinglu@gmail.com

Securitizing longevity/mortality risk can transfer longevity/mortality risk to capital markets. Modeling and forecasting mortality rate is key to pricing mortality-linked securities. Catastrophic mortality and longevity jumps occur in historical data and have an important impact on security pricing. This paper introduces a stochastic diffusion model with a double exponential jump diffusion process that captures both asymmetric rate jumps up and down and also cohort effect in mortality trends.

■ WA43

H - Suite 402 - 4th Floor

Contemporary Issues in Energy Policy and Management

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Paul Bergey, Associate Professor, North Carolina State University, Campus Box 7229, Poole College of Management, Raleigh, NC, 27695, United States of America, paul_bergey@ncsu.edu

1 - The Greenfield vs. Brownfield Problem – Revitalization of Sustainable Energy Platforms

Paul Bergey, Associate Professor, North Carolina State University, Campus Box 7229, Poole College of Management, Raleigh, NC, 27695, United States of America, paul_bergey@ncsu.edu, Geoffrey Parker

A greenfield is a scenario where a 2nd generation biofuel producer constructs a new production facility in a location of their choosing. A brownfield is a scenario where a 2nd generation biofuel producer attempts to renovate an existing 1st generation biofuel production facility. We present a framework that allows us to establish the necessary and sufficient conditions to form a non-empty core when the problem is modeled as a three person cooperative game.

2 - The Role of Universities in Invention of Renewable Energy and Green Technologies

Deborah Strumsky, Professor, University of North Carolina at Charlotte, Department of Geography and Earth Scienc, 9201 University City Boulevard, Charlotte, NC, 28269, United States of America, dstrumsky@uncc.edu, José Lobo

Universities account for less than 3% of US patents overall; however universities are almost 15% of US patents in renewable energy technologies. Our research constructs a new concordance of renewable energy and "green" technologies for US patent data, and explores the unique role of universities for invention in green technologies in the US. Empirical results to be presented include the role of federal grant funding in advancing university research in renewable energy and green technologies.

3 - Techno-Economic Evaluation of a Next-Generation Building Energy Management System

Victor M. Zavala, Assistant Computational Mathematician, Argonne National Laboratory, 9700 S Cass Avenue, Argonne, IL, 60439, United States of America, vzavala@mcs.anl.gov, Tom Celinski, Peter Dickinson

We perform a technological evaluation of BuildingIQ's next-generation energy management (EM) system and present a preliminary energy savings analysis fora commercial-sized building at Argonne National Laboratory. We demonstrate that the EM system is amenable for large-scale deployment and discuss implications in electricity markets.

■ WA44

H - Suite 406 - 4th Floor

Supply Chain Management I

Contributed Session

Chair: Haitao Li, University of Missouri at St. Louis, College of Business Administration, St. Louis, MO, 63121, United States of America, lihait@umsl.edu

1 - An Econometric Analysis of Product Recall Strategies and Recall Speed

Tracy Johnson-Hall, Doctoral Candidate, Clemson University, 113 Daniel Avenue, Seneca, SC, 29678, United States of America, tdjohns@clemson.edu, Manpreet Hora, Aleda Roth

We study the role of strategies adopted by firms during product recalls and their association with product shelf life. Using recall data from the food and pharmaceutical industries, we employ econometric methods to examine this association. We discuss the preliminary results and their implications to firms, consumers and policy-makers.

2 - Supply Chain Configuration for Diffusion of New Products

Haitao Li, University of Missouri at St. Louis, College of Business Administration, St. Louis, MO, 63121, United States of America, lihait@umsl.edu, Mehdi Amini

We develop an integrated/hybrid optimization model for configuring new products' supply chains while explicitly considering the impact of demand dynamics during new products' diffusion. The hybrid model simultaneously determines optimal production/sales plan and supply chain configuration. We provide insights on optimal production/sales plan and supply chain configuration for new products during their diffusion process.

3 - On the Advantage of Quantity Leadership When Outsourcing Production to a Competitive CM

Yulan Wang, Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong - PRC, tcywang@polyu.edu.hk, Pengfei Guo

We investigate a supply chain comprising an OEM and a CM, where the CM acts as both an upstream partner and a downstream competitor of the OEM. The two parties can engage in a simultaneous-move game, a sequential game with the OEM as the Stackelberg leader or a sequential game with the CM as the Stackelberg leader. Based on these three basic games, we investigate their decisions in choosing Stackelberg leadership/followership by considering various system parameters.

4 - Capacity, Pre-commitment, and Imperfect Information in a Procurement Game

Abdullah Dasci, Visiting Associate Professor, Sabanci University, Faculty of Management, Orhanli-Tuzla 34956, Istanbul, Turkey, dasci@sabanciuniv.edu, Kemal Guler

An economic model for a procurement problem faced by a large-scale buyer will be presented. The supply market is assumed to be duopoly, in which firms' strategic interactions are driven by their limited capacities and the buyer's procurement design decisions. In this setting, the impact of dynamic procurement, pre-commitment, and imperfect information on the outcome of the procurement costs and supplier profits will be explored.

■ WA45

H - Suite 407 - 4th Floor

Topics in Procurement

Contributed Session

Chair: Maximilian Budde, University Vienna, Brünner Strafle 72, Vienna, 1210, Austria, maximilian.budde@univie.ac.at

1 - Study of the Optimal Procurement Strategy Based on B2B Electronic Spot Market

Jinpeng Xu, School of Management, Xi'an Jiaotong University, Mailbox 2230, No.28, Xianning West Road, Xi'an, China, jinpxu@foxmail.com, Gengzhong Feng, Wei Jiang

B2B electronic spot markets have grown to be effective trading channels in recent years. Besides the forward and option procurement from regular suppliers, the retailer can procure or sell commodities immediately to adjust her inventory on spot markets. Using single-period newsboy model, this paper analyzes the optimal ordering strategy of forward and option contracts in the presence of a spot market, and provides the optimal decisions under different liquidities of spot market.

2 - The Optimal Number of Suppliers in the Presence of Quantity Discounts and Default Risks

Alexander Rothkopf, EBS Business School, Soehnleinstrasse 8F, Wiesbaden, 65197, Germany, alexander.rothkopf@ebs.edu, Richard Pibernik, Sebastian Moritz

Firms face a fundamental tradeoff when choosing the optimal number of suppliers and allocating purchasing volume across them: While supplier management costs and volume discounts favor a concentration of the purchasing volume, supply default risks suggest a more balanced volume allocation and a larger supply base. We study the interaction of the two tendencies and identify conditions under which supplier selection and volume allocation decisions are not in line with normal business intuition.

3 - First and Second Price Sealed Bid Auctions for Push and Pull Supply Contracts

Maximilian Budde, University Vienna, Brünner Strafle 72, Vienna, 1210, Austria, maximilian.budde@univie.ac.at, Stefan Minner

We consider a retailer facing random demand and having the option to source from multiple suppliers with manufacturing costs being private information. To deal with demand uncertainty, the retailer can choose between push and pull contracts to source the required goods. For both contract formats, we consider reverse first price and second price sealed bid auctions with endogenous quantity to find the best supplier. We extend these results for risk aversion on the retailer and supplier side.

■ WA47

H - Dunn Room - 3rd Floor

Reverse Logistics and Supply Chain I

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Ron Lembke, Associate Professor, Supply Chain Management, University of Nevada, MGRS / 0028, Reno, NV, 89557, United States of America, ronlembke@unr.edu

Co-Chair: Theresa Barker, Affiliate Assistant Professor, University of Washington, Box 352650, Seattle, WA, 98115, United States of America, barkertj@uw.edu

1 - Reverse Logistics and Carbon Footprints

Ron Lembke, Associate Professor, Supply Chain Management, University of Nevada, MGRS / 0028, Reno, NV, 89557, United States of America, ronlembke@unr.edu, Dale Rogers

Most carbon footprints metrics focus on the production and distribution aspects of the product and do not include important portions of the process such as reverse logistics and end-of-life management. In this research the authors describe several ways in which Reverse Logistics and end-of-life must be considered in computing a carbon footprint, and ways that good RL practices can actually reduce carbon usage within the firms and its supply chains.

2 - Closed-loop Supply Chain Network Configuration by Stochastic Goal Programming Approach

Saman Hassanzadeh Amin, Ph.D. candidate, University of Windsor, Department of Industrial Engineering, 401 Sunset Avenue, Windsor, ON, N9B3P4, Canada, hassanzs@uwindsor.ca, Guoqing Zhang

In this research, a generic closed-loop supply chain network is investigated which includes multiple plants, distribution centers, demand markets, collection centers, and products. To this aim, a goal programming model is proposed. Besides, the model is developed by stochastic programming (scenario-based) to consider uncertainty in goals, demands, and returns. Results of the numerical example indicate that the model can handle different sources of uncertainty, simultaneously.

3 - Reverse Logistics and Recall and Outdate Management in Healthcare Supply Chain

Vijith Malayil Varghese, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, vvarghe@uark.edu, Ronald Rardin, Nebil Buyurgan, Raja Jayaraman, Angelica Burbano, Nabil Lehlou, Paiman Farrokhvar, Eghbal Rashidi

In this presentation we describe recall and outdate management practices widely adopted in healthcare supply chain and how returns are managed. We compare these practices to some of the best practices in other industries. Efficiencies gained in recall and outdate management through data standards adoption are also discussed.

■ WA48

H - Graham Room - 3rd Floor

Topics in Freight Transportation

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Xuesong Zhou, University of Utah, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu

1 - Lagrangian Relaxation-based Algorithm for Vehicle Routing Problem under Stochastic Travel Times

Lixing Yang, State Key Laboratory of Rail Traffic Control and Safety, Beijing Jiaotong University, Beijing, China, lxyang.utah@gmail.com, Xuesong Zhou

We construct an optimization formulation for finding the a priori least expected time paths in a time-dependent and stochastic network using a sample-based representation for link travel times. A number of reformulations are proposed to establish linear inequalities that can be easily dualized by a Lagrangian relaxation approach for the vehicle routing problem.

2 - Two-stage Adaptive Reliable Routing Algorithm with Embedded Travel Time Prediction Engine

Lixing Yang, State Key Laboratory of Rail Traffic Control and Safety, Beijing Jiaotong University, Beijing, China, lxyang.utah@gmail.com, Tao Xing

On-line adaptive route guidance has been an emerging research problem in last decade. This study proposes a two-stage adaptive reliable routing algorithm based on travel time prediction and its uncertainty. With various prediction uncertainty sources been considered, in this research we develop a Lagrangian relaxation based routing algorithm to measure the real-time path travel time reliability under time-dependent and stochastic traffic conditions.

3 - Joint Inventory-location Problem under the Risk of Probabilistic Facility Disruptions

Qi Chen, Tsinghua University, Department of Automation, Beijing, China, george.c1988@gmail.com, Xiaopeng Li, Yanfeng Ouyang

This paper proposes a reliable joint inventory-location problem that optimizes facility locations, customer (re-)allocations, and inventory management decisions when facilities are subject to disruption risks (e.g., due to natural or man-made hazards). We propose an integer programming model and a Lagrangian relaxation algorithm to solve this problem. Experiments are conducted to draw managerial insights.

4 - Capacitated Dynamic Multi-type Facility Location Problem with Co-Location Benefits

Weijun Xie, University of Illinois Urbana-Champaign, Department of Civil and Enviromental Engineeri, Urbana, IL, 61801, United States of America, wxie4@illinois.edu, Yanfeng Ouyang

This talk presents a mixed-integer programming model for a multi-type facility location problem with capacity expansion over a multi-period horizon. This problem is motivated by the emerging biofuel industry. Each type of facility requires a different type of raw material to produce the same final product. In addition, co-location of different types of facilities results in cost-saving benefits. An algorithm based on accelerated Benders decomposition is proposed to solve this problem.

■ WA49

H - Graves Room - 3rd Floor

Military Applications of Simulation

Sponsor: Simulation

Sponsored Session

Chair: Ray Hill, Professor, AFIT/ENS, 2950 Hobson Way, Bldg 641 Suite 201, WPAFB, OH, 45433, United States of America, Raymond.Hill@afit.edu

1 - Tanker Aircraft Consolidation versus Air Task Order Resiliency

Alan Johnson, Associate Professor, Air Force Institute of Technology, Department of Operational Sciences, Wright-Patterson AFB, OH, United States of America, Alan.Johnson@afit.edu, Scott Linck

The new Air Force tanker aircraft will have the ability to receive fuel from other tankers while airborne, a practice called fuel consolidation. Rising fuel costs suggest that future planners may use fuel consolidation to reduce the number of tanker sorties needed for a given Air Tasking Order. We simulate an ATO under different tanker employment scenarios to investigate effects to air campaign resiliency.

2 - Model Theory and Modeling and Simulation

Andreas Tolk, Professor, Old Dominion University, 241 Kaufman Hall, 23529, Norfolk, VA, 23529, United States of America, atolk@odu.edu, Saikou Diallo, Jose Padilla

Model theory is a subset of mathematics that focuses on the study of formal languages and their interpretations. Using model theory to define terms like model, simulation, data, and interoperability not only results in formal, unambiguous expressions, but also allows the application of model theoretic insights. We show that the current practice training federations contradicts our findings, in particular when integrating Human, Social, Cultural, and Behavioral models.

3 - Executable Architecture Systems Engineering (EASE), A New Vision for M&S

Henry Marshall, S&T Manager, US Army Research Laboratory Simulation & Training Technology Center, RDRL-HRT-M, 12423 Research Parkway, Orlando, FL, 32826, United States of America, henry.a.marshall@us.army.mil, Chris Gaughan, Scott Gallant

This paper will describe our solutions for systems engineering and automating a distributed Modeling & Simulation (M&S) implementation to create an Executable Architecture Systems Engineering (EASE) for M&S. We'll demonstrate how we capture high level system requirements and their linkage to low level model specifications. We'll show how we capture metadata about the models, scenarios and execution environment and ultimately how we deploy and execute the specified models using virtual machines.

■ WA50

H - Ardrey Room - 3rd Floor

Inventory and Forecasting Behavior

Sponsor: Behavioral Operations Management

Sponsored Session

Chair: Brent Moritz, Assistant Professor, Pennsylvania State University, 469 Business Building, University Park, PA, 16802, United States of America, bmoritz@psu.edu

1 - How to Compete Against a Newsvendor

Anton Ovchinnikov, Assistant Professor, University of Virginia, 100 Darden Blvd, Charlottesville, VA, 22903, United States of America, AOvchinnikov@darden.virginia.edu, Brent Moritz, Elena Katok, Bernardo F. Quiroga

In this work we study the behavioral aspects of newsvendor competition. In particular, a well known behavioral result for the monopolistic newsvendor problem is that the subjects' orders are biased toward the middle of the demand range. Does a similar bias propagate in a competitive environment? And if it does, then how can a knowledgeable newsvendor capitalize on such a bias of his or her competitor? We address these questions through a combination of theoretical results and lab experiments.

2 - The Behavioral Benefits and Pitfalls of Top-down and Bottom-up Forecasting Processes

Enno Siemsen, Assistant Professor, University Minnesota, Carlson School, Minneapolis, MN, United States of America, siems017@umn.edu, Doug Thomas, Mirko Kremer

Organizations need forecasts at multiple levels of aggregation to support operational decisions. A firm can choose to generate forecasts at the lowest level needed and sum them up to create aggregate forecasts. Alternatively, a firm can forecast the aggregate data series directly and then apportion to create lower-level forecasts. We examine whether either approach has advantages from a behavioral perspective if forecasts are made based on human judgment.

3 - Asymmetric Ordering Behavior in Newsvendor Inventory Decisions

Brent Moritz, Assistant Professor, Pennsylvania State University, 469 Business Building, University Park, PA, 16802, United States of America, bmoritz@psu.edu, Arthur V. Hill, Karen Donohue

Prior research has shown that individuals making newsvendor inventory decisions exhibit an asymmetric "pull to center" effect relative to mean demand. This research posits that cognitive dissonance surrounding customer service expectations is a cause of this anomaly, as individuals act to mitigate dissonance even when this results in lower compensation. We test this proposition in a behavioral experiment, including a manipulation of the asymmetric ordering pattern.

■ WA51

H - Caldwell Room - 3rd Floor

Building Evacuation and Crowd Management

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Douglas Bish, Assistant Professor, Virginia Tech, Department of ISE, 250 Durham Hall, Blacksburg, VA, 24061-0118, United States of America, drb1@vt.edu

1 - Optimizing the Control Delay in High-rising Building Evacuation Plan

Jeongin Koo, POSTECH, San 31 Hyoja, Pohang, Korea, Republic of, xession@postech.ac.kr, Byung-In Kim, Yong Seog Kim

We take an agent-based simulation approach to develop optimal evacuation plans in a high-rising building considering people with disabilities, social dynamics among people, and the structural characteristics of the building. We use the information of congested floors and stair areas to determine the control delay that regulates the start of evacuation for all the people on different floors and people with various disabilities.

2 - Prioritizing Strategies for Healthcare Facility Evacuations

Kevin Taaffe, Associate Professor, Clemson University, 130-A Freeman Hall, Clemson, SC, 29642, United States of America, taaffe@clemson.edu, Ashley Childers, Maria Mayorga

There is a lack of consensus about whether critical care or non-critical care patients should be transferred away from a healthcare facility first during an emergency evacuation. In this research, we formulate a dynamic programming model and discuss insights of the resulting patient prioritization strategies. We show that a greedy policy is not always optimal. We also compare the performance of several policy options through simulation analysis.

3 - Optimization-based Models for Hospital Evacuation Planning

Douglas Bish, Assistant Professor, Virginia Tech, Department of ISE, 250 Durham Hall, Blacksburg, VA, 24061-0118, United States of America, drb1@vt.edu, Roger Glick, Esra Agca

A hospital evacuation is a logistically complex process. To assist emergency planners in planning for and managing hospital evacuations, we study optimization-based planning models that minimizes the expected risk (from both the threat prompting the evacuation and the movement of patients), given limited resources and patients that have varying medical-logistical requirements. Results are illustrated using a realistic case study.

■ WA52

H - North Carolina - 3rd Floor

Facility Logistics V

Sponsor: Transportation Science and Logistics/Facility Logistics

Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin-Madison, 1513 University Avenue, Madison, WI, United States of America, ananth@engr.wisc.edu

1 - Improving the Revenue of Self-storage Warehouses by Optimizing Storage Scheduling Decision

Yeming Gong, Assistant Professor, EM Lyon Business School, 12 Rue Dunoir, Lyon, France, gong@em-lyon.com

A self-storage warehouse manager has to decide which storage requests to accept and schedule them to maximize the revenue. We model warehouse operations as scheduling n independent multiprocessor tasks. We identify 5 cases for basic operations and show that two polynomial algorithms can solve the basic problem optimally for all cases. We further consider more complex problems with upgrading operations, and employ column generation algorithm to solve the problem.

2 - Investigating Slotting Strategies for Physical Internet Stores

Benoit Montreuil, Laval University, CIRRELT Research Center, 2325, rue de la Terrasse, Quebec, Canada, benoit.montreuil@cirrelt.ulaval.ca, Stefan Oldewarris, H. Ronald Mantel

This paper explores alternatives for slotting inbound containers in storage centers in a Physical Internet (www.physicalinternetinitiative.org). It provides a slotting conceptual framework suited for this context and describes the alternatives and their differences. It then analyzes exploratory simulation based empirical results showing the open duration-of-stay target strategy to be best in throughput and space performance for the studied cases.

3 - How to Pick a Picking System: Standardized Order Picking Modules for Criteria-based Warehouse Design

Tim Geissen, Fraunhofer IML, Joseph-von-Fraunhofer Str. 2-4, Dortmund, 44227, Germany, tim.geissen@iml.fraunhofer.de, Michael ten Hompel, Detlef Spee

Order picking systems differ in their organizational and technical configuration in order to meet specific performance and quality requirements. By analyzing existing types of implementation, similar concepts and general design principles can be identified. The paper describes standardized order picking modules, common fields of application, and relevant selection criteria to support a systematical and transparent design process with a top-down approach.

■ WA53

H - South Carolina - 3rd Floor

Data Mining

Sponsor: Data Mining

Sponsored Session

Chair: Juheng Zhang, University of Florida, 306 Diamond Village Apt. 10, Gainesville, FL, 32603, United States of America, Juheng@ufl.edu

1 - Linear Discrimination with Strategic Missing Values

Juheng Zhang, University of Florida, 306 Diamond Village Apt 10, Gainesville, FL, 32603, United States of America, Juheng@ufl.edu, Gary J. Koehler, Haldun Aytug

We study a data mining problem where data may be strategically hidden from a decision maker. Anticipating such strategic hidden data, the decision maker finds a set of default vectors to substitute missing values, so that observations will be classified correctly and also hidden information can be induced to publish.

2 - A Universal Correlation Coefficient

Xuan Huang, Assistant Professor, University of Alabama at Birmingham, 400 Birchall ln. Apt 203, Hoover, AL, 35226, United States of America, xuanh@uab.edu, Nuo Xu

A universal correlation coefficient is developed based on the deviation of the average first difference on the ranked data from its expected value. Such an index can detect degree of randomness irrespective of form of dependency and provides as a commensurate correlation coefficient among pairs of variables. A comparative study on a simulated dataset is presented to show its generality over other correlation coefficients.

3 - The Parameters Effects on Performance in Artificial Neural Network for Diabetes Diagnosis

Youqin Pan, Salem State University, 352 Lafayette Street, Salem, MA, 01970, United States of America, ypan@salemstate.edu, Saverio Manago

In this study, the parameters of ANNs were varied to determine the effects on system performance. The results indicate that the training algorithms significantly affect the effectiveness of ANNS. Neural networks with one-hidden layer outperform multilayer neural networks (MLNNs). Too many neurons of MLNNs may reduce the classification rate. Further, the interaction effects between the training algorithms and the structures of ANNs were shown to be significant.

4 - Practitioners Guide to Predictive Model Evaluation

Sam Koslowsky, VP: Modeling Solutions, Harte Hanks, 55 Fifth Avenue, NY, NY, 10003, United States of America, samkos@aol.com

Decision makers have not paid sufficient attention to model evaluation.Analysts need to ask "What performance criteria were used in model selection."Some believe that a model decile report provides all that is necessary in selecting among all the models that have been developed.The emphasis is on whether there are more HAVES on top, and fewer on the bottom." This is important,but there are additional critical dimensions that need to be considered.This paper will address these key issues.

■ WA54

H - Charlotte Hall - 3rd Floor

Sustainable and Reduced-Cost Energy Systems Through Optimization

Sponsor: Junior Faculty Interest Group (JFIG)

Sponsored Session

Chair: Esra Buyuktahtakin, Assistant Professor, IME Department, Wichita State University, Wichita, KS, United States of America, esra.b@wichita.edu

1 - Energy Efficient Operations Scheduling with System Reliability

Farnaz Ghazi Nezami, PhD Student, Wichita State University, 1845 N Fairmount, Wichita, KS, 67260-0035, United States of America, Farnaz.GhaziNezami@wichita.edu, Farnaz Ghazi Nezami, Pingfeng Wang

Significant savings in energy consumption can be achieved when manufacturing equipment is turned off if not in use. However, this approach may have some negative impacts on the machine life and reliability. In this talk, we present a framework to minimize energy consumption under reliability constraints.

2 - Electricity Generation Expansion Planning Considering Smart Grid Technologies as Investment Options

Hatice Tekiner-Mogulkoc, Assist. Professor, Istanbul Sehir University, Industrial Engineering, College of Engineering and Natural Sci, Istanbul, 34662, Turkey, haticetekiner@sehir.edu.tr, David Coit, Frank A. Felder

Generation expansion planning (GEP) problems are solved to determine the time, location and type of the new generations units to be installed in the power system.There are also new technological developments called "Smart Grid" technologies which can be used within the power grid.We propose models to incorporate Smart Grid technologies into the GEP problem to determine their optimal implementation planning and to observe their impact on the other expansion and dispatching decisions.

3 - Reserve Zone Partitioning

Joshua Lyon, Graduate Student, Arizona State University, P.O. Box 878809, Tempe, United States of America, Joshua.Lyon@asu.edu, Kory Hedman, Muhong Zhang

In the power grid, reserve levels and reserve zones are integral to maintain reliability. The current methods to determine reserve zones are limited. In this work, we propose a formulation that embeds zone partitioning and reserve requirements into the unit commitment problem. The approach progresses on current reserve zone practices while avoiding much of the computational burden associated with stochastic unit commitment.

■ WA55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS: Descriptive Analytics

Sponsor: Analytics/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Manoj Chari, Sr. Director, OR R&D, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Manoj.Chari@sas.com

1 - Descriptive Analytics and OR

Irv Lustig, Business Unit Executive, Optimization and Supply Chain Client Technical Professionals Leader, IBM, 25 Sylvan Way, Short Hills, NJ, 07078, United States of America, irv@us.ibm.com

We will give a short introduction to descriptive analytics, and describe some relationships to work that operations research practitioners do on a regular basis. If you analyze and visualize data, you're doing descriptive analytics, whether you know it or not!

2 - Unlocking the Hidden Value in Your Data with Analytics

Tonya Balan, Senior Manager, Analytical Product Management, SAS Institute, Cary, NC, United States of America, Tonya.Balan@sas.com

Organizations today are overwhelmed with data – transactional data, demographic data, data from social media and web sources, and more. It is critical to understand how the information locked in that data can be leveraged to drive actionable decisions for the business. Analytics is the key that can unlock that hidden value. This presentation provides an overview of analytical methods with a focus on applications of those methods to solve specific business problems.

3 - Descriptive Analytics via a CFO Dashboard

Morris Treadway, Vice President-NA BIPM Leader, IBM, Yorktown Heights, NY, United States of America, morris.treadway@us.ibm.com

Descriptive analytics will be illustrated via the CFO Dashboard. It leverages a company's data sources to report on actual, plan, and forecast finance KPIs in an executive dashboard format. The package includes detailed drill down reporting capability based on the key metrics, encompassing a value driver tree to better diagnose problem areas. It provides an ability to generate insight from data sets, helping track organization performance and adjust forecast KPIs through "what if" analysis.

■ WA56

H - Biltmore Boardroom - 2nd Floor

Patient Flow

Contributed Session

Chair: Douglas Fuller, Principal Consultant, Priority Perspective, 132 Feather Falls Circle, Suite B, Folsom, CA, 95630, United States of America, doug.fuller@priorityperspective.com

1 - Determining Patient Flow and Resource Utilization

Monica Puertas, University of South Florida, 4202 East Fowler Avenue, Tampa, United States of America, mpuertas@mail.usf.edu, Bo Zeng, José L. Zayas-Castro, Peter Fabri, Courtney Feliciani, Serkan Gunpinar

The care of patients with multiple injuries demands a large amount of time and the majority requires total care over multiple stages. Such a complex situation requires: a decision support tool to design a well-planned treatment path achieving the goal of safety, quality and progression; and sufficient and well-managed resources. The purpose of this work is to apply healthcare systems engineering methods to improve the delivery of care, leading to a team-based care delivery frame.

2 - Modeling Patient Flow in a Cardiac Intensive Care Unit (CICU)

Yazan Roumani, University of Pittsburgh, 233 Mervis Hall, Pittsburgh, PA, 15260, United States of America, yfr1@pitt.edu, Luis Vargas

Intensive Care Units (ICUs) operate at a high level of occupancy and this leads to longer waiting times in the upstream units and lower patient throughput. Studying patient flow can help in identifying sources of congestion and therefore in improving patient throughput. We build a queueing network model of patient flow in a Cardiac Intensive Care Unit (CICU) using discrete event simulation. We also validate our model using real patient flow data that was collected over four years.

3 - Scope in/Scope Out: The Use of Simulation in Patient Flow Redesign

Douglas Fuller, Principal Consultant, Priority Perspective, 132 Feather Falls Circle, Suite B, Folsom, CA, 95630, United States of America, doug.fuller@priorityperspective.com, Anne Fuller

The Endoscopy department at Barnes Jewish Hospital felt that they had the opportunity to significantly increase their volume if they expanded their capacity for procedures. As a prerequisite, the CFO required that an analysis of the current patient flow be conducted to see if capacity to be gained from a redesign. This study examines the use of simulation in the project. It focuses on the challenges of acceptance of the tool by the clinic staff as well as the surprising results of the study.

■ WA57

W - Providence I- Lobby Level

Modified Trajectory Impacts

Sponsor: Aviation Applications

Sponsored Session

Chair: Marc Rose, Senior OR Analyst, MCR, LLC, 425 3rd Street, SW, Suite 700, Washington, DC, 20021, United States of America, mrose@mcri.com

1 - Rushing to Wait; Slowing Down to Save

Marc Rose, Senior OR Analyst, MCR, LLC, 425 3rd Street, SW, Suite 700, Washington, DC, 20021, United States of America, mrose@mcri.com, Dave Knorr, John Gulding

In absorbing terminal delay many flights are forced to take longer routes, level off at various altitudes, have circular holding, etc. Earlier an estimate of the pool of these delays was provided (elimination of level-offs and circuitous routing). In this segment we will present the possibility of moving a portion of this excess terminal time to the cruise phase of flight, saving fuel by slower speeds. Minimum cruise times and look ahead were examined parametrically.

2 - Estimating ATM Efficiency Pools in the Descent Phase of Flight

John Gulding, FAA, 600 Indpendence Avenue, Washington, DC, United States of America, John.Gulding@faa.gov

This paper focuses on a methodology for estimating the total benefit pools that ATM can potentially influence. This paper explores the benefits of reducing speed in cruise to absorb delays currently managed in the terminal area. Our findings estimate the unimpeded benefit pool in the terminal area averages 3 minutes for the top 34 airports in both US and Europe, or approximately 120 Kg. per flight.

3 - Importance Assignment of Metric Components

Marc Rose, Senior OR Analyst, MCR, LLC, 425 3rd Street, SW, Suite 700, Washington, DC, 20021, United States of America, mrose@mcri.com

A discussion of different methods of assigning importance to metrics composed of multiple sub-group. For example system level average delay/flight can be broken down by airport, carrier, etc. For data analysis it can be vital to understand the drivers by these sub-groups. I will provide a couple of methods, each of which have strengths and weakness. My hope is to provide food for group discussion.

■ WA58

W - Providence II - Lobby Level

Joint Session MAS/DAS: Military Decision Analysis

Sponsor: Military Applications Society/ Decision Analysis

Sponsored Session

Chair: Gregory Parnell, Distinguished Visiting Professor, United States Air Force Academy, Department of Management, 2354 Fairchild Drive, Suite 6H130, USAF Academy, CO, 80840, United States of America, greg.parnell@gmail.com

1 - Measurement for National Security Analysis: Theory, Best Practices and an Illustrative Example

Gregory Parnell, Distinguished Visiting Professor, United States Air Force Academy, Department of Management, 2354 Fairchild Drive, Suite 6H130, USAF Academy, CO, 80840, United States of America, greg.parnell@gmail.com

The presentation will review the use of measures in national security analysis drawing on insights from several disciplines. I will proposed a systems thinking framework for measure development and illustrate the concepts using a study on Metrics for Cooperative Threat Reduction.

2 - Interdiction Analysis of a Thinking Enemy
Lee Ewing, Research Associate Professor of Operations Research, Naval Postgraduate School, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, plewing@nps.edu

We developed a model to assist various agencies and units in requests for analysis related to disruption of fighter-flow across border areas to specific destinations in both Iraq and Afghanistan. The infiltrator determines a path-selection strategy that minimizes the interdiction probability while the interdictor determines a checkpoint assignment that maximizes the infiltrator's overall detection probability.

3 - Survey of Value-focused Thinking: Applications, Research Developments, and Areas for Future Research
Dave Hughes, Department of Systems Engineering, Mahan Hall, Bldg 752, West Point, NY, 10996, United States of America, David.Hughes@usma.edu

We wrote this paper to identify significant developments, themes, and streams of research in the area of value-focused thinking (VFT). We searched key operations research and decision analysis journals as well as Google Scholar to find relevant articles that reference Keeney's 1992 book, Value-Focused Thinking: A Path to Creative Decisionmaking. This review is comprehensive, unbiased, and focuses on articles written after Keeney's book was published through the end of 2010.

■ WA59

W - Providence III - Lobby Level

IT Service Outsourcing

Sponsor: Service Science

Sponsored Session

Chair: William Rand, University of Maryland, College Park, MD, wrand@umd.edu

1 - On Dynamic Resource Allocation in IT Outsourcing Projects
William Rand, wrand@umd.edu, Anand Gopal, Balaji Koka

Within the context of IT outsourcing, we focus on the interaction between managers, their portfolio of projects, and the strategic type of the firm they operate within, and argue that some project are better suited for certain combinations of these elements than others. We assume that different strategic types affect project size variance, and that these types also affect how firms deal with interruptions and how they prioritize projects. We use an agent-based model to explore this interaction.

2 - Design and Analysis of a Two-Stage Service Outsourcing Process
Walter Yund, yundw@rpi.edu, Jennifer Ryan, Yue Jin

We study two-stage outsourcing processes commonly used in process outsourcing, in which vendors are qualified in the first stage and compete in the second stage. We present a model of this process and gather insights that will enable procurement managers to understand interactions between the stages of the procurement process.

3 - External Technology Supply and Client-side Innovation
Christian Peukert, Ludwig-Maximilians-University Munich, Schackstr. 4, München, Germany, c.peukert@lmu.de

We employ a stylized theoretical model to derive hypotheses for the empirical analysis of the role of IT outsourcing in product and process innovation. Estimation results based on German firm-level data suggest that IT outsourcing has positive effects on both types of innovation. For product innovation we find a hump-shape.

4 - Implementing the Revised FMEA in Service Outsourcing Quality Analysis
Ya-Hui Chan, Chung Hua University, 707, Sec.2, WuFu Rd., Hsinchu, Taiwan, Hsinchu, Taiwan - ROC, silvia_219@yahoo.com.tw, Shu-Ping Lin

Service outsourcing is a rapidly growing phenomenon in global business. As services attached with greater uncertainties, the risk management of the potential service failure modes will need more attention. Accordingly, this study aims at proposing a risk analysis approach based on FMEA for service outsourcing quality monitor and control.

■ WA60

W - College Room - 2nd Floor

Joint Session OPT-LP/OPT-IP: New Relaxations of Binary Quadratic and Multi-Objective Integer Programs

Sponsor: Optimization – Linear Programming and Complementarity/Optimization – Integer Programming

Sponsored Session

Chair: Alexander Engau, Assistant Professor, University of Colorado Denver, 1250 14th Street Suite 600, Campus Box 170, P.O. Box 173364, Denver, CO, 80217-3364, United States of America, alexander.engau@ucdenver.edu

1 - Semi-definite Relaxation of Quadratic Assignment Problems based on Nonredundant Matrix Splitting
Tao Zhu, U of Illinois at Urbana-Champaign, Department of Industrial and Enterprise, Urbana, IL, 61801, United States of America, taozhu1@illinois.edu, Hezhi Luo, Jiming Peng

Recently, a new class of semi-definite relaxations for QAPs based on matrix splitting has been shown to be strong yet cheap to compute. In this work, we consider the issue of how to choose a matrix splitting scheme so that the resulting relaxation can provide strong bounds.

2 - Nonconvex Quadratic Reformulation and Second Order Sufficient Global Optimality Condition for Binar
Ye Tian, North Carolina State University, 443 Daniels Hall, I.S.E., NCSU, Raleigh, NC, 27695, United States of America, ytian4@ncsu.edu

In this talk, we will present a mixed integer constrained quadratic programming problem. By reformulating the problem to a box constrained quadratic programming and solving the reformulated problem, we can obtain a global optimal solution of a sub-class of the original problem. Moreover we propose a solvability condition for the reformulated problem, and discuss methods to construct a solvable reformulation for the original problem.

3 - Two Phased Approximation Algorithm for Multi Objective Integer Problems
Ozgu Turgut, Graduate Research Assistant, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States of America, ozgu.turgut@gmail.com, Alper Murat

In this study, generating representative sets for multi objective integer programming problem is considered. The proposed algorithm has two phases. In second phase, a modified version of branch and bound technique is applied to the solutions obtained by solving the relaxed problem with a certain scalarization. Outputs of the first phase are used to fathom the branches. Comparative results will be presented.

4 - Quadratic Relaxations of Binary Integer Programs in Computational Biology
Alexander Engau, Assistant Professor, University of Colorado Denver, 1250 14th Street Suite 600, Campus Box 170, P.O. Box 173364, Denver, CO, 80217-3364, United States of America, alexander.engau@ucdenver.edu

We present several recent integer programming models in molecular biology and discuss practical reformulations and relaxation approaches to compute solutions to some of these problems. Truly large in scale, techniques are taken from interior-point, bundle, and Lagrangean methods for semidefinite relaxations and heuristic approaches for the original integer programs.

■ WA61

W - Sharon Room - 2nd Floor

Traffic Planning

Contributed Session

Chair: Wenxin Qiao, University of Maryland - College Park, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, wxqiao@umd.edu

1 - Trip Maximization: A New Objective Function for Traffic Signal Timing Optimization Problem

Ali Hajbabaie, Graduate Research Assitant, University Of Illinois at Urbana Champaign, 205 N mathwes Avenue, room 3150, Urbana, IL, 61801, United States of America, ahajbab2@illinois.edu, Rahim Benekohal

In traffic signal timing optimization problem, delay minimization and throughput maximization have been widely used. In this study, we introduce a new objective function: maximizing the number of trips completed in the network. The advantages of this objective function over the others are discussed. In addition, near-optimal signal timing parameters associated with these three objective functions are found in a case study network where network performance measures are determined and compared.

2 - Long-Term Incident Response Vehicle Dispatching Policy under Probabilistic Environment

Cem Iyigun, Assistant Professor, Middle East Technical University, Inonu Blvd., Ankara, 06800, Turkey, iyigun@ie.metu.edu.tr, Kaan Ozbay

This study proposes a long-term incident response vehicle dispatching policy in a probabilistic environment. The uncertainty in incident occurrence rate, travel time, response vehicle availability, and response vehicle requirements are included in the vehicle dispatching problem using stochastic programming approach. Concepts such as level of service, reliability, and road network performance are introduced to the stochastic incident response problem via probabilistic constraints.

3 - Short Term Travel Time Prediction Considering Weather Impact

Wenxin Qiao, University of Maryland - College Park, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, wxqiao@umd.edu, Ali Haghani, Masoud Hamedi

Reliable travel time prediction enables both user and system controller to be well informed of the future conditions on roadways, so that pre-trip plans and traffic control strategies can be made accordingly. This research focuses on short-term travel time prediction for freeways using real-time traffic and weather data sources. The integrated model incorporates various weather parameters in the prediction process with special consideration to inclement weather conditions.

■ WA62

W - Independence Room - 2nd Floor

Issues in the Energy Grid

Contributed Session

Chair: G N Srinivasa Prasanna, International Institute of Information Technology, Electronics City, Hosur Road, Bangalore, India, 560100, India, gnsprasanna@iiitb.ac.in

1 - Bayesian Techniques for U.S. Electricity Grid Monitoring

Robert Love, Associate, Booz Allen Hamilton, 22 Batterymarch Street, Boston, MA, 02109, United States of America, love_robert@bah.com

The current U.S. Electricity Grid operates under capacity constraints that result in distribution chokepoints, shortages, and blackouts, costing consumers billions of dollars. Prevailing mathematical methods for assessing these inefficiencies are regression based, and limited in their ability to assess peak load conditions. Models that leverage Bayesian inference are proposed as a way to assess and enable proactive mitigation strategies that reduce peak load through demand response.

2 - Integration of Operational and Strategic Decisions for Power-intensive Processes in the Smart Grid

Sumit Mitra, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sumitm@andrew.cmu.edu, Ignacio Grossmann, Jose M. Pinto, Nikhil Arora

In presence of fluctuating electricity prices, the smart grid provides optimization opportunities for power-intensive processes. We present a framework that integrates operational and strategic decision-making. The strategic decisions involve capacity expansions and equipment upgrades that potentially facilitate cost savings on the operational level. We show the efficiency of our optimization model for power-intensive processes such as air separation and cement plants based on industrial data.

3 - Nash Equilibrium Model for Micro-storage Management in the Smart Grid

Pando Georgiev, University of Florida, Gainesville, FL, United States of America, pandogeorgiev@ufl.edu, Alexey Sorokin, Marco Carvalho, Panos Pardalos

We propose a game theoretic approach for electricity market participants with storage devices by formulating a Nash equilibrium problem and proposing extensions for generalized Nash equilibrium. While the theory of the generalized Nash equilibrium is well developed, its computation is a challenge. In the simplest case, our model presents a Nash equilibrium problem with quadratic cost functions. It is attacked with several methods recently developed.

4 - Storage Operation and Investments in an Electrical System

Santhosh Suresh, PhD Student, Ross School of Business, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, sssandy@umich.edu, Roman Kapuscinski, Owen Wu

Storage technology is becoming increasingly prevalent in today's electric grid. We discuss the optimal siting and sizing of storage units in a distribution network. The objective is to minimize overall operating costs accounting for transmission and storage losses. We show the degree of storage pooling to be related structurally with: the efficiency of storage and transmission, variance, correlation and mean in the demand distribution.

5 - Smart Grid: Optimization Methods for Demand Response Systems

G N Srinivasa Prasanna, International Institute of Information Technology, Electronics City, Hosur Road, Bangalore, India, 560100, India, gnsprasanna@iiitb.ac.in, Sunil Vuppala

In this presentation, we discuss optimization algorithms, for real time control of smart electric grid systems. Fine grain grid power flow measurements, yield sufficient state observability for individual appliance level control. We present analytical and simulation results on a optimizing demand response system evaluated on cost, fairness, and ability to handle demand uncertainty.

■ WA63

W - Tryon North - 2nd Floor

Advances in Preference Modeling for MCDM

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Gilberto Montibeller, Lecturer, Decision Sciences, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, G.Montibeller@lse.ac.uk

1 - Modeling Dynamic Preferences of Malicious Agents

Sumitra Sribhashyam, LSE, Management Science Group, Houghton Street, London, WC2A 2AE, United Kingdom, S.Sribhashyam@lse.ac.uk, Gilberto Montibeller

Traditional decision analysis assumes the availability of a decision maker to model preferences, but if one wants to infer those of inaccessible agents, such as terrorists, it is necessary to explore how preferences evolve over time. Using multi-attribute utility theory we suggest modeling dynamic preferences of a malicious agent by incorporating state dependent weights to account for preference change caused by exogenous triggers. We explore its use in the context of counter-terrorism analysis.

2 - A Diagnostics Tool for Assessing Decision Making Effectiveness

K. Nadia Papamichail, Senior Lecturer in Information and Decision Systems, Manchester Business School, Booth Street East, Manchester, M15 6PB, United Kingdom, nadia.papamichail@mbs.ac.uk

This paper presents a framework and an analytical diagnostics tool for assessing decision making performance in projects. The tool is an intelligent decision-making support system that combines the analytical capabilities of multiple criteria decision analysis with the reasoning functionalities of artificial intelligence techniques. It is intended to periodically review decision making effectiveness and communicate its results in natural language form.

3 - Representing Equitable Preferences

Alec Morton, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, A.Morton@lse.ac.uk, Nikos Argyris, Ozlem Karsu

Decision makers often have preferences for equity in distribution. From a modelling point of view this can be handled by imposing person anonymity and quasiconcavity conditions on the model of the DM's preferences. In this talk, we study how equity considerations can be introduced into multicriteria models, and show how to incorporate information which the DM may have given us (for example that she prefers one distribution to another) in the preference model.

4 - Modeling Preferences under Deep Uncertainty
Gilberto Montibeller, Lecturer, Decision Sciences, London School of Economics, Houghton Street, London, WC2A 2AE, United Kingdom, G.Montibeller@lse.ac.uk, Camelia Ram

Decisions under deep uncertainty, when a mutually-exclusive and exhaustive set of outcomes for the decision alternatives cannot be defined, pose a challenge to decision analysts. In this talk we argue that scenario planning might be a useful way of analyzing strategic options and suggest that preferences are scenario-dependent. We review ways of evaluating options under multiple scenarios and conflicting objectives, suggesting some extensions which are illustrated in real-world applications.

■ WA64

W - Queens Room - 2nd Floor

Joint Session SPPSN/LAW: Problems in Real-World OR

Sponsor: Public Programs, Service and Needs/Law, Law Enforcement and Public Policy

Sponsored Session

Chair: John Hall, Division Director—Fire Analysis, NFPA, 1 Batterymarch Park, Quincy, MA, 021697471, United States of America, jhall@nfpa.org

1 - Trade-offs That Should be Made Explicitly but Aren't
John Hall, Division Director—Fire Analysis, NFPA, 1 Batterymarch Park, Quincy, MA, 021697471, United States of America, jhall@nfpa.org

In public sector OR, effectiveness often depends on multiple aspects, e.g., performance vs. reliability or effectiveness vs. universality. Even a good program won't yield good outcomes if no one has access or implementation often goes off track. However, program analysis often focuses on base performance as if other aspects don't matter or are assured. This paper will discuss how to make such trade-offs more explicit and better.

2 - The Math Works, The Reality Doesn't - Tales of Woe from Unrealistic Modeling
John Hollywood, Operations Researcher, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States of America, johnsh@rand.org

We consider possible consequences when the modeler does not know (or care) enough about the application area to develop a sufficiently realistic model. Examples are drawn from law enforcement, homeland security, and defense. We also consider some possible incentives to improve modeling realism, and how the Analytics initiative might contribute.

3 - The Editor, AIDS, and Columbine: Deciding When to Decide
Doug Samuelson, President, InfoLogix, Inc., 8711 Chippendale Court, Annandale, VA, 22003, United States of America, samuelsondoug@yahoo.com

The most insidious and powerful source of bias in scientific studies and more general reporting is the process by which we decide what to study. The second worst culprit is the process by which we decide when we have enough information to make a decision, balancing sensitivity (react when appropriate) versus specificity (not reacting when reacting is inappropriate.) Real-life policy-related examples include the responses to the Columbine shootings, AIDS screening, and the invasion of Iraq.

4 - When the Client is Biased, Delusional or Unethical
John Hall, Division Director—Fire Analysis, NFPA, 1 Batterymarch Park, Quincy, MA, 021697471, United States of America, jhall@nfpa.org

"Ethics" in a profession are not like "ethics" anywhere else. A lawyer can mislead or deceive in an adversarial position, but should an OR analyst do the same in a non-adversarial process, even if the client demands it? In public sector OR, there is the added complication of reflexively pro-management or anti-government OR professionals injecting biases and myths that they and the client share. No answers but discussion of issues.

■ WA65

W - Kings Room - 2nd Floor

Operations and Supply Chains

Contributed Session

Chair: Xuili He, Assistant Professor, UNC-Charlotte, 9201 University City Blvd, BISOM Department, Charlotte, NC, 28269, United States of America, xhe8@uncc.edu

1 - Coordinating a Two Stage Supply Chain with Option for Outsourcing Decisions in Insufficient Capacity
Changhyun Kim, Doctorate Student, Drexel University, 101 N 33rd Street, Room #229, Department of Decision Sciences, Philadelphia, 19104, United States of America, changhyun.kim@drexel.edu

This paper illustrates the individual decision making and the coordinated policy in a supply chain that consists of lost sales cases through supply chain integration. In this paper, an individual decision making model for overcome the shortage, and a coordinated model with considering capacity levels and quality have been derived and compared. A numerical example demonstrates the effectiveness of the model for the outsourcing decisions and the revenue sharing of the channel.

2 - Improve the Intangible Service Quality and Revenue in Decentralized Service Chain
Shiming Deng, Professor, Huazhong University of Science and Technology, 1037 Luo Yu Rd, Wuhan, 430074, China, smdeng@mail.hust.edu.cn

The decentralized service chains we consider consist of an brand service provider and a local store. The service provider receives orders from Internet and relies on local store to deliver the service. The intangible nature of service quality make it a core issue for the service provider to motivate the local store to keep a high service quality. We study how brand service provider can use customer satisfaction to improve service quality without expanding their promotion footprint.

3 - Channel Decision and Service-Product Bundling Strategy under Sequential Entry
Xuili He, Assistant Professor, UNC-Charlotte, 9201 University City Blvd, BISOM Department, Charlotte, NC, 28269, United States of America, xhe8@uncc.edu, Shu Zhou

A manufacturer produces and sells a product to an incumbent service provider (ISP) who sells the bundle of the product and services to the end consumers. A potential entrant service provider (ESP) offers a bundle of competitive service and product. We study the manufacturer's channel decisions of whether to sell through the ESP. We also study the completive pricing and bundling strategies of ISP and ESP.

■ WA66

W - Park Room - 2nd Floor

Analytics Tools for Logistics I

Contributed Session

Chair: Saurabh Chandra, Indian Institute of Management Lucknow, Prabandh Nagar, Off Sitapur Road, Lucknow, 226013, India, saurabh.c.pathak@iiml.org

1 - A Container Yard Storage Strategy for Improving Land Utilization in a Transshipment Hub Port
Xinjia Jiang, National University of Singapore, 10 Kent Ridge Crescent, Industrial and Systems Engineering, Singapore, 119260, Singapore, xinjia@nus.edu.sg, Kok-Choon Tan, Loo Hay Lee, Ek Peng Chew

This paper studies the storage yard management problem in a busy transshipment hub, where intense loading and unloading activities have to be considered at the same time. The need to handle huge volumes of container traffic and the scarcity of land in the container port area pose serious challenges for the port operator. A new approach named space-sharing yard template planning, is studied to balance the equipment productivity and the land usage when the consignment strategy is implemented.

2 - Collaboration Among Small Shippers in a Transportation Market
Secil Savasaneril, Asst.ProfessorDr., Middle East Technical University, Department of Industrial Engineering, Ankara, Turkey, secil@ie.metu.edu.tr, Ozhan Yilmaz

We study the coalition formation among small shippers in a transportation market characterized by uncertain demand. We study the effect of shipper characteristics on the benefit of collaboration. Analysis shows that the shippers always benefit from the coalition, but when the benefits are to be allocated, the coalition may not always guarantee the budget balance. Using a game theoretical approach we propose saving allocation mechanisms and discuss the conditions that lead to a balanced budget.

3 - Allocating Freight Costs in Cooperative Load Sharing Agreements
Don Warsing, Associate Professor, North Carolina State University, 2346 Nelson Hall, Raleigh, NC, 27695, United States of America, don_warsing@ncsu.edu, Michael Kay

What we call cooperative load sharing is related to two other important problems, the joint replenishment problem and the cooperative inventory game. In cooperative load sharing, however, the fixed cost of shipping depends on the composition of the coalition, and shippers may benefit from forming varying coalitions over time, altering their shipment frequency. We propose a solution approach to address these complications, and we demonstrate its application.

4 - Real-time Ordering Quantity Control in Logistics Management with Uncertainty
Jia Gao, City University of Hong Kong, Dep. of Management Sciences, 7/F, Academic Building, City University of HK, Hong Kong, Hong Kong - PRC, gjtina@cityu.edu.hk, Lawrence C. Leung, Yer Van Hui

New shipment monitoring systems with real-time tracking capability, such as Control Tower, have become popular in freight forwarding industry. We formulate the replenishment problem with uncertainty in the context of modern logistics management. Adopting the real-time SPC concept, we construct a continuous stochastic model to derive the optimal ordering strategy. Impacts of different types of information on the final solution and managerial insights in decision making are discussed.

5 - Automotive Maritime Logistics: An Application of Inventory Maritime Problem
Saurabh Chandra, Indian Institute of Management Lucknow, Prabandh Nagar, Off Sitapur Road, Lucknow, 226013, India, saurabh.c.pathak@iiml.org, Rajiv Srivastava

The problem deals with logistics management planning of various 'finished automobiles' exported/imported across countries. The Logistics provider is responsible for maritime transportation planning along with stock management at the ports. It has been taken as an extension to "maritime inventory routing problem"with the proposed inclusion of inventory costs at ports, spot cargoes etc, as per problem scenario.

■ WA67

W - Grand A - 2nd Floor

Game Theory: Strategy and Cost Sharing

Contributed Session

Chair: Nelson Uhan, School of Industrial Engineering, Purdue University, 315 N. Grant Street, Grissom Hall 308, West Lafayette, IN, 47907, United States of America, nuhan@purdue.edu

1 - Strategy Selection and Strategy Discovery: Principles and overview
Steve Kimbrough, University of Pennsylvania, 3730 Walnut St., Philadelphia, PA, 19004, United States of America, kimbrough@wharton.upenn.edu

Given a consideration set of strategies, players in a game face the problem of selecting which strategies they will actually play. Given a strategic situation, players in a game face the problem of discovering good strategies to consider for play. This talk illustrates these problems on games of practical import, and presents results based on innovative tournament designs as well as machine learning, using agent-based models, evolutionary computation, and other metaheuristics.

2 - Finding Strategies in Adversarial Situations
Stephany Coffman-Wolph, PhD Student, Western Michigan University, 11704 Landers Drive, Plymouth, MI, 48170, United States of America, stephany.s.coffman-wolph@wmich.edu

The development of a hierarchical system containing separate sub-systems for each side in an adversarial gaming situation based on the concepts introduced in Linguistic Geometry (LG) will be presented. By using separate sub-systems, the total system is able to generate moves under more realistic circumstances. The system, using Fuzzy Logic concepts and a Particle Swarm Optimization (PSO) search algorithm, generates a smaller and more focused search tree than traditional algorithms.

3 - Resource Pooling and Cost Allocation Among Independent Service Providers
Frank Karsten, Eindhoven University of Technology, P.O. Box 513, Eindhoven, Netherlands, f.j.p.karsten@tue.nl, Geert-Jan van Houtum, Marco Slikker

We apply concepts from cooperative game theory to study the problem of fair allocation of shared costs in multi-server systems. Each coalition of players collaborates by complete pooling of resources and individual customer streams into a joint M/M/c queue. We consider server costs and delay costs. In both cases studied, with fixed numbers of servers and optimal numbers of servers, we examine the existence of core allocations that can be reached through a population monotonic allocation scheme.

4 - Cost Allocation in City Logistics
Stefan Engevall, Associated Professor, Linköping University, Department of Science and Technology, ITN, Norrkoping, 60174, Sweden, stefan.engevall@liu.se

In this paper a cost allocation problem in a city logistics situation is studied. In a City Distribution Center (CDC) setting, it may be necessary to allocate common costs to the participants. In this paper, as a mean to allocate costs, a number of alternative cooperative games are formulated and discussed, including or excluding the costs associated to the CDC, and including or excluding the operator of the CDC as a player. The Shapleyvalue and the nucleolus are computed for numerical examples.

5 - Sharing Isn't Easy: On Strategyproof Mechanisms for Sharing the Costs of Linear Programs
Nelson Uhan, School of Industrial Engineering, Purdue University, 315 N. Grant Street, Grissom Hall 308, West Lafayette, IN, 47907, United States of America, nuhan@purdue.edu

We study linear programming (LP) games, an important class of cooperative games that model a myriad of cost sharing problems, including those from logistics, network design, and homeland security. We give an approximately budget-balanced and approximately efficient group strategyproof cost sharing mechanism for these games. In addition, we give impossibility results for the budget-balancedness and computational complexity of various classes of strategyproof cost sharing mechanisms for LP games.

■ WA68

W - Grand B - 2nd Floor

Game Theory in Supply Chain

Contributed Session

Chair: Fouad El Ouardighi, Professor, ESSEC Business School, Avenue Bernard Hirsch, B.P. 105, Cergy Pontoise, 95021, France, elouardighi@essec.fr

1 - Dual Functionalities of Acceptance Sampling Plans in a Supply Chain with Endogenous Product Quality
Tian Ni, Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, ni10@purdue.edu, Xiaowei Xu, Hong Wan

This paper studies a firm that procures a product from a supplier. The firm determines the acceptance sampling plan and the supplier determines the quality effort level in a simultaneous game. We identify the Nash equilibrium form and provide sufficient conditions of the existence of a pure strategy Nash equilibrium. Sensitivity analysis of the optimal sample size, rejection threshold and quality effort level is conducted as well.

2 - Biform Game: Reflection as a Stochastic Programming Problem
Nichalin Summerfield, The University of Arizona, MIS Department, 1130 E. Helen St., Tucson, AZ, 85721, United States of America, nichalin@email.arizona.edu, Moshe Dror

In this paper we examine the biform games modeling framework. More specifically, we recast biform games as two-stage stochastic programming with recourse. The two-stage stochastic programming view of biform games is demonstrated on various known examples regarding operational decision problems of competing firms from the literature. It allows an "old" mathematical methodology to showcase its versatility in modeling combined competitive and cooperative game options.

3 - Integrating Options with B2B Online Spot Market for Equilibrium Strategies in Supply Chain

Xiaolan You, Xi'an Jiaotong University, School of Management, No.28, Xianning West Road, Xi'an, China, xiaolan.youyou@stu.xjtu.edu.cn, Gengzhong Feng, Wei Jiang

Considering a supply chain consisting of a manufacturer, a retailer and a third-party B2B online spot market, this paper derives the manufacturer's optimal bidding strategy for options and the retailer's optimal procurement strategy in a Stackelberg game with the manufacturer as the leader. In the case of uniform distribution, the impact of market liquidity on the profits of all participants in the supply chain is discussed.

4 - Production Capacity and Pricing Equilibrium Strategies in a Supply Chain

Fouad El Ouardighi, Professor, ESSEC Business School, Avenue Bernard Hirsch, B.P. 105, Cergy Pontoise, 95021, France, elouardighi@essec.fr, Bowon Kim

We develop a differential game model to determine how a manufacturer and its supplier should determine their production capacities and pricing policies to maximize their profits over an infinite planning horizon. We derive the cooperative equilibrium, and the open-loop and closed-loop Nash equilibria. In order to contrast the myopic and far-sighted behaviours of the supply chain's members, we compare the dynamic and the static solutions of the game.

■ WA69

W - Grand D - 2nd Floor

Economics of Reverse Logistics

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Canan Savaskan, Southern Methodist University, Cox School of Business, Dallas, TX, United States of America, csavaskan@cox.smu.edu

1 - Managing Returns of Experience Goods with Dishonest Customers

Michael Galbreth, Asisstant Professor, Moore School of Business, United States of America, galbreth@moore.sc.edu, Bikram Ghosh, Guangzhi Shang

Customers value the ability to return a defect-free item when there is some probability that, after a trial period, they will find that it does not fit their needs. Dishonest customers might act as 'returns abusers,' using the trial to extract value rather than assess fit. Retailers can use restocking fees to deter dishonest customers, but these will also impact the purchase decisions of honest customers. We provide insights into the pricing and restocking fees of retailers in this context.

2 - The Effect of Remanufacturing on the Perceived Value of New Products

Atalay Atasu, Georgia Institute of Technology, Atlanta, GA, United States of America, atalay.atasu@mgt.gatech.edu, Vishal Agrawal

We experimentally investigate the effect of remanufactured products on the perceived value of new products. We find that the perceived value of an OEM's new product depends on who sells the remanufactured product: the perceived value decreases when the OEM sells the remanufactured product, but this effect reverses when a third-party sells remanufactured products. We then analytically investigate an OEM's competitive remanufacturing strategy in the presence of this effect.

3 - The Impact of Competition on Producer Responsibilities and Environment

Hyoduk Shin, Assistant Professor, Northwestern University, Kellogg School of Management, Evanston, IL, 60201, United States of America, hyoduk-shin@kellogg.northwestern.edu, Jingqi Wang

We study how the downstream competition in a supply chain affects firm's investment incentives for different producer responsibility regulations. We confirm that individual responsibility encourages more investment than collective responsibility, as shown in Atasu and Subramanian (2011). However, individual responsibility results in more production. Consequently, the average environmental costs depend on the level of competition, without the cost-efficiency of collective responsibility.

4 - Formal Waste Recovery Systems and Scavengers: Symbiotic or Conflicting?

Maria Besiou, Postdoctoral Fellow, INSEAD, Social Innovation Centre, Fontainebleau, France, Maria.Besiou@insead.edu, Luk Van Wassenhove, Patroklos Georgiadis

Formal waste systems displace collection of used products by scavengers. However, scavenging still exists, especially in places with low living standards. Informal recycling of waste electrical and electronic equipment constrains profits of the formal system and pollutes the environment. Using system dynamics we reveal that incorporating scavengers into the formal system (instead of ignoring/prohibiting their participation) is beneficial for economical, environmental and social sustainability.

Wednesday, 11:00am - 12:30pm

■ WB01

C - Room 201A

Robust Dynamic Optimization and Learning with Applications in Inventory and Revenue Management

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Dan Iancu, Assistant Professor, Stanford University, Stanford, CA, United States of America, Iancu_Dan@GSB.Stanford.Edu

1 - Achieving Targets Dynamically

Melvyn Sim, National University of Singapore, Mochtar Riady Building, BIZ 1, 8-76 15 Kent Ridge Drive, Singapore, melvynsim@nus.edu.sg, Zhuoyu Long, Lucy Chen

We consider a dynamic optimization problem in which the periodic payoffs are potentially uncertain and the decision maker desires a policy where the income stream can achieve some specified targets in these periods under uncertainty. We propose a new measure for examining how well a random income stream can meet targets dynamically. We show how this measure can be optimized by solving a converging sequence of dynamic optimization problem.

2 - A Learning-while-doing Algorithm for a Class of Single-product Revenue Management Problems

Zizhuo Wang, Stanford University, 314T, Huang Engineering Building, Stanford, CA, 94305, United States of America, zzwang@stanford.edu, Yinyu Ye, Shiming Deng

We propose a dynamic "learning-while-doing" pricing algorithm for the single product revenue management problem. Our algorithm learns the optimal pricing policy "on the fly" without assuming any parametric form of the demand function. We show that our algorithm has the best possible performance in terms of asymptotic regret of revenue. It also closes the performance gap between parametric and non-parametric learning in previous works as well as the gap between auction and post-price mechanism.

3 - On the Power of Static Policies for Non-linear Adjustable Robust Optimization Problems

Vineet Goyal, Assistant Professor, Columbia University, 500W 120th St, New York, NY, United States of America, vgoyal@ieor.columbia.edu, Dimitris Bertsimas

For a fairly general adjustable robust optimization problems with nonlinear constraints and nonlinear objective function where the uncertainty appears in both the constraint as well as objective functions, we show that a static solution provides a good approximation under fairly general assumptions. Our model applies to a wide variety of problems in revenue management, resource allocation under uncertainty, scheduling problems with uncertain processing times among many others.

4 - Supermodularity and Dynamic Robust Optimization

Dan Iancu, Assistant Professor, Stanford University, Stanford, CA, United States of America, Iancu_Dan@GSB.Stanford.Edu, Mayank Sharma, Maxim Sviridenko

In this talk, we discuss several dynamic robust optimization models (which include single product dynamic pricing, single-echelon inventory replenishment with arbitrary convex ordering and inventory costs), for which we prove that affine policies parameterized in the history of model disturbances are optimal. Our proof techniques rely on an interesting connection with the theory of supermodularity and concave envelopes, which may be of independent interest.

■ WB02

C - Room 201B

Pricing II

Contributed Session

Chair: Ahmad Bajwa, Doctoral Student, University of Alabama, Tuscaloosa, Tuscaloosa, AL, 35406, United States of America, anbajwa@crimson.ua.edu

1 - Optimal Pricing and Advertising ia a Dynamic Durable Goods Supply Chain

Anshuman Chutani, Visiting Assistant Professor, School of Management, Binghamton University, Ofice AA 274, School of Management, Binghamton University, P.O. Box 6000, Binghamton, NY, 13902, United States of America, achutani@binghamton.edu, Suresh P. Sethi

We study the case of a dynamic durable goods supply chain where a manufacturer sells his product through two independent and competing retailers. The problem is modeled as a Stackelberg differential game where the manufacturer announces his wholesale prices and his shares of advertising costs of the retailers or his subsidy rates, and the retailers in response play a Nash differential game in choosing their optimal retail prices and advertising efforts over time.

2 - Pricing with Production Learning and Strategic Consumer Behaviour

Shilu Tong, University of New South Wales, Australian School of BusinessUni, University of New South Wales, Sydney, Australia, sl.tong@unsw.edu.au, Albert Y. Ha, Stephen Shum

We study the pricing problem of a firm that can reduce its production cost due to its learning capability during production. We show that, when facing strategic customers, the firm may not always benefit from higher production learning capability. We also compare the firm's profit, consumer surplus and social welfare under different pricing policies.

3 - Coordinating Pricing and Production Decisions

Ahmad Bajwa, Doctoral Student, University of Alabama, Tuscaloosa, Tuscaloosa, AL, 35406, United States of America, anbajwa@crimson.ua.edu, Charles Sox

Dynamic problem of joint pricing and production decisions for multiple products with setups and capacity constraints. Demand is decreasing in price with seasonality. Objective is to determine the optimal prices and production plan to maximize profit. We show that the nonlinear optimization problem can be modeled in terms of one dual variable. Optimal solution (satisfying KKT & saddle point) is found by using a one dimensional search procedure. Solution approach is independent of problem size.

■ WB03

C - Room 202A

Inventory Management I

Contributed Session

Chair: Nils Buch, N.C. State University, 400 Daniels Hall, Raleigh, NC, 27695, United States of America, nbuch@ncsu.edu

1 - A Retail Inventory Policy for Time-dependent Cyclical Demand

Joachim Ehrenthal, University of St.Gallen, Dufourstrasse 40a, St.Gallen, Switzerland, joachim.ehrenthal@unisg.ch, Tom Van Woensel, Thomas Gruen, Joerg Hofstetter

Fast-moving retail items follow a cyclical demand pattern depending on timing and marketing efforts. In our research, we observe the occurrence of intraday sales patterns. We therefore model an inventory policy accounting for intraday sales patterns by refitting the review period. We include lost sales, inventory holding and handling costs, and marketing efforts. Using actual transaction data, we compare this new policy to current practice, evaluating effects on customer service and total cost.

2 - Integrated Approach for a Single Vendor and a Single Buyer Inventory System of Deteriorated Items

Sunghee Lee, Graduate student, Korea University, Room 516, Main Bldg. of Business school, Anam-dong, Seongbuk-gu, Seoul, Korea, Republic of, cool_scm@korea.ac.kr, Daeki Kim

A deteriorating property of products is one of the key points to note for practice and research in the inventory management. Although many priori articles involves various characteristics in their modeling, inventory loss from both imperfect quality caused by manufacturing process and deterioration has room to find more. Furthermore a simple remanufacturing policy chained with the inventory models is proposed with a rough assumption.

3 - A Finite-horizon Inventory Model with Multiple Replenishment Opportunities

Nils Buch, N.C. State University, 400 Daniels Hall, Raleigh, NC, 27695, United States of America, nbuch@ncsu.edu, Russell E. King, Don Warsing, Anita Vila-Parrish

The literature on finite-horizon inventory models typically assumes that ordering cost is either fixed or zero. We present a multi-period, finite horizon model with a known demand distribution in each period. We characterize the optimal policy structure of the model, demonstrating that specifying the number of orders allowed across the horizon, with no explicit ordering cost, provides a useful marginal value of each additional order as an alternative to specifying an explicit ordering cost.

■ WB04

C - Room 202B

Applications of Network Optimization

Contributed Session

Chair: Benazir Portal, Student, Florida Atlantic University, 1675 NW 4th Avenue Apt. 812, Boca Raton, FL, 33432, United States of America, benazir833@hotmail.com

1 - Optimal Location of Electric-car Charging Stations

Ali Haji Agha Bozorgi, University of Central Florida, 1927 Cuesta Dr. Apt 724D, Orlando, Fl, 32826, United States of America, alililihozak@yahoo.com, Mansooreh Mollaghasemi, Talayeh Razzaghi, Vernet Lasrado

In this model, we try to propose a fuzzy model for locating the charging stations for electrical cars. In the literature, there are some works on this, but they all assume a fixed, predetermined value for the vehicle range. Trying to make it more realistic, we use fuzzy value for that, which might affected by driving habits, the geography of the path, etc.

2 - A Risk-minimization Network Flow Problem for Designing Safe Walking-routes for School Children

Ken-ichi Tanaka, The University of Electro-Communications, 1-5-1, Chofugaoka, Chofu-shi, Tokyo, 182-8585, Japan, ken1tnk@se.uec.ac.jp, Ryuhei Miyashiro, Yuichiro Miyamoto

For school children to walk safely to and from school, it is desirable to walk in groups, not alone, while maintaining the route distance of each child within an acceptable level. This paper presents a network flow problem in which arc cost functions are non-increasing with the number of children and the length of each route is bounded. An integer programming formulation and some numerical solutions are presented. The network design version of the problem is also considered.

3 - Scenario-Scaping with Inverse Programming for Intermodal Transporation

Christina Burt, Dr, Austrian Institute of Technology, Giefinggasse 2, Wien, 1210, Austria, christina.naomi.burt@gmail.com, Jakob Puchinger

We study an intermodal transportation problem over a long-term planning horizon where scenarios involving different equipment, location and network arcs are possible. We model the problem as a capacitated multi-commodity network flow problem and make use of inverse programming techniques to sketch the landscape of the uncertain scenario cost function to show when one scenario becomes preferable to another. We apply reduction, preprocessing and heuristic methods to solve some steps our procedure.

4 - Optimizing Shuttle Service for Minimum Cost Operation – A Case Study in Florida Atlantic University

Benazir Portal, Student, Florida Atlantic University, 1675 NW 4th Avenue Apt. 812, Boca Raton, FL, 33432, United States of America, benazir833@hotmail.com, Evangelos I. Kaisar

Florida Atlantic University first began classes conducting classes in 1964 in Boca Raton, FL as an upper-level school only. The parking issue came to the forefront of university issues at the beginning of Fall '09. FAU has implemented a shuttle system to encourage the use of remote access parking and to reduce congestion on campus. The intent of this project is to evaluate and make recommendations for the FAU shuttle system by optimizing the network for travel time, efficiency, and safety.

■ WB06

C - Room 203B

Scheduling and Timetabling

Contributed Session

Chair: Jingyang Xu, Visiting Scientist, Mitsubishi Electric Research Laboratories, Amherst, NY, 14228, United States of America, jxu7@buffalo.edu

1 - An Approximation Algorithm for the Spatial Scheduling Problem

Sudharshana Srinivasan, Virginia Commonwealth University, 2820 Monument Avenue Apt 3, Richmond, VA, 23221, United States of America, srinivasans3@vcu.edu, Jill Wilson

Spatial Scheduling Problem (SSP) deals with the spatial component (where), and the temporal component (when) of a schedule. Such problems are common in shipbuilding, where large spaces are a premium. Solution methods discussed in the literature provide heuristic-based solutions for the problem. We present a variation of a mixed-integer programming formulation found in the literature, and an approximation algorithm to determine the schedule for a given problem instance.

2 - Fast Algorithms for Scheduling with Learning Effects and Time-dependent Processing Times

Jianbo Qian, Phd candidate, McMaster University, Apt 601, 244 Willow Rd., Guelph, ON, N1H6R5, Canada, qianj2@mcmaster.ca, George Steiner

We consider scheduling problems with learning/deterioration effects and time-dependent processing times on a single machine, with or without due date assignment considerations. By reducing them to a special assignment problem on product matrices, we solve all these problems in near-linear time. This improves the time complexity of previous algorithms for some scheduling problems and establishes the fast polynomial solvability for several other scheduling problems

3 - Examination Timetabling with Mathematical Programming: An Application in Turkish Air Force Academy

Ghaith Rabadi, Associate Professor, Old Dominion University, Engineering Management & Systems Enginee, 241 Kaufman Hall, Norfolk, VA, 23529, United States of America, GRabadi@odu.edu, Emrah Koksalmis

The problem addressed is the timetabling of examinations at the Turkish Airforce Academy with different number of departments, branches, classes, and students. The constraints include examination conflicts, classroom capacities, seating plan restriction and exam spread. A constraint satisfaction model is introduced to find feasible solutions to the problem. The model is extended into an optimization model to minimize the number of classroom utilized. The obtained results will be presented

4 - University Timetabling Considering Inter-campus Traffic

Jia Wang, National University of Singapore, Department of Industrial Systems & Engineering, Blk E1-7-17, 1 Engineering Drive 2, Singapore, 111920, Singapore, wangjia@nus.edu.sg, Loo Hay Lee, Ek Peng Chew, Kien Ming NG, Yan Fu Li, Hui-Chih Hung, Hui Xiao

This study presents a timetabling problem arising from the university expansion. The new campus is expected to be enjoyed by students from different disciplines. Main transportation between campuses is shuttle bus. Given the timetabling schedule for each module, we select the modules to the new campus such that the estimated traffic flow between these two campuses is minimized. We formulate the problem as a mixed integer programming model and develop a heuristic based on clustering to solve it.

5 - Solving Assembly Scheduling Problems Using Lagrangian Relaxation

Jingyang Xu, Visiting Scientist, Mitsubishi Electric Research Laboratories, Amherst, NY, 14228, United States of America, jxu7@buffalo.edu, Rakesh Nagi

We consider an assembly scheduling problem with tree-structured precedence constraints. In our problem, there are a number of work centers. Each work center contains machines of the same functionality. We propose a mixed integer linear programming formulation and solve the problem with Lagrangian relaxation approach. Near optimal results are obtained and the computational time is within several seconds for problems with size up to 8 machines and 300 operations.

■ WB07

C - Room 204

Applications of Simulation

Contributed Session

Chair: Bo Sun, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, Louisville, KY, 40292, United States of America, B0Sun004@louisville.edu

1 - Call Center Routing Policies and Learning

Tom Robbins, Assistant Professor, East Carolina University, 3212 Bate Building, Greenville, NC, 27858-4353, United States of America, robbinst@ecu.edu

We examine the relationship of learning curves, routing policies, and turnover. Specifically we perform a simulation study to determine if routing policies can be structured in such a way as to improve the overall efficiency of the call center. Specifically, is it possible that by prioritizing less experienced agents during slow periods to facilitate learning; and prioritizing more experienced agents during busy times, to facilitate customer service, overall effectiveness can be improved?

2 - Evaluating of Dynamic Cross-sell Policy Effects in Real Call Center System

Nevra Akbilek, Visiting Scholar, Auburn University, 516 E Glenn Avenue, Auburn, AL, United States of America, nakbilek@gmail.com

In a call center system where response time is important, the specialized dynamic equilibrium and continuity of process supporting customers and selling must be reached. Thus, a model is designed that determines cross-selling threshold considering queue length. In conclusion, this study determined the proposed dynamic exponential cross-selling threshold must be applied considering patience limit, retrial rate, and trunk capacity. Finally, choosing a high threshold value is more profitable.

3 - A Simulation-based Model for overbooking in a Multi-resource Medical Clinic

Bo Sun, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, Louisville, KY, 40292, United States of America, B0Sun004@louisville.edu, Brooke Sweeney, Gerald Evans, Lihui Bai, Lijian Chen

In this paper, we describe a simulation model of a multi-resource medical clinic for overweight children. The clinic's staff includes pediatricians, a nurse practitioner, a psychologist, an exercise physiologist, and a nutritionist. Various overbooking schemes are modeled to determine their affect on staff utilization and patient waiting time.

■ WB08

C - Room 205

Topics in Disaster and Emergency Management

Contributed Session

Chair: Diana Prieto, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, dprieto@mail.usf.edu

1 - Non-pharmaceutical Interventions for Pandemic Influenza

Dayna Lee Martinez, University of South Florida, Tampa, FL, United States of America, dlmartin@mail.usf.edu, Tapas Das

Non-pharmaceutical interventions (quarantine, closures) have been shown to reduce infection attack rates and delay the spread in selected pandemic influenza outbreak outbreak scenarios. We investigate the nature of interactions among some of the key intervention parameters, such as initiation thresholds, intervention duration, and compliance levels, and the levels of virus transmissibility.

2 - Real-time Data Collection Strategies for Epidemiological Characterization of Pandemic Outbreaks

Diana Prieto, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, dprieto@mail.usf.edu, Alfredo Santana, Sharad Malavade, Tapas Das

State Public Health Laboratories (PHLs) determine the strain of circulating viruses in the US. Specimens are generally collected from the sentinel healthcare providers for routine surveillance. However, during the recent H1N1 pandemic, the PHLs also received specimens from non-sentinels. The PHLs tested all the specimens received, extending the desired testing timeline. Using simulation and Bayesian estimation, we suggest strategies for better specimen collection and processing.

■ WB09

C - Room 206A

Topics in Revenue Management

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Ozge Sahin, Assistant Professor, Johns Hopkins University, Carey Business School, Baltimore, MD, 21231, United States of America, ozge.sahin@jhu.edu

1 - Competitive Dynamic Pricing of Perishable Assets with Time-Varying Demand

Ming Hu, University of Toronto, Rotman School of Management, Toronto, ON, Canada, Ming.Hu@Rotman.Utoronto.Ca, Guillermo Gallego

We present a game framework of dynamically pricing perishable capacities over a finite horizon with time-varying consumer arrivals and time-varying discrete choice probability functions, which accommodates the co-existence of substitutable and complementary products. We fully characterize equilibrium solutions with structural properties. We discuss various equilibrium behavior, such as alternating monopoly and the impact of assumed demand structures (e.g., MNL or linear) on equilibrium behavior.

2 - Pricing Policy in a Supply Chain: Negotiation or Posted Pricing?

Chia-Wei Kuo, National Taiwan University, 1 Sec 4 Roosevelt Road, Taipei, Taiwan - ROC, cwkuo@ntu.edu.tw, Hyun-Soo Ahn, Goker Aydin

This paper examines the choice between posted pricing and negotiation when selling to the end customers. We find that the retailer and the manufacturer disagree only when the retailer prefers posted pricing, but the manufacturer wishes the retailer to use negotiation. Such friction arises when the capacity or the cost of negotiation is moderate. Surprisingly, in this region of friction, a decrease in capacity or an increase in negotiation costs translates into higher profit for the retailer.

3 - Bi-clustering to Estimate the Effect of Placement on Retail Sales

Garrett Van Ryzin, Professor, Columbia University, New York, NY, United States of America, gjv1@columbia.edu, Wei Ke

We look at an application of bi-clustering to estimate the effect of product location in a store on sales. Products are clustered based on location sensitivity and locations are clustered based on sales productivity. We review the algorithm and initial performance tests or retail sales data.

4 - Optimal Pricing and Capacitated Replenishment with Consumer Upgrades

Oben Ceryan, Postdoctoral Research Fellow, Ross School of Business, University of Michigan, 701 Tappan St., Ann Arbor, MI, 48109, United States of America, oceryan@umich.edu, Ozge Sahin, Izak Duenyas

We study a capacitated dynamic pricing and replenishment control problem with consumer upgrades. At each period, the firm first replenishes and sets the prices for a high and a low quality item, and then decides whether it should offer upgrades to any of the customers requesting the low quality item. We characterize the optimal upgrade, pricing and replenishment policies as well as the effect of customer upgrades on the prices of the high and low quality items.

■ WB10

C - Room 206B

Financial Risk Management

Contributed Session

Chair: Neslihan Fidan, Research Assistant, Istanbul University, School of Business, Quantitative Methods Department, Istanbul, Turkey, neslihan.fidan@gmail.com

1 - The Dotcom and Subprime Phenomena – Two Sides of the Same Coin?

George Hylden, University of Cambridge, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, g.hylden@jbs.cam.ac.uk

The empirical paper tests the explanatory powers of systematic behavioral biases and the resulting violations of the stylized facts on options & portfolios to account for the dotcom and subprime phenomena. Using proprietary data on the VC fund market and the CDS index market, we conclusively prove the occurrence of a type II error with the traditional stylized facts as the null hypothesis. Our findings call for the reversed stylized facts to be given prominence in academia and business practice.

2 - Time-Consistent Revised CVaR

Ke Zhou, The Chinese University of Hong Kong, Department of Systems Engineering and En, Room910A ERB Shatin, N.T., Hong Kong, Hong Kong - PRC, kzhou@se.cuhk.edu.hk, Xiangyu Cui, Duan Li

Time consistency of a dynamic coherent risk measure is equivalent to the stable property of the testing set.CVaR is a popular coherent risk measure,but its testing set is not stable. We construct a time consistent risk measure to approximate CVaR based on the stable property, in the sense that its testing set has the maximal measure. For incomplete markets, the no-good-deal pricing technique generates a more accurate price interval than no-arbitrage by adopting the time consistent revised CVaR.

3 - On the Modelling Zero Mean Squared Returns in Mean Variance Portfolio Selection

Neslihan Fidan, Research Assistant, Istanbul University, School of Business, Quantitative Methods Department, Istanbul, Turkey, neslihan.fidan@gmail.com

Modelling the time varying market risk of an asset is getting complicated in financial markets. This paper represents some results of portfolio selection procedure which considers modelling of dependent squared returns of the assets. It tries to find out the role of the conditional mean equation, when squared returns have zero mean and conditional variance.

■ WB11

C - Room 207A

Queueing Applications in Health Care Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Tolga Tezcan, Assistant Professor, University of Rochester, Rochester, NY, United States of America, tolga.tezcan@simon.rochester.edu

1 - A Tandem Queueing Model of Direct & Indirect Waiting in an Appointment System

Jianzhe Luo, University of North Carolina, Department of Stat. and OR., Chapel Hill, NC, 27599, United States of America, jzluo@email.unc.edu, Vidyadhar Kulkarni, Serhan Ziya

We develop a useful queueing model for an appointment system which consists of an appointment queue and a service queue. We propose a Decoupled-Two-Queues model in which the appointment delay customers encounter in the appointment queue affects their show-up probability at the service queue. We manage to solve the optimization problem that aims to minimize the server's long-run average idle time while keeping customer long-run average waiting times in both queues below given levels.

2 - Inpatient Flow Management in a Singaporean Hospital

Jim Dai, Professor, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, dai@isye.gatech.edu, Pengyi Shi, Ding Ding, James Ang, Mabel Chou

We study patient flow management in an inpatient department of a Singaporean hospital. We focus on understanding the effect of an "early discharge" policy, implemented in late 2009, on ward containment and on fraction of ED patients who have to wait six hours or longer to get a bed. We propose new analytical models that capture key features such as non-iid service times and discharge distributions.

3 - Optimal Workflow Decisions for Investigators in Systems with Interruptions

Tolga Tezcan, Assistant Professor, University of Rochester, Rochester, NY, United States of America, tolga.tezcan@simon.rochester.edu, Greg Dobson, Vera Tilson

Motivated by emergency departments, we model a system that consists of a stream of customers processed through three steps by two resources. The investigator handles the first and third steps and the back office handles the second step. We show that the investigator should prioritize new customers to maximize throughput. If customers in the system generate interruptions for the investigator then we show that it is asymptotically optimal for the investigator to prioritize discharging customers.

■ WB12

C - Room 207BC

Stochastic Optimization: Algorithms and Applications

Contributed Session

Chair: Jongbin Jung, Yonsei University, 50 YonseiRo, Seodaemungu, Seoul, 120-749, Korea, Republic of, olorin@yonsei.ac.kr

1 - A Simulation Based Optimization Approach for Two-stage Stochastic Programming with Recourse

Tahir Ekin, PhD Candidate, The George Washington University, Department of Decision Sciences, 2201 G St. NW Funger Hall 415H, Washington, DC, 20052, United States of America, ekin@gwu.edu, Nicholas Polson, Refik Soyer

We provide a simulation-based approach to solve two-stage stochastic problems with recourse. An augmented probability model is constructed with both decision and random variables by recasting a linear problem as the mode of a pseudo-posterior distribution. The main advantage of our approach is the ability to simultaneously compute expectations in the objective function without a need of any derivative information. We demonstrate our method with different examples.

2 - Exact and Inexact Methods for Solving the Two-Stage Stochastic View Selection Problem in DBMS

Rong Huang, Research Assistant, North Carolina State University, 484 Daniels Hall, Campus box 7913, Raleigh, NC, 27695, United States of America, rhuang@ncsu.edu, Yahya Fathi, Rada Chirkova

We introduce the two-stage stochastic view selection problem with random query sets in database management systems and model it as a stochastic integer programming model. We present exact methods to obtain optimal solutions for our problem, and propose a heuristic to obtain competitive inexact solutions where our exact method is inapplicable. We present the results of a computational experiment of our methods.

3 - Two Methods of Error Reduction in Portfolio Optimization with CVaR

Gah-Yi Vahn, UC Berkeley, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, CA, 94704, United States of America, gyvahn@berkeley.edu, Noureddine El Karoui, Andrew Lim

We investigate two methods for reducing estimation error in CVaR portfolio optimization. The first approach regularizes empirical CVaR by penalizing portfolios with large variance. The regularized problem is a QCQP, and can be interpreted as a chance-constrained program. The second approach is to use the empirical Markowitz solution if the log-return distribution is in the elliptical family, as the Markowitz and mean-CVaR problems are equivalent in this case.

4 - Two-Stage Portfolio Optimization with Conditional Measures of Risk

Sitki Gulten, PhD Student, Rutgers Business School - Department of Management Science & Information Systems, 1 Washington Park, Newark, NJ, 07102, United States of America, sgulten@andromeda.rutgers.edu, Andrzej Ruszczynski

Optimization of a portfolio from finitely many assets is a major problem in portfolio theory. In this research, a two-stage portfolio problem, in which decisions are made in each stage, and observations are gathered between stages, is formulated. Next, a conditional measure of risk, mean-semideviation risk function is used to formulate the objective function. Finally, performance of the two-stage portfolio optimization problem is analyzed.

5 - Performance of Markowitz's Portfolio Selection Model in a Global Context

Jongbin Jung, Yonsei University, 50 YonseiRo, Seodaemungu, Seoul, 120-749, Korea, Republic of, olorin@yonsei.ac.kr, Seongmoon Kim

This work aims to conduct an empirical analysis on the actual performance of Markowitz's portfolio selection model. By conducting virtual investments in stock markets of different conditions (US, UK, South Korea, etc.), we will attempt to identify the characteristics of each market, and to provide a framework for optimizing stock portfolios solely relying on a computational model.

■ WB13

C - Room 207D

Dynamic Pricing

Contributed Session

Chair: Sam Kirshner, Doctoral Candidate, Queen's University, 143 Union Street, Kingston, ON, Canada, skirshner@business.queensu.ca

1 - Improved Bid Prices for Multistage Network Revenue Management

Marco Bijvank, University of Montreal, Pavillon André-Aisenstadt, CP 6128 succ Centre-Ville, Montreal, QC, H3C 3J7, Canada, bijvankm@iro.umontreal.ca, Alwin Haensel, Pierre L'Ecuyer, Patrice Marcotte

We present new and efficient mathematical programming methods to compute time-dependent bid prices to control the availability of products for a network revenue management problem with stochastic demand. The frequency to update the bid prices during the booking horizon is arbitrary, which makes our new procedures very flexible.

2 - Dynamic Discrete Choice Model for Revenue Management

Pratt Hetrakul, Graduate Research Assistant, Department of Civil & Environmental Engineering, 1173 Glenn L. Martin Hall Bldg #088, University of Maryland, College Park, MD, 20742, United States of America, hetrakul@umd.edu, Fabian Bastin, Cinzia Cirillo

We consider purchase behavior of consumers with respect to perishable product, offering cancellation and exchange possibilities. A monopolistic company sets the price which appears random to the consumers. Viewing the decision as an optimal stopping problem, we adopt a 1-SL policy, using approximation of the continuation value, with an adjustment that accounts for unobservable factors. The approach is applied to simulated data in a revenue management context.

3 - Dynamic Pricing under Consumers' Conversion Behavior

Xiangyong Li, School of Economics & Management, Tongji University, 1239 Siping Road, Shanghai, 200092, China, xyli@tongji.edu.cn, Peng Tian, Li Zhao

We study a dynamic pricing problem under consumers' conversion behavior. Purchasing conversion rates, defined as the percentage of consumers' visits that results in purchases, are a primary focus of attention for many online retailers. We formulate this problem by the dynamic programming approach and derive an optimal dyanmic pricing policy that captures effects of consumers' conversion behavior. Numerical examples are used to demonstrate effects of conversion behavior on firms' dynamic pricing.

4 - Scalable Dynamic Bid Prices for Network Revenue Management in Continuous Time

Sam Kirshner, Doctoral Candidate, Queen's University, 143 Union Street, Kingston, ON, Canada, skirshner@business.queensu.ca, Mikhail Nediak

We present a method to generate dynamic bid prices for a network revenue management problem in continuous time. Our approach formulates the problem as a SDP and uses cubic splines to model the derivative of the value function. The primary benefits of the framework are few constraints are required to produce effective bid prices and the method is scalable. In experiments for networks of realistic size, the approach produces higher revenues than the bid pricing policy based on resolved static LPs.

■ WB14

C - Room 208A

Stochastic Optimization in Short-Term Power Generation I

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Steffen Rebennack, Assistant Professor, Colorado School of Mines, Engineering Hall 310, Golden, CO, 80401, United States of America, srebenna@mines.edu

1 - Optimal Bidding Strategies in Joint Electricity and Allowance Markets

Vishnu Nanduri, Assistant Professor, University of Wisconsin-Milwaukee, Industrial Engineering, Milwaukee, WI, United States of America, vnanduri@uwm.edu

In this research we develop a game-theoretic model to capture strategic behavior of generators in electricity and allowance markets. We develop a reinforcement learning approach to solve the model. Data from northern Illinois electricity markets is used to examine the impact of transmission congestion on electricity and allowance prices.

2 - Wind Power Forecasting and Electricity Market Operations: A Case Study of Illinois

Zhi Zhou, Argonne National Laboratory, 9700 South Cass Avenue, Lemont, IL, 60439, United States of America, zzhou@anl.gov, Jianhui Wang, Jean Sumaili, Ricardo Bessa, Audun Botterud, Hrvoje Keko, Vladimiro Miranda

In this paper we model a power system with wind energy penetration. We first discuss the use of wind power forecasting in electricity market operations. In particular, we compare different wind power uncertainty representations, corresponding reserve strategies, and test the forecasts in a market with DA and RT settlements. The market clearing is modeled using stochastic unit commitment. The power system of Illinois is taken as a test case and result is discussed.

3 - Stochastic Programming for Electricity Spot Auction Bidding

Stein-Erik Fleten, Professor, Norwegian University of Science and Technology, Department of Industrial Econ. & Techn. Mgmt, Trondheim, Norway, stein-erik.fleten@iot.ntnu.no, Daniel Haugstvedt

Hydropower producers with reservoirs must decide whether to release water now or in the future. This challenge is subject to price and inflow uncertainty and becomes manifest in the bidding problem, in which the producer decides on a price-volume curve for each hour of the next day. The problem is multiscale since bidding is short-term while future release might mean several months ahead. Hierarchical optimization is a common approach; we propose stochastic programming alternatives.

■ WB15

C - Room 208B

Decision Support Models and Sensitivity Analysis II

Sponsor: Decision Analysis

Sponsored Session

Chair: Emanuele Borgonovo, Professor, Bocconi University, Via Roentgen 1, Milano, Italy, emanuele.borgonovo@unibocconi.it

1 - Assumption Free Multiattribute Utility Function Elicitation

Alessandra Cillo, Bocconi University, Via Roentgen 1, Milan, Italy, alessandra.cillo@unibocconi.it, Emanuele Borgonovo, Francesca Beccacece

The elicitation of multiattribute utility functions is a crucial step in the formulation of decision-analysis problems. The classic assessments methods suffer of one major critique: they rely on assumptions which, even though conceptually convincing, have often been questioned from a behavioral point of view. The goal of this paper is to introduce a methodology which allows an assumption free multiattribute utility function elicitation.

2 - An Entropy-based Uncertainty Measure and Importance Indicator

Douglas Allaire, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, dallaire@mit.edu, Karen Willcox

Often large uncertainties in model outputs render a model uninformative in aiding decisions. In such cases, factor importance indicators are used to identify uncertainty sources. When the second moment captures output uncertainty, variance-based indicators suffice. However, when this moment is not adequate, alternatives must be considered. For this we propose an uncertainty measure and importance indicator based on information theory, which is compared to variance-based and moment-free methods.

3 - Optimal Uncertainty Quantification and Sensitivity Analysis with Incomplete Information

Tim Sullivan, California Institute of Technology, 1200 East California Boulevard, Pasadena, CA, 91125, United States of America, sullivan.t.j@gmail.com, Michael Ortiz, Clint Scovel, Mike McKerns, Florian Theil, Houman Owhadi, Dominik Meyer

We show, using optimization with respect to incomplete information, that output uncertainties may be insensitive or even discontinuous with respect to input uncertainties when the transfer functions (or probability distributions) are imperfectly known. For hierarchical structures, this phenomenon can lead to the non-propagation of uncertainties or information across scales.

4 - Application of Global Sensitivity Analysis in Finance

Sergei Kucherenko, Imperial College London, London, United Kingdom, s.kucherenko@imperial.ac.uk, Emanuele Borgonovo

Global Sensitivity Analysis (GSA) is applied to financial problems. GSA allows to rank variables, to estimate models effective dimension and to reduce models complexity. We analyse option-pricing models, identify the most important parameters and model structure. We also show how GSA can be used to explain the efficiency of Quasi Monte Carlo methods. Pricing of path-dependent options and the forecasts of interest rates using the Cox-Ingersoll-Ross model are considered.

5- Sensivity Analysis of the Replacement Problem

Eva Selene Hernández Gress, PhD, Universidad Autonoma del Estado de Hidalgo, Carretera Pachuca Tulancingo km 4.5, Pachuca 42184, Mexico, evah@uaeh.edu.mx, Pérez Lechuga Gilberto

In our proposal we modeled the replacement problem using a Markov decision process and then, the instance is optimized using linear programming. Our goal is to analyze the sensitivity and robustness of the optimal solution across the perturbation of the optimal basis obtained from the simplex algorithm. The perturbation can be approximated by a given matrix added to the optimal basis. Some algebraic relations between the optimal solution and the solution of the perturbed instance are obtained.

■ WB16

C - Room 209A

Spatial and Dynamic Optimization Approaches for Conservation and Natural Resource Management

Sponsor: Energy, Natural Resources and the Environment/ Environment and Sustainability

Sponsored Session

Chair: Hayri Onal, Professor, Department of Agricultural and Consumer Economics, Univ of Illinois at Urbana-Champaign, Urbana, IL, United States of America, h-onal@illinois.edu

1 - Imposing Connectivity Constraints in Forest Planning Models

Rodolfo Carvajal, Georgia Tech, Depy. Industrial & System Engineering, Atlanta, GA, United States of America, rocarvaj@gatech.edu, Miguel Constantino, Marcos Goycoolea, Juan Pablo Vielma, Andres Weintraub

Connectivity requirements are a common component of forest planning models, with important examples arising in wildlife habitat protection. In harvest scheduling models, preservation concerns can be addressed by requiring large contiguous patches of mature forest to be left standing after harvest. We present a new integer programming methodology in this context and test it on real medium-sized forest instances available in the FMOS repository.

2 - A Network Formulation for Wildlife Corridors in Forest Harvest Scheduling Models

Rachel St. John, University of Washington, School of Forest Resources, Seattle, WA, 98195, United States of America, rkrieg@u.washington.edu, Sàndor Tôth

Wildlife habitat is an important forest ecosystem service. While many species of conservation concern require sufficient vegetative cover to move across the landscape, providing such protection can be challenging in intensively managed forest plantations. We propose a new network formulation for wildlife corridors in the context of spatially explicit harvest scheduling. The construct allows the corridors to change over time to ensure the maximization of timber revenues.

3 - Combining Contiguity and Compactness Criteria in Reserve Design

Hayri Onal, Professor, Department of Agricultural and Consumer Economics, Univ of Illinois at Urbana-Champaign, Urbana, United States of America, h-onal@illinois.edu, Sahan Dissanayake, Kevin Patrick

A linear integer programming formulation is developed to configure a conservation reserve considering spatial compactness and contiguity along with ecological and economic criteria. The model is applicable to both seeded and unseeded contiguity problems. The computational performance of this approach on real large scale data sets has been amazing. We present the model and empirical results.

■ WB17

C - Room 209B

Decision Analysis II

Contributed Session

Chair: Ursula Ott, Assistant Professor, Loughborough University, Ashby Road, Loughborough, LE11 3TU, United Kingdom, U.F.Ott@lboro.ac.uk

1 - Maverick Buying in Centralized Purchasing Organizations: Optimal Mitigation and Compliance Levels

Volker Groetsch, EBS Business School, Soehnleinstr. 8F, Wiesbaden, 65201, Germany, volker.groetsch@ebs.edu, Richard Pibernik, Alexander Rothkopf

Maverick buying (MB), i.e. non-compliant buying without using official channels and dedicated suppliers, is a major concern to many companies that are trying to achieve economies of scale in purchasing. We use a principal-agent type of setting to model different approaches that are commonly used to prevent MB and provide intuition into their effects. We show that these approaches are usually not suitable for achieving full compliance; alternative methods to reduce MB are proposed and evaluated.

2 - To What Extent Do USF MBA Graduates Employ Business Analytics Practices in Their Decision Making?

Mouwafac Sidaoui, Professor, University of San Francisco, 2130 Fulton Street, San Francisco CA 94117, United States of America, sidaoui@usfca.edu

This study is designed to explore the use of business analytics to improve decision making by recent USF MBA graduates and the benefits of using various analytical tools for achieving high results across functions in an organization. A multiple regression model will be constructed to determine to what extent USF MBA graduates employ business analytics into their decision making in their job function.

3 - Sabermetics: Analytics and Baseball

John Burbridge, Professor of Operations and Supply Chain Management, Elon University, 2075 Campus Box, Elon, NC, 27244, United States of America, burbridg@elon.edu

Sabermetrics is the search for objective knowledge in baseball. Recently researchers have been exploring a variety of topics that better explain why teams win or lose including better performance measures. For the past six years the author has been teaching a course Baseball and Statistics at Elon University that requires a research paper. For this session, it is proposed to provide an overview of sabermetrics and then discuss some of the more interesting research findings from these papers.

4 - In the Land of the Blind.... A Model of Double Sided Uncertainty for International Negotiations

Ursula Ott, Assistant Professor, Loughborough University, Ashby Road, Loughborough, LE11 3TU, United Kingdom, U.F.Ott@lboro.ac.uk

We use an intercultural double-sided incomplete bargaining mechanism for managerial players to analyze cultural learning. In a globalized world, managers have adapted to their organizations and have learnt to make decisions in a multi-cultural environment. The dynamics of their behavior ignores the deep-rooted cultural bargaining models people are brought up with. These models are relevant for managers who were educated and worked in Western countries, while growing up in the Middle or Far East.

■ WB18

C - Room 210A

Lot-Sizing

Contributed Session

Chair: Andrew Yu, Assistant Professor, Southern Methodist University, 3145 Dyer St., Dallas, TX, 75205, United States of America, yuj@lyle.smu.edu

1 - A Rounding Heuristic for Dynamic Lot-Sizing Problem with Congestion

Yong Ha Kang, Edward P. Fitts Department of Industrial & Systems Engineering, North Carolina State University, 400 Daniels Hall, College of Engineering, Raleigh, NC, 27695-7906, United States of America, yyjgj@korea.ac.kr, Reha Uzsoy

This study presents a rounding procedure for a multiple product single machine dynamic lot-sizing problem with congestion. We develop a nonlinear optimization model with clearing functions. Given the fractional solutions obtained by the nonlinear optimization model, we construct an approximate solution to the original problem by using a shortest path based rounding procedure.

2 - The Horizon Decomposition for Capacity Constrained Lot Size Problems

Ioannis Fragkos, PhD Candidate, University College London, Gower Street, London, United Kingdom, i.fragkos@ucl.ac.uk, Bert De Reyck, Zeger Degraeve

We introduce a new Danzig-Wolfe decomposition for Lot Size Problems, called the Horizon Decomposition. The problem horizon is partitioned in subsets of contiguous periods, and columns correspond to extreme points of short-horizon lot size problems. Computational experiments show that this approach leads to strong lower bounds. Our method is generic and can be applied to a wide variety of optimization problems.

3 - Solving Large Scale Capacitated Lot-Sizing Problems with Setup Times and Setup Carry-over

Hakan Karagul, PhD Candidate, North Carolina State University, 611 Smithdale Drive, Raleigh, NC, 27606, United States of America, hfkaragu@ncsu.edu, Don Warsing, Thom J. Hodgson

We propose two mixed integer linear programming (MILP) models to solve short-term, large-scale capacitated lot-sizing problems that allow carryover of setups across periods. One model is a modified version of an existing model in the literature and the other is unique. Through extensive computational testing, we identify the conditions under which our models outperform existing models, and we develop an efficient heuristic and evaluate its performance in solving these problems.

4 - Optimal Production Cycle with Stochastic Demand in a Two Stage Supply Chain

Yuanyuan Dong, Southern Methodist University, 3145 Dyer St., Dallas, TX, United States of America, ydong@smu.edu, Andrew Yu

This research studied a production lot sizing problem involving a retailer and a manufacturer. Customers purchase item randomly from retailer and retailer replenishes item from the manufacturer. Hence the inter-arrival time of the retailer's replenishment orders at the manufacturer is a stochastic process. An analytical model which determines the maximum on-hand inventory at the manufacturer, with the objective to minimize the total expected inventory and setup costs, is developed and solved.

■ WB20

C - Room 211A

Joint Session: Opt Global/Opt Network:Optimization in Wireless System

Sponsor: Optimization- Global Optimization/Optimization- Networks

Sponsored Session

Chair: Kangyuan Zhu, Software Researcher, CSSI, Inc, 8201 Corporate Drive, Sutie 750, Hyattsville, MD, 20785, United States of America, kz3y@virginia.edu

1 - The Coastal Seaspace Patrol Sector Design and Allocation Problem

Brian Lunday, Assistant Professor, United States Military Academy, Department of Mathematical Sciences, United States Military Academy, West Point, NY, 10996, United States of America, Brian.Lunday@usma.edu, Kevin Lunday, Hanif Sherali

We model the problem of designing and allocating coastal seaspace sectors for steady-state patrolling operations by a maritime protection agency, for which we construct a spanning forest of arborescences to cover the demand nodes and assure contiguity of each patrol sector. We present three alternative formulations, as well as selected symmetry defeating constraints, and conduct a computational comparison of their complexity to solve the problem for a representative instance.

2 - Integrated Mitigation and Restoration Problem for Infrastructure Systems

Burak Cavdaroglu, Rensselaer Polytechnic Insitute, 110 8th Street, CII Building Suite 5015, Troy, 12180, United States of America, cavdab@rpi.edu, William Wallace, John Mitchell, Thomas Sharkey

We address a network design problem that integrates pre-disaster mitigation of civil infrastructures and post-disaster restoration of services provided by these civil infrastructure systems for a set of realistic hurricane scenarios. Our model and optimization methods are tested on realistic data representing the interdependent infrastructure systems of New Hanover County, North Carolina.

3 - Linear Network Deployment Problems Accommodating Uncertain Transmission Range

Kangyuan Zhu, Software Researcher, CSSI, Inc, 8201 Corporate Drive, Sutie 750, Hyattsville, MD, 20785, United States of America, kz3y@virginia.edu, Stephen Patek

Typically the transmission range is assumed to be known and constant for nodes at different locations and directions. However, in practice it is highly uncertain a priori, even for homogeneous networks. In this paper, we explore physical layer models for estimating dynamic node connectivity in linear networks. We present a dynamic programming framework, as well as heuristics, for the linear network deployment to achieve the optimal network connectivity with limited network resources.

■ WB21

C - Room 211B

Stochastic Optimization with Application to Engineering Design

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Johannes Royset, Associate Professor, Naval Postgraduate School, Monterey, CA, United States of America, joroyset@nps.edu

1 - Mixed Continuous-Discrete Surrogate Models for Engineering Analysis

Patty Hough, Sandia National Laboratories, P.O. Box 969, MS 9159, Livermore, CA, 94551, United States of America, pdhough@sandia.gov

Surrogates are essential for mitigating the computational expense of simulation-based optimization and uncertainty analyses. We describe our experience with categorical regression, ACOSSO splines, and treed GPs for engineering simulations with both continuous and discrete parameters. We describe the principles and metrics used for evaluating these approaches, the characteristics of the test functions, and our numerical results. We discuss our observations regarding the merits of each approach.

2 - Optimal Engineering Design Using the Buffered Failure Probability

Johannes Royset, Associate Professor, Naval Postgraduate School, Monterey, CA, United States of America, joroyset@nps.edu, R. Tyrrell Rockafellar

The buffered failure probability is an alternative measure of reliability related to the conditional value-at-risk that offers several theoretical, practical, and computational advantages over the traditional failure probability. In this presentation, we examine algorithmic and computational issues when solving stochastic optimization problems involving the buffered failure probability.

3 - Constrained Global Optimization of a Paper Helicopter Based on Experiments

Raphael Haftka, Distinguished Professor, University of Florida, Mechanical and Aerospace Engineering, Gainesville, FL, 32611, United States of America, haftka@ufl.edu, Felipe A. C. Viana, Gerhard Venter, Richard Hamman

The Efficient Global Optimization (EGO) is often applied to design under uncertainty with assumed uncertainty distributions that may have little to do with reality. Here we apply it to experimentally minimizing the fall time of a paper helicopter (improving the time it takes to fall from a certain height) with substantial manufacturing and operating uncertainties. A classifier was used to reject infeasible designs. With this, we improved the initial fall time by 10%.

4 - Shape Optimization with Stochastic Dominance Constraints

Martin Pach, University of Duisburg-Essen, Forsthausweg 2, Duisburg, 47057, Germany, martin.pach@uni-due.de, Ruediger Schultz

We investigate the impact of uncertainty in shape optimization problems. In particular, we consider elastic structures under random forces. A formulation for shape optimization models with stochastic dominance constraints will be presented. Here, the shape function, e.g. compliance, is compared to a preselected benchmark random variable. The required numerical methods, these are level set methods and a grid generation algorithm, are discussed.

■ WB22

C - Room 212A

Applications of Nonlinear Optimization

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Frank E. Curtis, Lehigh University, 200 W. Packer Avenue, Bethlehem, PA, United States of America, frank.e.curtis@gmail.com

1 - A Localized Augmented Lagrangian Method for Minimizing the Kohn-Sham Energy

Marc Millstone, Research Staff Member, IBM T.J. Watson Research, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, mszetom@us.ibm.com

The combination of ever increasing computational power and new mathematical models has fundamentally changed the field of computational chemistry. One example of this is the use of new algorithms for computing the charge density of a molecular system from which one can predict many physical properties of the system. We present a new method for minimizing the Kohn-Sham energy that evaluates the energy and gradient functions at sparse iterates. Detailed numerical experiments are provided.

2 - Optimizing Coverage and Duration for a Chlamydia Trachomatis Screening Program

Nan Kong, Purdue University, School of Biomedical Engineering, West Lafayette, IN, United States of America, nkong@purdue.edu, Lanshan Han, Yu Teng

Chlamydia trachomatis infection, a major sexually transmitted disease, affects millions of people worldwide. A key public health challenge in controlling such a transmittable disease is how to cost effectively identify asymptomatically infected individuals through screening. We adapt a well-established system dynamic model for the transmission dynamics and formulate a parameter optimization problem to determine the optimal coverage and duration for a public screening program.

3 - Value Functions: Variational Properties and Applications to Inversion

Aleksandr Aravkin, University of British Columbia, Earth and Ocean Sciences, Vancouver, BC, Canada, saravkin@eos.ubc.ca, James V. Burke, Michael P. Friedlander

Striking the right balance between data-fitting and regularization is an important problem in many fields, including signal processing, compressive sensing, and seismic applications. Recent advances in sparsity promotion/regularization algorithms demonstrate the importance of understanding the variational properties of value functions with respect to perturbations of the feasible region. In this talk we present a broad class of problems where differentiability of the value functions can be established, and derivatives explicitly computed, with respect to perturbations of the level set of a regularization function. The results allow us to combine robust and sparsity promoting inversion techniques for large-scale applications.

■ WB23

C - Room 212B

Network and Power Issues in Homeland Security

Contributed Session

Chair: Sinan Tas, PhD Candidate, UW-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, tas@wisc.edu

1 - A Knapsack Approximation for the Shortest Path Network Interdiction Problem

Justin Yates, Texas A&M University, 237D Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States of America, jtyates@tamu.edu, Kavitha Lakshmanan

A modified shortest path network interdiction model is approximated by a constrained binary knapsack problem. The goal of this work is to develop a method for approximating the regional allocation of defense resources that maintains accuracy while reducing both computational effort and the sensitivity of computation time to network/regional properties. Statistical and spatial analysis methods are utilized to verify approximation performance of the knapsack method in two real-world networks.

2 - Addressing Protection, Robustness and Resilience in a Power System Vulnerability Model
Sinan Tas, PhD Candidate, UW-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, tas@wisc.edu, Vicki Bier

Most past methods of vulnerability assessment focus on reducing system vulnerability through protection or hardening of critical system components. We present a greedy heuristic model of vulnerability assessment that also addresses robustness (as measured by the potential for cascading failures) and resilience (as measured by component restoration times).

3 - Nuclear Detection Using Higher Order Learning
Christie Nelson, Ph.D. Student, Rutgers University, 23A Norwood Ct, Princeton, NJ, 08540, United States of America, cgrewe@eden.rutgers.edu, William M. Pottenger

The detection of potential nuclear materials is a challenging homeland security problem. This research reports on the application of a novel statistical relational learning algorithm, Higher Order NaÔve Bayes (HONB), to improve the detection and identification of nuclear isotopes. Traditional IID machine learning methods are applied to the area of nuclear detection, and the results compared with the performance of leveraging higher-order dependencies between feature values using HONB.

■ WB24

C - Room 213A

Mixed-Integer Programming Theory and Applications

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Simge Kucukyavuz, Ohio State University, 1971 Neil Avenue, Columbus, OH, United States of America, kucukyavuz.2@osu.edu

1 - Computational Study of Chance Constrained Linear Program
Feng Qiu, PhD Student, Georgia Tech, 765 Ferst Dr. Nw., Atlanta, GA, 30332, United States of America, fqiu@gatech.edu, Shabbir Ahmed, Santanu S. Dey, Laurence Wolsey

A general Chance Constrained Linear Program (CCLP) that has non-negative random coefficients on the left hand side is considered. We show this problem is generally NP-hard even though the probabilistically constrained system contains only one linear inequality. CCLP can be approximated using the Sample Approximation Approach (SAA). We propose several approaches to solve the SAA MIP model and present preliminary computational results.

2 - A Method for Computing the Efficient Frontier of Chance-constrained Optimization Models
Jim Luedtke, Assistant Professor, University of Wisconsin-Madison, 3236 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 5370, United States of America, jrluedt1@wisc.edu

Chance-constrained optimization models minimize cost while limiting the likelihood of a bad outcome to a specified level. This model can be seen as a bicriteria model with objectives of risk and cost, and hence it is important to explore the efficient frontier between these objectives by solving it for multiple risk levels. We describe how a recently introduced integer programming decomposition algorithm can solve this sequence of problems more efficiently than considering them separately.

3 - Arc-Residual Capacity Inequalities for Robust Network Design
Arie Koster, Professor Dr., RWTH Aachen University, Lehrstuhl II für Mathematik, Wüllnerstr. 5b, Aachen, 52062, Germany, koster@math2.rwth-aachen.de, Manuel Kutschka

Arc-Residual Capacity Inequalities are a well-known class of valid inequalities for capacitated network design problems. In robust network design demand uncertainty is modeled following the approach of Bertsimas and Sim (2003,2004). In this talk we generalize the class of arc-residual capacity inequalities to robust network design. Preliminary computational experiments will be presented to evaluate the effectiveness of the new inequalities.

4 - Exact Interdiction Models and Algorithms for Disconnecting Networks via Node Deletions
Siqian Shen, Assistant Professor, University of Michigan, Industrial & Operations Engineering, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, siqian@umich.edu, Roshan Goli, J. Cole Smith

We study the problem of maximizing the graph disconnectivity by deleting a subset of nodes. We consider three connectivity metrics: the number of components (which we attempt to maximize), the largest component size (which we minimize), and the minimum cost required to reconnect the graph (which we maximize). We formulate each problem as a MIP, and study valid inequalities for the first two objectives by examining intermediate dynamic programming solutions to k-hole subgraphs.

■ WB25

C - Room 213BC

Operations Management With Strategic Players

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Gad Allon, Northwestern University, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu

1 - Markdown Management: Pricing as a Signaling Device
Gad Allon, Northwestern University, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Ramandeep Randhawa, Achal Bassamboo

We study the classical revenue management scenario of a monopolist retailer selling to customers over a finite horizon. The retailer possesses information about the aggregate demand, whereas customers have private information on their valuations and are strategic. We study how the profit maximizing retailer strategically uses price as a signaling device.

2 - Revenue Sharing and Information Leakage in a Supply Chain
Guangwen Kong, Ph.D. Candidate, University of Southern California, 3670 Trousdale Parkway, Los Angeles, 90089, United States of America, Guangwen.Kong.2013@marshall.usc.edu, Raj Rajagopalan, Hao Zhang

Information sharing in a supply chain has many benefits but information leakage reduces the incentive to share information. An upstream supplier in a two-level supply chain may be better off by leaking information from an informed retailer to an uninformed retailer, reducing the incentive of the informed retailer to share information. We explore how a revenue sharing contract can reduce the incentive of upstream suppliers to leak information and when such a non-leakage equilibrium will exist.

3 - Saving Seats for Strategic Customers
Eren Cil, University of Oregon, 1208 University of Oregon, Eugene, OR, 97403-1208, United States of America, erencil@uoregon.edu, Martin Lariviere

We consider a firm serving two segments. The first segment requests a reservation while the second segment, who behaves strategically, walks in. The firm decides how much of its capacity to make available to reservation customers. When the reservation customers are more valuable, the firm may decline some reservation requests to bolster walk-in demand. When walk-ins are more valuable, the firm may save no capacity for walk-ins. Thus, it may be better to ignore rather than pamper walk-ins.

4 - Impact of Delay Announcement
Achal Bassamboo, Northwestern University, Evanston, IL, United States of America, a-bassamboo@kellogg.northwestern.edu, Qiuping Yu, Gad Allon

Many service system announce anticipated delay to the customers. In this paper, we explore the impact of such announcement. We study the data from a medium size call center where the customers are provided announcement concerning their delay. The data provides information about how long the customer stayed in system before they decided to abandon or entered service, whichever occurred first.

■ WB26

C - Room 213D

Consumer Driven OM Models

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Muge Yayla-Kullu, Assistant Professor, Rensselaer Polytechnic Institute, Lally School, 110 8th Street, Troy, NY, 12180, United States of America, YAYLAH@rpi.edu

1 - Advance Selling and Supply Chain Decisions
Xuying Zhao, University of Notre Dame, Mendoza College of Business, Notre Dame, United States of America, Xuying.Zhao.29@nd.edu, Kathryn Stecke, Zhan Pang

We study a two-level supply chain with a supplier and a newsvendor retailer who may adopt advance selling to consumers through pre-orders. The interaction between advance selling and supply chain decisions including prices and quantity is analyzed. We show the impact of a decentralized supply chain on a retailer's advance selling strategy.

2 - Pricing Policies for Heterogeneous Quality Products
Yalcin Akcay, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul, Turkey, yakcay@ku.edu.tr, Fikri Karaesmen

We study the pricing of inventories of items whose quality levels are heterogeneous. All else being equal, customers have preferences for higher quality items, while lower quality items tend to stay unsold longer. We investigate an environment where the same price is charged for the inventory but customers choose the best available items first. As inventory is depleted, adjusting the prices enables the seller to better exploit the current supply-demand mismatch.

3 - Is Better Place Really Better?: An Analysis of a New Electrical Vehicle Business Model
Serguei Netessine, Professor, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, serguei.netessine@insead.edu, Buket Avci, Karan Girotra

We analyze and compare a novel business model for the deployment of electric vehicles, best exemplified by Better Place (BP) to the traditional EV sales model. BP charges customers for the miles driven and establishes a network of battery swapping stations to enable rapid change of batteries. We compare BP model to the traditional EV sales model in terms of adoption and environmental impact. We also study the impact of different public policy mechanisms to reduce carbon emissions on both models.

4 - The Interplay between Perceived Quality and Resource Utilization: Does Product Size Matter?
Muge Yayla-Kullu, Assistant Professor, Rensselaer Polytechnic Institute, Lally School, 110 8th Street, Troy, NY, 12180, United States of America, YAYLAH@rpi.edu, Praowpan Tansitpong

We empirically investigate how the customer perceived quality and the resource consumption differences of products may impact product line decisions, and how they are related to firms' market performances. Using an international airline data set and path analysis methodology, we find that the firms that implement correct capacity utilization strategies during product line design make significantly more money than the firms that do not.

■ WB27

C - Room 214

Empirical Work in OM

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Baris Ata, Professor, Northwestern University, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, b-ata@kellogg.northwestern.edu

Co-Chair: Che-lin Su, Professor, University of Chicago Booth School of Business, 5807 S. Woodlawn Avenue, Chicago, IL, 60637, United States of America, che-lin.su@chicagobooth.edu

1 - The Impact of Schedules on Delays: understanding the Heterogeneity in Airline Scheduling Decisions
Mazhar Arikan, Purdue University, West Lafayette, IN, United States of America, marikan@purdue.edu, Vinayak Deshpande

From the systems approach point of view, delays in the US air transportation system is a symptom of poor customer service and ineffective resource planning. We present a study that investigates the drivers of the heterogeneity in airline scheduling decisions. Using publicly available flight data, we provide a method for forecasting scheduled on-time arrival probability for each US domestic flight, which captures the heterogeneity in various factors that affects the on-time arrivals.

2 - Empirical Analysis of Pricing in the Automotive Supply Chain
Antonio Moreno-Garcia, Northwestern University, Kellogg School of Management, Evanston, IL, United States of America, a-morenogarcia@kellogg.northwestern.edu, Christian Terwiesch

Demand for new automobiles has been subject to a very high volatility over the last few years, affected by the evolution of gas prices, the introduction of new products and the recent economic turmoil. Using a detailed dataset of the U.S. auto industry, we study how manufacturers respond to this increased volatility.

3 - Structural Estimation of Callers' Delay Sensitivity in Call Centers
Seyedmorteza Emadi, PhD Student, Kellogg School of Management, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, s-emadi@kellogg.northwestern.edu, Che-lin Su, Baris Ata, Zeynep Aksin

We model callers' decision making process in call centers as an optimal stopping problem. After each period of waiting a caller decides whether to abandon or to continue to wait. The utility of a caller is modeled as a function of his waiting cost and reward for service. We use random coefficient model to capture the heterogeneity of the callers. Using the data of individual calls made to an Israeli call center, we estimate the cost and reward parameters of the callers.

4 - Traffic Arrivals Into Retail Stores - Distributional Assumptions and Why They Matter?
Jayashankar Swaminathan, University of North Carolina at Chapel Hill, McColl Building, Chapel Hill, NC, United States of America, msj@unc.edu, Saravanan Kesavan, Vidya Mani

Most analytical work on customer arrivals into a retail store assume Poisson distribution for tractability. In this study, using hourly traffic data from a major retailer, we identify the underlying distribution of incoming traffic and explore the implications of incorrect arrival distributional assumptions on store planning and execution.

■ WB28

C - Room 215

Scheduling and Logistics

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: R. Logen Logendran, Professor, Oregon State University, School of Mech, Indust, and Mfgr Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, logendrr@engr.orst.edu

1 - Single Machine Carryover Sequence-Dependent Group Scheduling Problems in PCB Manufacturing
Mohammad Yazdani Sabouni, PhD Student, Oregon State University, School of Mech, Indust, and Mfgr Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, yazdanim@onid.orst.edu, R. Logen Logendran

We consider a single machine problem with carryover sequence-dependent setup time in PCB manufacturing. We introduce a setup time called external setup time and integrate it with the machine setup time. A branch-and-bound algorithm with a lower bound is developed to minimize the completion time of PCBs in a way repeated solutions or those inferior in quality can be identified. The algorithm can optimally solve small problems and for large problems we present its deviation from the lower bound.

2 - Supply Planning Models for JIT Manufacturing Environment with Remanufacturing and Reverse Logistics
Kyung Sung Jung, PhD Student, The Unversity of Texas at Dallas/School of Management, 800 W. Campbell Rd, SM30, Richardson, TX, 75083, United States of America, kysung63@utdallas.edu, Milind Dawande, Neil Geismar, Chelliah Sriskandarajah

A supply planning problem at the remanufacturer is studied. Optimal production plans are developed for different production strategies which are differentiated by whether inventories of products are carried, and the demand of retailers are resequenced. Production policies are devised to minimize the total cost. Effects of production capacity are also explored. A comprehensive computational study provides insights into this closed-loop supply chain for different production strategies.

3 - Group Scheduling on Unrelated-Parallel Machines
Mir Abbas Bozorgirad, PhD Student, Oregon State University, School of Mech, Indust, and Mfgr Engr., 204 Rogers Hall, Corvallis, OR, United States of America, bozorgim@onid.orst.edu, R. Logen Logendran

We develop a model to optimally solve the group scheduling problem on a set of unrelated parallel machines. We consider sequence-dependent setup times, machine eligibility, and dynamic job releases/machine availabilities. For large industry-size problems, a tabu search based algorithm is developed to minimize the weighted sum of total weighted completion times and total weighted tardiness to benefit both the producer and customers. Also, its applicability is demonstrated on an example problem.

■ WB29

C - Room 216A

Real Asset Valuation

Cluster: Quantitative Finance

Invited Session

Chair: Steven Golbeck, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, stevengolbeck2008@u.northwestern.edu

Co-Chair: Lingfei Li, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, lingfeili2012@u.northwestern.edu

1 - The Electricity Stack: Linking Coal, Gas, Power and Emissions Markets

Michael Coulon, Princeton University, 117 Sherrerd Hall, Princeton University, Princeton, NJ, 08544, United States of America, mcoulon@princeton.edu

Observed bidding of power generators shows the clear link between the dynamics of underlying fuel and emissions costs and resulting power prices. We propose an intuitive and tractable structural model, capturing key effects such as merit order changes, crucial for the pricing of spread options and the valuation of physical assets. We discuss the resulting dependence structure between energy prices, implications for option pricing and the availability of some closed-form expressions.

2 - Stochastic Models for Asset-backed Financing and Leasing

Steven Golbeck, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, stevengolbeck2008@u.northwestern.edu, Vadim Linetsky

We discuss a stochastic model for the valuation of leases and loans secured by assets that generate a stochastic service flow or rental stream to the owner-operator. In particular, we examine the impact of credit and asset risk on secured financing, and introduce a method to imply risk premia, due to asset volatility, from observed market spreads on secured financing transactions.

3 - An Eigenfunction Expansion Approach to Optimal Stopping with Applications to Commodity Derivatives

Lingfei Li, Northwestern University, Department of Industrial Engineering, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, lingfeili2012@u.northwestern.edu, Vadim Linetsky

In this paper, we solve the finite horizon discrete time optimal stopping problem for one-dimensional m-symmetric Markov processes using eigenfunction expansion. Under general conditions, we prove that the corresponding continuous time solution is the limit of the discrete time solution. As an application, we consider pricing Bermudan style commodity futures option under the SubOU model introduced in Li and Linetsky (2010), and obtain the American option value by extrapolation.

4 - Adaptive Algorithmic Trading with Market Impact

Shijie Deng, Georgia Institute of Technology, School of ISYE, Atlanta, GA, United States of America, deng@isye.gatech.edu, Jiangchuan Yuan, Jim Dai

We develop an adaptive trading algorithmic for trading large quantity of stocks. The objective is to minimize mean-variance of the "implementation shortfall" through trading off the market impact cost of fast-trading with the volatility risk from slow trading. By reformulating the problem into MDPs and using a parsimonious state representation, we obtain fully price-adaptive trading strategy that numerically outperforms alternative trading schemes proposed in existing literature.

■ WB31

C - Room 217A

Improving Efficiency in Healthcare Operations

Sponsor: Health Applications

Sponsored Session

Chair: Muer Yang, Assistant Professor, University of St Thomas, MCH 316, 2115 Summit Avenue, St Paul, MN, 55105, United States of America, yangmuer@stthomas.edu

1 - Reducing Length of Stay in Hospital Emergency Rooms through Process Redesign

Lijie Song, MIT-Zaragoza International Logistics Program, Edificio Nayade - Portal 5, c/bari 55, PLAZA, Zaragoza, Spain, lsong@zlc.edu.es, Nicole DeHoratius, Thomas Lee

Point of care (POC) testing is becoming increasingly popular in US hospitals as a way to speed up testing processes, reduce patient length of stay, and improve patient satisfaction. This study uses propensity score matching (PSM) to test the impact of POC versus central lab testing on patient length of stay, using two years of patient data collected at an American hospital. Our analysis shows a significant reduction in length of stay for patients that underwent POC testing.

2 - A Large Scale ICU Simulation Model with Blocking

Theologos Bountourelis, Post Doctoral Associate, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, United States of America, bountourelis@gmail.com, Spencer Nabors, Gilles Clermont, Louis Luangkesorn, Andrew Schaefer

As patients transition through Intensive Care Units, a lack of available beds in a requested unit may cause patient blocking leading to unnecessary costs. This work concerns the methodology behind the compilation, validation and calibration of a large scale ICU simulation model designed to predict patient blocking. The model is validated and calibrated using real patient blocking data derived from patient movement databases of a large hospital.

3 - Storing and Dispensing Medical Supplies – Taking Advantage of Technology

Claudia Rosales, Michigan State University, N301 North Business Complex, East Lansing, MI, 48824, United States of America, rosales@bus.msu.edu, uday Rao, Michael Magazine

Two-bin inventory systems have been used at hospitals to store and replenish large numbers of medical supplies. The adoption of RFID technology to track empty bins has enabled continuous time tracking of system conditions. We present a semi-Markov decision model for the two-bin system. We characterize the optimal replenishment policy. We validate our results with data obtained from a Canadian hospital where RFID-enabled two-bin systems are currently in use.

4 - Who is the Next Patient in ICU?

Muer Yang, Assistant Professor, University of St Thomas, MCH 316, 2115 Summit Avenue, St Paul, MN, 55105, United States of America, yangmuer@stthomas.edu, Michael Fry, Corey Scurlock

Mt. Sinai Hospital is struggling to respond to the high demand for Intensive Care Units (ICUs). Post-surgery, patients are generally transferred to the ICU. If no ICU bed is available, a scheduled surgery has to be postponed ó deferring the profits from surgery and costing both the hospital and the patient's health. Our goal is to help the hospital optimally schedule surgeries given the limited number of beds in ICU. Our solution method combines simulation and optimization techniques.

■ WB32

C - Room 217BC

High-Speed Rail: International Experience and Research Needs in US

Sponsor: Railway Applications

Sponsored Session

Chair: Xuesong Zhou, University of Utah, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu

1 - Analyzing the Influence of Train Operation Plan on Passenger Demands of High Speed Railway

Shiwei He, Professor, Beijing JiaoTong University, School of Traffic and Transportation, Beijing, 100044, China, shwhe@bjtu.edu.cn, Zuoyi Liu

This talk evaluates the potential market share of high speed rail (HSR) by calibrating the Nested Logit mode choice models. With the sample data of Wuhan to Guangzhou HSR in China, the relationship of the passenger volume split share proportion and the several key operation factors such as the train stop plan, operation frequency, operating time and fares are analyzed. The findings are valuable for predicting HSR market shares by improving the train operation plan.

2 - High Speed Rail Requirements in North America

Steven Harrod, Asst. Professor, University of Dayton, 300 College Park, Dayton, OH, 45459, United States of America, Steven.Harrod@udayton.edu

Multiple economic and demographic indicators (population, fuel cost) project that high speed rail will grow in importance in the United States and Canada. However, North America lags behind other nations in high speed rail operating mileage, and consequently, lags behind in research depth. Further, North America operates a much higher freight traffic density than Europe. Consequently, North American high speed rail requires greater investigation into shared network operations and scheduling.

3 - High-Speed Railway in Korea: Past, Present and Future
Jun Oh, Associate Professor, Western Michigan University, Kalamazoo, MI, 49008-5316, United States of America, jun.oh@wmich.edu, Yeonkyu Kim

The presentation talks about the high-speed railway in Korea. Korea's high-speed railway, called Korea Train Express (KTX), connects major cities in Korea along the Korea's major transportation corridor between Seoul and Busan. Its first stage was completed in 2004, and the second stage in 2010. KTX has greatly changed the intercity travel pattern and mode choices. Korea plans to expand the high-speed railway network for better rail services.

4 - An Integrated Optimization Model and Algorithm for Rail Train Operating Plan and Locomotive
Baohua Wang, Staff Researcher, IBM Research - China, Analytic & Optimization, Beijing, China, baohuaw@cn.ibm.com, Howard Rosen

Train operating plan and locomotive allocation are optimized in an integrated model. A continuous time-space network is constructed to describe the train plan while locomotives can be treated as a special kind of flow as well as cars which should be transported. The objective is minimizing the train operating cost and light travel of locomotives. There are some rules (maintenance and fueling, etc.) when allocating locomotives. The algorithm should take the rules into consideration.

■ WB33

C - Room 217D

Large-Scale Networks and Applications

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Abe Zeid, Northeastern University, Room 334SN, Boston, MA, United States of America, zeid@coe.neu.edu

Chair: Sagar Kamarthi, sagar@coe.neu.edu

1 - Exploring the Foreclosure Contagion Effect Using Agent-Based Modeling with Social Networks
Andrew Collins, Research Assistant Professor, VMASC, Old Dominion University, 1030 University Blvd, Suffolk, VA, 23435, United States of America, ajcollin@odu.edu, Seiler Michael, Nina Fefferman

The global financial markets have experienced a significant recession over the last several years; as a result the number of foreclosures has risen dramatically. Recent studies have shown reduction in real-estate values due to neighboring foreclosures. This presentation shows the results from applying an agent-based model to explore the foreclosure contagion effect including imposing a social network on the model to investigate the impact of strategic defaults becoming more socially acceptable.

2 - A Decision on Innovativeness Focusing on an Efficient Social Network Structure
Oguz Cimenler, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, Tampa, FL, 33620, United States of America, ocimenle@mail.usf.edu, Kingsley A. Reeves

This paper describes our work towards determining the potential innovativeness of an individual in a social network. To accomplish this, we will compute the number of appearances that a particular node has in the complete graphs that are found.

3 - Community Detection in Social News Websites
Roja Bandari, Ph.D. Student, UCLA, 56-125B Engineering IV Building, los angeles, CA, 90095, United States of America, roja.bandari@gmail.com, Hazhir Rahmandad

Social news websites, where users post, read, and rate stories, are now an integral part of the online experience. Detecting the social communities underlying these websites is hard due to their complex dynamics and lack of benchmark graphs. We develop validation methods and find appropriate algorithms for detection of community structures from the voting patterns in these contexts. The approach is tested on data from a large social news website.

4 - Reliability Evaluation Using Fuzzy Sets for Systems with Continuous Performance Degradation
Zhaojun Li, University of Washington, Department of Industrial and Systems Eng, Box 352650, Seattle, WA, 98105, United States of America, zjli@uw.edu, Kailash Kapur

This paper proposes a new approach to model reliability for a system using fuzzy sets. The fuzzy success membership function is defined over the universal set of performance degradation. For systems with continuous performance levels, it is shown that the time to fuzzy failure can be modeled as a fuzzy random variable. The membership function for the expectation of TTFF can be evaluated using the decomposition theorem or extension principle with theoretical results showing their equivalency.

5 - Robust Optimization Approach to Uncertain Redundancy Allocation Problems
Mohammadjavad Feizollahi, Student, Georgia Institute of Technology, 1760 Northside Dr. N.W., Apt:102, Atlanta, GA, 30318, United States of America, feyzollahi@gmail.com, Mohammad Modarres, Shabbir Ahmed

We consider redundancy allocation in series-parallel reliability optimization problems and develop linear equivalent mixed integer programming and binary models. Then, we consider interval and budgeted uncertainty in component reliabilities, develop the robust counterparts of the problems, and develop different methods to solve them. Finally, we compare these methods with respect to their relative computational performance and examine the quality of robust solutions by simulation.

■ WB34

C - Room 218A

Operations Research in the Federal and Governmental Sectors

Sponsor: Health Applications

Sponsored Session

Chair: Lawrence Fulton, Texas State University, 601 University Drive, San Marcos, TX, 78108, United States of America, lf25@txstate.edu

1 - Optimizing Army MEDEVAC Helicopter Emplacement: A Scenario-based, Multi-criteria Modeling Approach
Nathaniel D. Bastian, Center for AMEDD Strategic Studies, U.S. Army Medical Department Center & School; Center for Operations Research in Medicine and Healthcare, Georgia Institute of Technology, 94-277 Makapipipi St Apt 121, Mililani, HI, 96789, United States of America, nathaniel.bastian@fulbrightmail.org

The U.S. Army's health service support system remains particularly effective by employing aeromedical evacuation (MEDEVAC) assets to efficiently evacuate casualties from the battlefield. Military commanders in Afghanistan have faced a significant combinatorial challenge integrating these life-saving yet limited assets into a comprehensive system for the entire combat theatre. This work describes a scenario-based, multi-criteria modeling approach to optimize Army MEDEVAC helicopter emplacement.

2 - Manpower Optimization Models in Army Healthcare
Pat Downes, PhD Student, McCombs School of Business, University of Texas, 1 University Station, B6000, Austin, TX, 78712-1178, United States of America, Patrick.Downes@phd.mccombs.utexas.edu

The U.S. Army's Medical Department (AMEDD) uses goal programming models to manage manpower policies. AMEDD models determine the annual number of officer accessions and promotions to meet the Army's personnel requirements. This research investigates whether a single optimization model encompassing the six diverse career management branches might be implemented as a decision support tool to ensure truly optimal manpower planning policies.

3 - A Discrete Event Simulation of Future Aerial Vehicles
Lawrence Fulton, Texas State University, 601 University Drive, San Marcos, TX, 78108, United States of America, lf25@txstate.edu

We use discrete event simulation to estimate the effects of emerging aerial capability in executing the scout, attack, and medical evacuation missions given certain military scenarios. The results of the discrete event simulation will be used to inform both civilian and military decision makers regarding cost-utility trade-off considerations. Manipulated variables include speed, survivability, lift capacity, hover capability, payload capability, maintenance characteristics, and others.

■ WB35

C - Room 218B

Quality Management

Contributed Session

Chair: Raja Jayaraman, Assistant Professor, Khalifa University of Science, Technology & Research, P.O. Box 127788, Abu Dhabi, United Arab Emirates, raja.jayaraman@kustar.ac.ae

1 - Non-GE Six Sigma

Thong Goh, Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, isegohtn@nus.edu.sg

After a quarter of a century, Six Sigma – and its variants such as Design for Six Sigma and Lean Six Sigma – is still being promoted frequently on the basis of greed and fear: greed for the promise of three hundred thousand dollars return per project, and fear because figures seem to show that ninety-nine percent defect-free is "not good enough." What's more, "If GE can, why can't we?" So the question is, does Six Sigma have to be promoted this way? Or, indeed, is Six Sigma the only way?

2 - Six Sigma Program Evaluations in Healthcare: A Case Study

Andres David Gonzalez, Universidad de los Andes, Cra 1 Este #19A-40, Bogota, Colombia, david-g1@uniandes.edu.co, Raha Akhavan-Tabatabaei

We present a case study for evaluating the effect of Six Sigma program in a medical hospital over its ten years of operation. A set of over ninety Six Sigma projects is evaluated for their impact on the organizational strategic objectives, financial benefits, organizational culture and sustainability of results.

3 - Optimization of Pro-Rata Warranty Models with Burn-in Criteria

Raja Jayaraman, Assistant Professor, Khalifa University of Science, Technology & Research, P.O. Box 127788, Abu Dhabi, United Arab Emirates, raja.jayaraman@kustar.ac.ae, Edward Pohl, Timothy Matis

Designing optimal product warranties include issues such as reliability, product conformance, customer satisfaction besides minimizing expected costs for servicing. In this presentation we develop a new warranty model considering burn-in and pro-rata costs for servicing product warranties.

■ WB37

C - Room 219B

Complex Systems Quality Monitoring and Control

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Hui Yang, Assistant Professor, University of South Florida, 4202 E Fowler Avenue ENB118, Tampa, FL, 33647, United States of America, huiyang@usf.edu

1 - Fault Diagnosis Using Relevance Vector Machine for underdetermined Multistage Assembly Processes

Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu, Kaveh Bastani, Wenzhen Huang

Fault diagnosis has a significant impact on providing high quality products in multistage assembly processes. Various diagnosis methodologies have been proposed based upon product quality measurements. They mostly focus on determined multistage cases where the number of measurements is greater than the number of error sources. This paper proposes a diagnosis method integrating state space approach and relevance vector machine for underdetermined cases that have not been systematically studied.

2 - Multiscale Recurrence Analysis of Long-term Nonlinear and Nonstationary Time Series

Hui Yang, Assistant Professor, University of South Florida, 4202 E Fowler Avenue ENB118, Tampa, FL, 33647, United States of America, huiyang@usf.edu, Yun Chen

Recurrence analysis is a powerful tool to characterize nonlinear and nonstationary behaviors in complex systems. However, recurrence computation is highly expensive as the size of time series increases. To address the problem of large-scale recurrence computation, we have investigated the recurrence dynamics in multiple wavelet scales as oppose to the traditional single scale. This presented paper experimentally demonstrates the effective applications in complex systems.

3 - Change Point Problems in Complex Data from Health Care and Clinical Area

Sung Won Han, Researcher, University of Pennsylvania, 423 Guardian Dr, Philadelphia, PA, United States of America, hansungw@mail.med.upenn.edu

The detection of the change point or the starting point of drop-down is one of the key problems in health care and biostatistics. However, the recent data from diseases spreading or clinical area in hospitals are so complex that the existing methods may not work well. In this presentation, we discuss several challenging issues in the change-point problems from complex data and propose better approaches based on the likelihood ratios or the reproducing kernel Hilbert space-based spline.

4 - Postsurgical Complication Patterns Based on Laboratory Test Results and Electrical Heart Signals

Diego Martinez, PhD Student, University of South Florida, 4202 E Fowler Avenue, ENB 118, Tampa, FL, United States of America, Monica Puertas, José L. Zayas-Castro, Peter Fabri, Hui Yang

The objective of the proposed research is to develop an alarm system that monitors post-surgical patients using laboratory blood test results and electrical heart signals; cardiovascular surgery is used as a prototype. The system will help physicians to timely identify and assess the risk of complications and death during the patient's recovery cycle, advancing the provision of personalized patient care.

■ WB38

H- Johnson Room - 4th Floor

Vehicle Routing Problem

Contributed Session

Chair: Ertan Yakici, Middle East Technical University, Ankara, Turkey, rtnykc@gmail.com

1 - Ant Colony Optimization (ACO) Solution for Split Delivery Vehicle Routing Problem (SDVRP)

Joseph Wilck, University of Tennessee, Knoxville, 411 East Stadium Hall, Knoxville, TN, 37996, United States of America, joe.wilck@gmail.com, Gautham Rajappa

Split Delivery Vehicle Routing Problem (SDVRP) is a relaxed form of Capacitated Vehicle Routing Problem (CVRP) in which a customer can be visited by more than one vehicle i.e. customers can be assigned to multiple routes. An Ant Colony Optimization based algorithm is presented to solve the SDVRP and is tested on benchmark test problems.

2 - A Heuristic Method for Solving Capacitated Team Orienteering Problem

Behrooz Kamali, Ph.D. Student, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, kamali@vt.edu, Leily Farrokhvar, Ashlea Bennett

In a given network, there are profits and demands associated with each vertex and travel times associated with each edge. A fleet of capacitated vehicles, each constrained by a travel time limit, is to serve these vertices. Each vehicle is only allowed to serve one vertex. The goal in this problem, which is called capacitated team orienteering problem (CTOP), is to maximize the collected profit. We propose a heuristic to solve this problem for large instances and present the numerical results.

3 - Parallel Strategies for Rich Large-Scale VRP's

Arne Lökketangen, Professor, Molde University College, Briveien 2, Molde, 6411, Norway, arne.lokketangen@himolde.no, Jianyong Jin, Teodor Gabriel Crainic

We look at various strategies for communication and cooperation between parallel cooperative meta-heuristic solvers for rich, large-scale VRP's. Results on the solution quality and the robustness aspects of the resulting solver system will be presented.

■ WB39

H - Morehead Boardroom -3rd Floor

Service in E-Business and Pricing

Sponsor: E-Business

Sponsored Session

Chair: Jianqing Chen, The University of Texas at Dallas, School of Management, Richardson, TX, United States of America, chenjq@utdallas.edu

1 - Software-as-a-Service Model: Elaborating Client-side Adoption Factors

Mingdi Xin, Assistant Professor, University of British Columbia, Sauder School of Business, 660-2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, Mingdi.Xin@sauder.ubc.ca

The Software-as-a-Service (SaaS) model is emerging as a viable outsourcing option. SaaS model employs the new multi-tenant architecture, which makes this outsourcing model quite intriguing. In this paper we investigate clients' side determinants of SaaS adoption. We draw on economic, strategic management, and Information Systems theories to develop an empirical framework. A pilot study using data collected from an online survey provides interesting suggestive results on the empirical framework.

2 - Does Service Quality Guarantee High Prices Online? An Integrated Model and Empirical Test

Jifeng Luo, Assistant Professor, Shanghai Jiao Tong University, 535 Fahuazhen Road, Shanghai, China, jifengluo@gmail.com

The advent of the Internet has led to a proliferation of empirical work on price differences. Empirical studies suggest that a negative relationship between service quality and prices rather than a positive one is often found in online markets. An integrated model is proposed to accommodate the gaps between theories and reality. Online price data on 106 randomly selected books was collected and used for empirical tests. Our theoretical results are generally supported.

3 - An Economic Analysis of Online Advertising Using Behavioral Targeting

Jianqing Chen, The University of Texas at Dallas, School of Management, Richardson, TX, United States of America, chenjq@utdallas.edu, Jan Stallaert

Behavioral targeting, under which users are presented with advertisements based on their past browsing and search behavior and other available information (e.g., hobbies registered on a website), has been hailed as the new "Holy Grail" in online advertising. In this paper, we study the economic implications when an online publisher engages in behavioral targeting.

■ WB40

H - Walker Room - 4th Floor

Organizational Learning

Sponsor: Technology Management

Sponsored Session

Chair: Charles Weber, Associate Professor, Portland State University, P.O. Box 751, Engineering and Technology Management, Portland, OR, 97207, United States of America, webercm@gmail.com

1 - The Effect of Problem Population Demographics on Organizational Learning

Marcelo Pancotto, Professor, IAE Business School, Mariano Acosta s/n y Ruta Nac. 8, Casilla de Correo Nro 49, Pilar, BA, 1629, Argentina, mpancotto@iae.edu.ar

This paper contributes to research on organizational learning by defining and estimating metrics on problem population demographics, and testing their effect on quality improvement learning curves at 17 automobile assembly plants. Problem category frequency distributions follow a Power Law distribution, with high problem population diversity and low frequency counts even among the most frequent problems. These two problem population characteristics are associated to lower learning rates.

2 - The Effect of Learning and Integration Investment on Manufacturing Outsourcing Decisions

Wenli Xiao, Ph.D. Candidate, College of Management, Georgia Institute of Technology, 800 West Peachtree NW, Atlanta, GA, 30308, United States of America, wxiao6@gatech.edu, Cheryl Gaimon

In a two-period game, a buyer determines the portion of demand to manufacture in-house versus outsource; the supplier determines the price and the investment in integration process improvement. The buyer realizes learning in its manufacturing and outsourcing costs. The supplier realizes learning in its manufacturing cost. We show how the supplier's price and integration investment decisions interact with the buyer's outsourcing decision and how both firms' decisions are impacted by learning.

3 - Knowledge Management Strategies for Product and Process Design Teams

Gulru Ozkan, Assistant Professor, Clemson University, Department of Management, 101 Sirrine Hall, Clemson, SC, 29634, United States of America, gulruo@clemson.edu, Cheryl Gaimon, Stelios Kavadias

A manager's knowledge creation strategy for product and process design teams developing a single new product is examined. Knowledge development for each team and knowledge transfer between teams create knowledge that increase levels of product and process performance (after the errors in design knowledge is recovered) which in turn drive expected net revenue. Results include the impact of rates of recovery from errors and drivers of expected net revenue on dynamic knowledge creation strategies.

■ WB41

H - Waring Room - 4th Floor

Research and Development Planning

Contributed Session

Chair: Maryam Hafezi, Wilfrid Laurier University, 75 University Avenue West, Waterloo ON N2L 3C5, Canada, hafe1390@mylaurier.ca

1 - Communicating the Value of Intangibles: The Role of Capitalization and Patent in the Software Industry

Pantea Alirezazadeh, Uconn, 2100 Hillside Rd. Unit 1041, Storrs, CT, 06269, United States of America, pantea.alirezazadeh@business.uconn.edu, Amit Mehra, Ram Gopal, Sarah Rice

This study examines the relationship between patent filings and the practice of capitalizing of software development costs. We explore the impact of successfully issued patents and the firm's capitalization choice, on information asymmetry between the firm and the market, analysts' forecast error, and the cost of equity capital.

2 - A Centralized versus a Global Approach: Case Study of the Expansion Into Global Software Development

Mark Colosimo, Global Director of Integrated Analytics, Urban Science, 200 Renaissance Center, Suite #1800, Detroit, MI, 48243, United States of America, macolosimo@urbanscience.com

In transforming an organization into a global, flexible organization from centralized, team-based product teams, a point of change is necessary. At Urban Science, this point occurred as the need for a new product surfaced, centralized resources were limited, and the deadlines were imminent. In order to overcome obstacles, a diverse group of resources had to be organized and managed. This case focuses on how this was accomplished and the lesson learned that could be applied to future scenarios.

3 - The Design of Green Product: The Impact of Development Cost

Maryam Hafezi, Wilfrid Laurier University, 75 University Avenue West, Waterloo, ON, N2L 3C5, Canada, hafe1390@mylaurier.ca, Chunming Shi

In this research, we investigate the effect of product development cost on the decision of monopolist for selecting the proper product development strategies (Mass marketing versus Market segmentation) when a durable product is differentiated on two dimensions of qualities; called environmental and traditional quality. Our model is also considering the consumer's intensity of preference for the quality of product and their willingness to pay. The environmental and economic consequences according to environmental quality, potential profit and total greenness of monopolist's decision are provided at the end.

■ WB42

H - Gwynn Room - 4th Floor

Personalized Recommender Systems

Sponsor: Information Systems Society

Sponsored Session

Chair: Nachiketa Sahoo, Visiting Assistant Professor, Carnegie Mellon University, 5000 Forbes ave, Posner 233A, Pittsburgh, PA, 15213, United States of America, nsahoo@cmu.edu

1 - Expecting the Unexpected: On Unexpectedness in Recommender Systems

Alexander Tuzhilin, Professor of Information Systems, Stern School of Business,New York University, 44 West 4th Street, Room 8-92, New York, NY, 10012, United States of America, ATuzhili@stern.nyu.edu, Panagiotis Adamopoulos

We propose a new concept of unexpectedness as recommending those items that depart from what the user expects from a recommender system. We define and formalize this concept and discuss how it differs from the related notions of novelty, serendipity and diversity. We also propose to measure the quality of unexpected recommendations using a certain utility function. Finally, we present algorithms for providing unexpected recommendations and compare our results with some other baseline methods.

2 - Maximizing Accuracy and Stability of Recommender Systems: A Meta-Learning Approach

Gediminas Adomavicius, University of Minnesota, 321 19th Avenue South, Minneapolis, MN, United States of America, gedas@umn.edu, Jingjing Zhang

Recommendation stability is a desired property that measures the consistency of predictions. Prior research has suggested that some popular recommendation algorithms can be highly unstable. We propose a novel meta-learning approach that can be integrated with different recommendation techniques to maximize stability. Experimental results suggest that our proposed approach can achieve substantially higher stability as compared to traditional algorithms, while also improving predictive accuracy.

3 - Count Amplification in "Top-N" News Recommender Systems

Balaji Padmanabhan, Anderson Professor of Global Management, University of South Florida, Tampa, FL, United States of America, bp@usf.edu, Shankar Prawesh

We focus on a common method used by media sites of recommending the N most viewed articles. For this "Top-N" recommender we show that the marginal next article - which may have just missed making the cutoff - is unduly penalized under simple user models. Small differences initially are easily amplified. Probabilistic selection, a simple variant that we propose and study here, creates no such artificial penalty. We present analytical and simulation results to illustrate our findings.

■ WB43

H - Suite 402 - 4th Floor

Modelling Energy Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Augusto Rupérez Micola, Universitat Pompeu Fabra, Ramon Trias Fargas 25, Barcelona, Spain, augusto.ruperezmicola@gmail.com

1 - Modeling Returns to Scale in an Integrated Assessment Model

Erin Baker, Associate Professor, University of Massachusetts, Amherst, Amherst, MA, United States of America, edbaker@ecs.umass.edu, Greg Nemet, Robert Barron

We investigate the optimal portfolio of technology policies, choosing among R&D investment and subsidies. We consider solar PV in the context of climate change, and under the assumption of increasing returns to scale. We add technology competition and increasing returns to scale into a modified version of the DICE Integrated Assessment Model.

2 - Reaction-consistent Equilibria and the Central Weakness of Oligopoly Theory

Frederic Murphy, fmurphy@temple.edu, Steve Kimbrough, Yves Smeers

The Cournot model assumes that each player believes that the other players will not respond to its actions. We change the Cournot model by assuming each player has beliefs consistent with the reactions of the other players. The resulting equilibria differ from many recent results of oligopoly theory. We use agent-based models to find reaction-consistent equilibria in markets and thereby to better represent player behavior.

3 - Being Held Back by the Old: Technological Adoption in the Energy Industry

Ekundayo Shittu, Tulane University, A.B. Freeman School of Business, New Orleans, United States of America, eshittu@tulane.edu, Carmen Weigelt

To understand the strategic mechanisms driving the adoption of new technologies, we examine how energy firms' competitive advantage is shaped by inter-temporal regulatory and market prescriptions. We apply time series cross-sectional model on firm-level data with prevailing regulations to test hypotheses on the institutional characteristics of adoption. We present outcomes on the influences of green demand, knowledge complementarity, market share, and network effects on adoption strategies.

4 - Production Intermittence in Spot Markets

Augusto Rupérez Micola, Universitat Pompeu Fabra, Ramon Trias Fargas 25, Barcelona, Spain, augusto.ruperezmicola@gmail.com

We address three questions, Does supply variability influence market prices?, does asset ownership mediate on the variability effects? and what is the impact of replacing reliable by intermittent capacity, as opposed to keeping them both? We study these questions analytically, and through simulations to find that the relationship between intermittent capacity and prices is negative and strongly influenced by pivotal dynamics and asset ownership.

■ WB44

H - Suite 406 - 4th Floor

Supply Chain Management II

Contributed Session

Chair: Asli Sencer Erdem, Associate Professor, Bogazici University, Department Management Information Systems, Hisar Campus, Bebek, Istanbul, 34342, Turkey, asli.erdem@boun.edu.tr

1 - Supply Chain Contract Design with Extended Warranties

Kunpeng Li, Sam Houston State University, 1821 Avenue I, Huntsville, TX, United States of America, kli@shsu.edu, Suman Mallik, Dilip Chhajed

We designed supply chain contracts in the extended warranty market. We studied two commonly observed practices of selling extended warranties: through the manufacturer and through the retailer. We identify the different causes of inefficiencies in each of the two decentralized models and propose coordination mechanisms that eliminate the inefficiencies. We then provide contracts to achieve both coordination and a Pareto improvement over a wholesale price contract.

2 - Sales Forecast Inaccuracy and Inventory Turnover Performance:An Empirical Study of US Retail Sector

Gulsah Hancerliogullari, PhD Student, Old Dominion University, Engineering Management & Systems Enginee, 241 Kaufman Hall, Norfolk, VA, 23529, United States of America, ghancerl@odu.edu, Alper Sen, Esra Agca

An empirical model is developed to investigate the impact of various financial measures on inventory turnover performance. In particular, we use inaccuracy of quarterly sales forecasts as a proxy for demand uncertainty and study its impact on firm level inventory turnover ratios. The model is implemented on a sample financial data for 304 publicly listed U.S. retail firms for the 25-year period 1985-2009.

3 - Capacity Option Transfer Rights: When and How Do They Benefit Suppliers?

Linlin Li, Northwestern University, 2145 Sheridan Road, Room C210, Evanston, IL, 60201, United States of America, linlinli2008@u.northwestern.edu, Izak Duenyas, Seyed Iravani

We consider situations where firms buy option to use the capacity of suppliers. We explore whether suppliers should provide transfer rights such that, a firm that cannot use all its reserved capacity can sell it to another firm that may need more. Comparing three strategies, we find that providing transfer rights to the buyers is better for the supplier than reserving transfer rights to itself in many cases. We provide managerial insights of the tradeoff between two typical transfer strategies.

4 - Customer Experience Management through Supply Chain Management

Hyejeong Gwon, Graduate student, Korea University, Room #516 main Bldg.of business school, Anam-dong, Seongbuk-gu, Seoul, Korea, Republic of, 11ku11@korea.ac.kr, Daeki Kim

Managing customer experience is essential in the competitive business environment. Customer experience management represents a business strategy designed to enhance customer experience all the time. It could be affected by many operations activities. In this research, we will propose some SCM topics which have the potential effect on customer experience.

5 - A DSS for Generating Optimal Raw Milk Management Strategies in a Dairy Supply Chain

Asli Sencer Erdem, Associate Professor, Bogazici University, Department Management Information Systems, Hisar Campus, Bebek, Istanbul, 34342, Turkey, asli.erdem@boun.edu.tr, Burak Gul

Raw milk in dairy system has high supply seasonality that contradicts with the demand. The inventory alternatives are very limited and demand is highly sensitive to lost sales. In this study, a mathematical model is developed to find an optimal mix of strategies that considers the whole raw milk management system. The model is embedded into a DSS where the user interface design is developed by the new generation Microsoft Ribbon interface. The DSS is applied in a real diary system.

■ WB45

H - Suite 407 - 4th Floor

Reliability

Contributed Session

Chair: Carlos Solorio, Assistant Professor, CETYS Universidad, Calz. CETYS s/n, Mexicali, Mexico, carlos.solorio@cetys.mx

1 - A Comparison of Metaheuristic Algorithms for Multiple Multi-level Redundancy Allocation Problem

Jae-Hwan Kim, Korea Maritime University, #1813, Taejong-ro, Yeoungdo-Gu, Busan, Korea, Republic of, jhkim@hhu.ac.kr, Kil-Woong Jang

We consider a MMRAP (Multiple Multi-level Redundancy Allocation Problem) in which all available items for redundancy (system, module, and component) can be simultaneously chosen. A tabu search of memory-based mechanisms is proposed for its solution. Our algorithm is compared with the memetic algorithm which is the best in the literature on the benchmark problems. Computational results show that the tabu search substantially outperforms the memetic algorithm.

2 - A Monte Carlo Method for Estimating the Global Reliability of General Networks

Jesús A. Rodrìguez-Sarasty, Pontificia Universidad Javeriana - Cali, Calle 18 No. 118-250, Cali, Colombia, rodriguez@ingenieros.com, Noel Artiles-Leon

Global Reliability is defined as the probability that there exists at least one path between each pair of nodes in a network. In telecommunications networks this is an important reliability measure whose assessment is known to be an NP-Hard problem. By means of network reductions, necessary and sufficient connectivity conditions, efficient connectivity evaluation methods and variance reduction techniques, we propose an algorithm for estimating the Global Reliability of general networks.

3 - Use of the Disutility Function on Dynamic Reliability Bounds for Multi-state Systems

Carlos Solorio, Assistant Professor, CETYS Universidad, Calz. CETYS s/n, Mexicali, Mexico, carlos.solorio@cetys.mx, Kailash Kapur

The disutility function captures the customer's preferences and is important to consider it when evaluating the performance of a system. Performance measures are used to compare multi-state systems with multi-states components which degrade over time. Computing dynamic reliability bounds for performance measures is easier than calculating exact values because it is computationally complex. Bounds are proposed for modeling system degradation using the homogeneous continuous time Markov process.

4 - Optimal Control of Stochastically Failing Systems with Costly Partial Information

Michael Kim, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, kimmi@mie.utoronto.ca, Viliam Makis

We model a partially observable deteriorating system subject to random failure. The state process follows an unobservable continuous time homogeneous Markov process. At equidistant sampling times multivariate observations that are stochastically related to the state process are obtained at a positive cost. Structural properties of the optimal control policy are analyzed, and it is shown that a control limit policy is optimal for the practical 3-state version of the problem.

■ WB46

H - Suite 403 - 4th Floor

Individuals in Organizations II

Contributed Session

Chair: Mengxiao Zhu, 2145 Sheridan RD, C210, Evanston, IL, 60208, United States of America, mzhu@northwestern.edu

1 - Karasek's JDCS Model in China: Test and Extension

Mi Zhou, School of Management, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an,China, Xi'an, 710049, China, zhoumi@mail.xjtu.edu.cn, Xiping Zhao, Xin Zhao

Employing data of 357 Chinese nurses, this article tests Karasek's Job Demands-Control-Support Model, finding that the two stress-relieving factors (job control and social support) cannot take effect simultaneously. In view of individual differences, this study introduces self-efficacy, and proposes that either the match between job control and high self-efficacy or the match between social support and low self-efficacy can relieve work stress. Results support hypotheses and the expanded model.

2 - Psychological Empowerment Mechanisms Linking Service Support to Job Satisfaction: A Moderated Mediation

Jianling Wang, Nanjing University of Aeronautics and Astronautics, 29# Yudao Street, Economics and Managemnt College, Nanjing, 210016, China, WJL7520@126.com, Shan Li, Robin Qiu

This study examined the association between superior support and job satisfaction, and data included measures of psychological empowerment and fit as well. Using a survey from automobile repair service employees, the authors tested the proposed relationships. Results demonstrated that empowerment and fit represent key mechanisms in determining how support is associated with team performance.

3 - Individual and Network Motivations for Assembling Into Project Teams

Mengxiao Zhu, 2145 Sheridan RD, C210, Evanston, IL, 60208, United States of America, mzhu@northwestern.edu, Yun Huang, Noshir Contractor

This study investigates motivations for individuals to assemble in project teams. Using Bipartite Exponential Random Graph Models (or p*), we investigated players' assembly into combat teams in an online game. Results show that people are more likely to join project teams to satisfy individual and social interests and accomplish difficult tasks. Further, individuals were more likely to choose teammates who have complementary skills, similar status or age, and same organization affiliation.

4 - The Effect of the Norm of Reciprocity on Organizational Citizneship Behavior: An Experimental Research

Jing Yan, Xiían Jiaotong University, School of Management, No.28, Xianning West Road, Xi'an, 710049, China, yj04081008@163.com, Yun Fan

The norm of reciprocity has effect on organizational citizenship behavior(OCB)by two ways:the obligation to reciprocite and the expectation to reciprocite.Using experimental methods, we design two scenarios to reflect the two ways of influence.Then it analyzes OCB with different other-orientation.The experimental results indicate that, facing the obligation,employees with higher other orientation exert more OCB;facing the expectation,employees with lower other orientation exert more OCB.

5 - How Different Mass, Lean and STS Are: from Social Capital and Organizational Learning Perspective

HoWook Shin, Michigan State University HRLR, 6125 Buckden Way, Apt 2i9, East Lansing, MI, 48823, United States of America, moltke777@gmail.com

High performance work system (HPWS) is characterized by an employee participation, HR practices increasing workforce skills, and higher level of wages. In this paper, I advance the theory of HWPS by comparatively analyzing traditional mass production system, LS, and STS in terms of social capital and organizational learning that have the most significant implications on HPWS because employee involvement and continuous improvement are two most representative characters of HPWS.

■ WB47

H - Dunn Room - 3rd Floor

Reverse Logistics and Supply Chain II

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Guoqing Zhang, Professor, University of Windsor, Department of Industrial Engineering, 401 Sunset Avenue, Windsor, ON, N9B3P4, Canada, gzhang@uwindsor.ca

Co-Chair: Theresa Barker, Affiliate Assistant Professor, University of Washington, Box 352650, Seattle, WA, 98115, United States of America, barkertj@uw.edu

1 - Optimal Supply Planning for a Closed Loop System with Uncertain Demand and Return

Guoqing Zhang, Professor, University of Windsor, Department of Industrial Engineering, 401 Sunset Avenue, Windsor, ON, N9B3P4, Canada, gzhang@uwindsor.ca, Jianmai Shi

We study the production planning problem for a closed loop system, in which the manufacturer has two channels for supplying products: producing brand-new products and remanufacturing returns into as-new ones. A mathematical model is presented to formulate the problem and a Lagrangian relaxation based approach is developed to solve the problem. Numerical examples are presented to illustrate the model and test the solution approach.

2 - Design of Integrated Forward and Reverse Logistics Network with Time Periods

Hyangsook Lee, Rutgers University, 100 Brett Road, Piscataway, NJ, 08854, United States of America, lee.hyangsook@gmail.com, Maria Boile, Sotiris Theofanis, Georgios Saharidis, Ti Zhang

The paper presents a facility location problem of the integrated logistics network aiming to improve the efficiency of both forward and reverse logistics. Three types of facilities are identified: warehouse (forward), collection center (reverse) and hybrid center (both). The paper proposes a nonlinear mixed integer model addressing the dynamic integrated distribution network design problem. A bi-objective model is developed to minimize the total shipping cost and time simultaneously.

3 - On the Study of Reverse Logistics Channels and Inentives in a Closed-loop Supply Chain

Dennis Z Yu, Assistant Professor, Clarkson University, 8 Clarkson Avenue, Potsdam, NY, 13699, United States of America, dyu@clarkson.edu, Chester Xiang

We study impacts of reverse logistics channel structures and incentives in a closed-loop supply chain. The business and individual demand segments show heterogeneous responses to the used-product return incentives. A third party may be used as an agent to collect used-products and exploit economies of scale. Three reverse logistics channel structures are investigated for the optimal incentive schemes, reverse logistics channel strategies, and resulting financial and social impacts.

4 - Coordinating the Discount for Purchase Quantity and Transportation in a Three-party Supply Chain

Ginger Y. Ke, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, y3ke@engmail.uwaterloo.ca, James H. Bookbinder

This research studies the coordination of the quantity and transportation discount decisions in a supply chain system involving the buyer, supplier and carrier. More specifically, the discount decisions are analyzed from the perspectives of the parties who offer the discount, rather than the one that takes them. The improvements of system performance obtained from several different models are observed and compared to achieve further understandings of the coordination.

■ WB48

H - Graham Room - 3rd Floor

Time in Transportation Problems

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Lei Zhang, Assistant Professor, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu

1 - Integrating Dynamic Departure Time, Routing, and Traffic Simulation Models for Traffic Operations and Dynamic Pricing Analysis

Lei Zhang, Assistant Professor, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu, Shanjiang Zhu, Longyuan Du, Gan-Len Chang

Subarea traffic operations and congestion management analysis often requires accurate representation of both supply-side congestion evolutions and demand-side user behavior responses. This research integrates a traffic microsimulation model and a rule-based departure time and routing model to consider supply- and demand-side dynamics. The models are empirically estimated, validated, and applied to analyze the peak spreading and route diversion effects of a brand new tolled freeway in Maryland.

2 - A Newton-type Algorithm for Dynamic Traffic Assignment

Steve Boyles, University of Wyoming, 1000 E. University Avenue, Laramie, WY, 82071, United States of America, sboyles@uwyo.edu, Ruoyu Liu

Algorithms based on Newton-type flow shifts lead to rapid convergence for static traffic assignment; this project considers its application to dynamic traffic assignment based on the cell transmission model. Although a convex programming formulation is unavailable, path travel time derivatives can be used to generate shifts among paths. Properties of the cell transmission model are used to calculate these derivatives, and convergence properties are studied.

3 - Simulation-based Optimization for Urban Traffic Management

Carolina Osorio, Assistant Professor, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Office 1-232, Cambridge, MA, 02139, United States of America, osorioc@mit.edu, Michel Bierlaire

We present a simulation-based optimization framework that allows urban traffic simulators to be used in a tractable manner for optimization. The metamodel approach combines information from the simulator and an analytical network model. We resort to a derivative-free trust region algorithm. We evaluate the performance of the method with a signal control problem for the city of Lausanne. This method is computationally efficient and suitable for problems with tight computational budgets.

■ WB49

H - Graves Room - 3rd Floor

Simulation Optimization: Ranking and Selection

Sponsor: Simulation

Sponsored Session

Chair: Seong-Hee Kim, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, Georgia, skim@isye.gatech.edu

1 - Bayesian Optimization via Simulation with Correlated Sampling and Correlated Prior Beliefs

Jing Xie, Cornell University, 232 Rhodes Hall, Ithaca, NY, United States of America, jx66@cornell.edu, Peter Frazier, Stephen Chick

We consider optimization via simulation over a finite set of alternatives. We employ a Bayesian value-of-information approach in which we allow both correlated prior beliefs and correlated sampling to improve overall efficiency. Correlations in prior beliefs allow us to learn about an alternative's value from samples of similar alternatives. Correlations in sampling due to common random numbers allow us to reduce the variance in comparing one alternative to another.

2 - Indifference-zone Ranking and Selection with 10,000 or More Alternatives

Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

We present a new elimination-based sequential indifference-zone procedure whose lower bound on probability of correct selection (PCS) is tight in continuous-time, and nearly tight in discrete-time. To the author's knowledge, this is the first such procedure with tight PCS bounds. The tightness of this bound now makes it computationally tractable to select the best among more than 10,000 noisy alternatives. This extends previous work on non-elimination procedures with tight PCS bounds.

3 - Rare-event Splitting for Power Grid Problems

John Shortle, George Mason University, 4400 University Dr., MSN 4A6, Fairfax, VA, United States of America, jshortle@gmu.edu, Chun-Hung Chen

One approach for simulating rare-event problems is to split the simulation into separate copies whenever it gets "near" the rare event. This talk investigates the application of splitting techniques to simulate blackouts in a power grid. We investigate theoretical properties of some simple grid structures in order to determine good level functions for the splitting technique. Then we apply results to more complicated networks and give numerical results.

4 - New Fully Sequential Ranking and Selection Procedure Based on Bivariate Brownian Motion Processes

Seong-Hee Kim, Associate Professor, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, Georgia, skim@isye.gatech.edu, Ton Dieker

We propose a new fully sequential procedure for finding a system with the largest or smallest performance measure among a finite number of simulated systems. The procedure compares systems in a group of three and eliminates a system when there is an evidence that the system is not better than the other two systems. The procedure's derivation is based on the behaviors of bivariate Brownian motion processes exiting an ellipse.

■ WB50

H - Ardrey Room - 3rd Floor

A Behavioral Perspective on Demand and Inventory Management

Sponsor: Behavioral Operations Management

Sponsored Session

Chair: Enno Siemsen, Assistant Professor, University Minnesota, Carlson School, Minneapolis, MN, United States of America, siems017@umn.edu

1 - The Effect of Payment Schemes on Inventory Decisions: The Role of Mental Accounting

Jordan Tong, Duke University, The Fuqua School of Business, Durham, NC, United States of America, jordan.tong@duke.edu, Gurhan Kok, Li Chen

Keeping the net cost structure constant, we study newsvendor behavior under three payment schemes – the newsvendor, supplier, or customer finances the newsvendor's order. We find orders are highest under newsvendor financing and lowest under customer financing. A second study shows that simply changing the framing of the problem induces similar results, suggesting the reason lies in the mental accounting of payments. Finally, we show the phenomenon is robust over high and low profit margins.

2 - Planning for Uncertainty with Bankruptcy Risk and Target-based Payoffs

Nelson Lau, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, Nelson.LAU@insead.edu, Neil Bearden

The Newsvendor model assumes unlimited wealth. Outcomes in one period are inconsequential for subsequent decisions. We consider carryover wealth effects. An agent begins with an endowment. Each season, he may only order up to his current wealth – if wealth falls below unit cost, the agent is "bankrupt." This prescribes conservatism in early ordering decisions. We experimentally investigate real agents' behavior. We also explore how the model and behavior change with target-based payoffs.

3 - Deliberate or Intuitive: Decision Speed and Cognitive Reflection in Demand Forecasting Behavior

Enno Siemsen, Assistant Professor, University Minnesota, Carlson School, Minneapolis, MN, United States of America, siems017@umn.edu, Mirko Kremer, Brent Moritz

This research analyzes how decision speed in time series forecasting impacts forecast performance, and how individual differences influence this decision speed. Data from a behavioral experiment shows that forecasting decisions that are either too slow or too fast lead to poorer forecasting performance. Further, a forecaster's tendency to make decisions within that optimal time frame depends on his or her cognitive reflection.

4 - Buyback vs. Revenue-sharing Contracts: Influence of Supplier's Loss Aversion

Yinghao Zhang, University of Minnesota, 321 19th Avenue South, Minneapolis, MN, 55108, United States of America, zhang786@umn.edu, Karen Donohue, Tony Cui

Prior analytical research shows that buyback and revenue-sharing contracts achieve equivalent channel-coordinating solutions when applied in a single supplier-buyer setting. We examine how loss aversion can lead suppliers to prefer one contract type over the other. The model predicts that loss averse suppliers prefer buyback contract in low profit margin environment while prefer revenue-sharing contract in high profit margin environment. The results of a human experiment confirm our theory.

■ WB51

H - Caldwell Room - 3rd Floor

Transportation Modeling and Privacy Protection

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Jeff Ban, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, United States of America, banx@rpi.edu

1 - VTL Zone-Based Path Cloaking Algorithm

Bin Zan, zanb@winlab.rutgers.edu, Peng Hao, Marco Gruteser, Jeff Ban

Traffic engineering applications often benefit from collecting vehicle GPS traces in well-defined locations. However, exist techniques do not guarantee both data accuracy for application requirement and privacy preserving for user's consideration. In this talk, we will present a virtual trip line zone-aware path cloaking algorithm which can be used to solve this problem. Zones where data should be retained can be predefined over the intersections of interest and the path cloaking algorithm uses entropy-estimates to decide whether the data can be revealed. By comparing to a zone-unaware scheme through simulation, we will also show the significant achievement the proposed scheme can obtain.

2 - Evaluation of Transportation Privacy Preserving Algorithms Using Traffic Knowledge Based Adversary Models

Zhanbo Sun, sunz2@rpi.edu, Bin Zan, Jeff Ban, Marco Gruteser, Peng Hao

Mobile traffic sensors have quickly emerged recently as an important data source for traffic applications. In this research, we develop traffic-knowledge-based adversary models to attack privacy algorithms that have been proposed so far for protecting mobile data privacy. The results can hopefully provide some insight on how mobile data should be collected and processed in order to ensure both privacy and application data needs.

3 - Value of Travel Information: Implications for Quality of Travel Experience

Yu-Ting Hsu, Purdue University, Nextrans Center, 3000 Kent Avenue, West Lafayette, IN, 47906, United States of America, yhsu@purdue.edu, Dong Yoon Song, Srinivas Peeta

We explore the value of real-time travel information in terms of the improvement in traveler experience, which involves both physical and psychological aspects. In the context of different travel environments, an analytical framework based on traveler behavioral aspects is proposed to discuss the psychological effects of information provision on travelers' decision-making processes and their perceptions of the system.

4 - Modeling Route Choice Behavior in a Driving Simulator with Real-time Information

Hengliang Tian, University of Massachusetts Amherst, 141 Marston Hall, 130 Natural Resources Road, Amherst, MA, 01003, United States of America, thliang17@gmail.com, Donald L. Fisher, Brian Post, Song Gao

We investigate travelers' strategic route choice behavior in a risky traffic networks using data collected from a driving simulator, namely whether travelers plan ahead for real-time information en-route. A mixed logit model with latent classes is estimated, and the results show that both strategic and non-strategic types of users exist, a moderate learning effect, and the adverse impact of network complexity on forward thinking.

5 - A New One-Level Convex Optimization Approach for Estimating Origin-Destination Demand

Wei Shen, Post-doctoral Researcher, IBM Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, wshen@us.ibm.com, Laura Wynter

We propose a new one-level convex optimization formulation to reasonably approximate the bilevel OD estimation structure, thus allowing the development of efficient solution algorithms. The approach improves previous one-level formulations in the literature by 'equilibrating' flows using external path cost parameters. It can be viewed as a special case of UE assignment with elastic demand, and be solved efficiently by path-based assignment algorithms with an iterative parameter updating scheme.

■ WB52

H - North Carolina - 3rd Floor

Facility Logistics VI

Sponsor: Transportation Science and Logistics/Facility Logistics

Sponsored Session

Chair: Yugang Yu, Assistant Professor, Rotterdam School of Management, Erasmus University, Rotterdam, Netherlands, yyugang@rsm.nl

1 - Generalized Asymmetric Traveling Salesman Problem: Sequencing Storage and Retrieval Containers

Amir Hossein Gharehgozli, PhD Candidate, Rotterdam School of Management, P.O. Box 1738, Rotterdam, 3000 DR, Netherlands, AGharehgozli@rsm.nl, Yugang Yu, Rene de Koster

We study how to select storage locations for storage containers while a set of storage and retrieval containers are sequenced in a block by minimizing the travel time of an automated crane. Multiple input/output (I/O) points are located at each side of the block. Every I/O point has a set of storage containers each with a given set of storage locations. The problem is modeled as a generalized asymmetric traveling salesman problem (GATSP) and solved by transforming the GATSP to the ATSP.

2 - Decentralization and Trade-offs of Equity and Efficiency in Humanitarian Fleet Management Systems

Maria Besiou, Postdoctoral Fellow, INSEAD, Social Innovation Centre, Fontainebleau, France, Maria.Besiou@insead.edu, Alfonso J. Pedraza-Martinez, Luk Van Wassenhove

Humanitarian Organizations manage the fleets using three systems: Centralized: decisions are made by the fleet management unit (FMU). Decentralized: there is no global FMU, decisions are made at program level. Hybrid: combines features of centralized and decentralized. Using system dynamics, we model the three systems exploring trade-offs of equity and efficiency for relief and development programs. Our findings help understand which system should best satisfy a particular organization's needs.

3 - Reduction of CO2 & Energy Cconsumption in Logistics in Bulgaria by Development of Green Supply Chains

Vikenti Spassov, Professor, University of Transport, 158 Geo Milev Street, 16 en.B Hemus Street, Sofia, 1111, Bulgaria, vikenti.spassov@yahoo.com

The trend towards developing a green supply chain is now gaining popularity but most companies are still coming to terms with how this can be achieved.The paper presents results of projects for the decreasing of the power consumption in cold storage by optimization of the storage systems and the organization and using a fuel cell lift trucks.For minimizing of the space of storage by the optimization of storage systems we propose two alternatives and the mathematical models for them.

4 - Game Theoretic Models for Competition in Public Transit Services

Janny M.Y. Leung, The Chinese University of Hong Kong, Systems Engineering & Eng. Mgt. Department, Hong Kong, Hong Kong - PRC, janny@se.cuhk.edu.hk, Eddie Chan

As metropolitan areas grow, commuting needs increase the burden on public transport systems, leading to traffic congestion and pollution. We model the competitive situation when several service providers offer public transit services using potential games, and discuss mathematical programmes for finding their Nash equilibria. We investigate the relative merits and tradeoffs for different structures of transit networks, and the interplay between the services offered and system ridership.

■ WB53

H - South Carolina - 3rd Floor

Bayesian Inference and Computational Issues

Sponsor: Data Mining

Sponsored Session

Chair: Tevfik Aktekin, University of New Hampshire, 15 Academic Way, McConnell 439, Durham, NH, 03824, United States of America, tevfik.aktekin@unh.edu

1 - Health Insurance Fraud Detection through Bayesian Clustering

Toros Caglar, The George Washington University, 2201 G ST NW, Funger Hall, Suite 415, Washington, DC, 20052, United States of America, toros@gwu.edu

One popular healthcare fraud scheme involves sharing stolen patient identities among groups of healthcare providers, where the stolen information can be used to bill false claims. In this work, we develop a Bayesian grouping methodology to help identify potentially stolen patient identities as well as the groups of providers that show sharing behavior. The proposed approach brings additional information by creating the patient and provider groups simultaneously at the cost of computation time.

2 - A Hierarchical Bayesian Model with Inflated Beta Mixtures

R. Muzaffer Musal, Assistant Professor, Texas State University, 115 Sandra Muraida Way apt 207, Austin, TX, 78703, United States of America, rm84@txstate.edu, Lawrence Fulton

We investigate questions involving the impact of covariates on the scores of a comprehensive exit exam that 120 undergraduate students via a Bayesian hierarchical model. The model makes use of a mixture of Beta distributions, inflated for the purposes of modeling students who are no-shows. We come up with the probability distribution of letter grade test scores as well as the probability that a student will belong to a particular grade cluster. We discuss model fit via cross validation.

3 - Bayesian State Space Modeling of Poisson Time Series

Tevfik Aktekin, University of New Hampshire, 15 Academic Way, McConnell 439, Durham, NH, 03824, United States of America, tevfik.aktekin@unh.edu, Refik Soyer

In this study, we introduce a general class of Poisson time series models. In doing so, we develop discrete time state space models with Poisson measurements and their Bayesian inference via Markov chain Monte Carlo methods. Furthermore, we discuss issues of model properties, sequential updating/filtering, smoothing and forecasting. In order to show the implementation of the proposed models, we use real count data and discuss further implications of the Bayesian approach.

4 - Dynamic Probit Models

Refik Soyer, Professor, George Washington University, Department of Decision Sciences, Washington D.C. 20052, United States of America, soyer@gwu.edu

In this paper we consider a dynamic probit model where the coefficients follow a first-order Markov process. We present an exact Gibbs sampler for Bayesian analysis of the model using the data augmentation approach of Albert and Chib (1993) and the forward filtering backward sampling algorithm of Fruhwirth-Schnatter (1994) for dynamic linear models. We discuss how our approach can be used for dynamic probit models as well its generalizations including Markov regressions and models with Student link functions. We also present an approach to compare static and dynamic probit models as well as for Markov order selection in these class of dynamic models. We implement our approach to some actual data.

■ WB54

H - Charlotte Hall - 3rd Floor

Joint Session JFIG/INFORM-Ed: Panel Discussion: Distance, Not Distant Education

Sponsor: Junior Faculty Interest Group/INFORM-ED

Sponsored Session

Chair: Malini Natarajarathinam, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, malini@entc.tamu.edu

1 - Distance Education, Not Distant Education

Moderator: John Kros, Associate Professor of Marketing and Supply Chain Management, East Carolina University, 3205 Harold Bate, Greenville, NC, 27858, United States of America, krosj@ecu.edu, Panelists: Daniel Conway, Chris Keller, James Barnard, Malini Natarajarathinam

JFIG/INFORM-Ed panel on distance learning. 5 Panelists will interactively discuss distance education.

■ WB55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS: O.R. Practice for a Smarter Energy Industry

Sponsor: Analytics/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Weiwei Chen, Scientist, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, chenw@ge.com

1 - Integrated Order Allocation and Distribution Scheduling for Wind Turbine Supply Chain

Bex Thomas, Researcher, General Electric Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, thomasb@ge.com

We present a structured optimization based framework to allocate order quantities of wind turbine parts for active projects to selected turbine part suppliers and schedule the dispatch of these orders on a daily basis to meet required service levels and target costs.

2 - Agent Based Modeling of Home Electricity Consumption

Jason Black, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, blackj@ge.com

The talk presents an agent based modeling methodology for assessing consumer electricity consumption behavior. End use devices are modeled physically and their usage is able to be modified by assigning behavioral profiles for each consumer. The model enables assessment of various consumer behavioral responses to time of use pricing schemes and calculates teh changes in household energy consumption based on pricing and behavioral scenarios.

3 - Optimal Scheduling of Demand Response Events for Electric Utilities

Weiwei Chen, Scientist, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, chenw@ge.com, Rajesh Tyagi, Jason Black

In demand response programs, electric utilities are usually allowed to schedule a limited number of events per year. For some programs, such as variable peak pricing, there are multiple electricity pricing levels that make the event scheduling more complicated. We propose a solution approach to optimize the expected total savings, accounting for potential benefit of deferring an event and future temperature prediction. Dynamic threshold values are provided to utilities for decision making.

■ WB56

H - Biltmore Boardroom - 2nd Floor

Topics in Health Care

Contributed Session

Chair: Vijith Malayil Varghese, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, vvarghe@uark.edu

1 - Analysis and Exploration of Health Care Supply Chains

Zhongxian Wang, Montclair State University, 1 Normal Avenue, Montclair, NJ, 07043, United States of America, wangj@mail.montclair.edu

The health care industry is one of the largest enterprises in the United States. Contradictory health care reform debates have never been diminished. The health care supply chain has received increasing attention in recent years. In this paper, we will review the current state of health care supply chains and the future trends.

2 - The Impact of Security Practices on Regulatory Compliance and Security Performance

Juhee Kwon, Center for Digital Strategies, Tuck School of Business, Dartmouth College, Hanover, NH, 03755, United States of America, juhee.kwon@tuck.dartmouth.edu, M.Eric Johnson

The study examines how a healthcare organization's security practices (including IT controls, policies, education, and hiring practices) influence their perceived regulatory compliance as well as their actual security performance. We utilized qualitative and quantitative survey data from 250 healthcare organizations. Using the HLM, we demonstrate that audit polices are positively associated with perceived regulatory compliance and security policies are associated with security performance.

3 - The Impact of Physician Processes on Cost and Quality of Care

Jillian Berry, Harvard Business School, Boston, MA, 02163, United States of America, jberry@hbs.edu, Anita Tucker

We are interested in understanding the relationship between quality and cost in the hospital setting, a field characterized by high worker autonomy and few defined processes. First we provide a broader overview of the relationship between cost and quality and then we move deeper into specific processes that affect each metric.

4 - RTLS-based Ubiquitous Healthcare Management System Design and Implementation

Xiaoyu Ma, Wayne State University, Detroit, MI, United States of America, xiaoyu.ma@wayne.edu, Kai Yang

The healthcare system has been challenged by ineffective medical supply, countless medical errors and escalating costs. Real-time Location System (RTLS) is recognized as a new resolution to increase visibility and drive operational efficiency. According to the theory of Information System Design Theory, lean management and task-technology fit, a hybrid design and implementation framework to implement RTLS in a hospital is proposed to reduce costs and improve medical service performance. A case study in the Veteran's Affairs hospital system is presented.

5 - Characterizing Gap between Healthcare vs. Retail Supply Chain

Vijith Malayil Varghese, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, vvarghe@uark.edu, Heather Nachtmann, Manuel Rossetti, Brian Smith, Edward Pohl, Server Apras, Fan Zhang, Tanvir Sattar

In this presentation we identify and characterize some gaps between the retail and healthcare supply chains and assess the potential impact if the practices associated with the gaps were utilized to a higher degree in the healthcare sector. We focus on best supply chain practices from the retail sector and determine opportunities and implementation issues related to pursuing these practices in the healthcare supply chain. Preliminary project findings are presented.

■ WB57

W - Providence I- Lobby Level

Optimization and Analysis Models for Air Traffic Management

Sponsor: Aviation Applications

Sponsored Session

Chair: Ioannis Simaiakis, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 35-217, Cambridge, MA, 02139, United States of America, ioa_sim@mit.edu

1 - An Assessment of the New Runway at Charlotte Airport

Hamsa Balakrishnan, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, hamsa@mit.edu, Ioannis Simaiakis

We assess the impact of the new runway at Charlotte Airport. We investigate the trade-off between longer taxi-in times and higher capacity and the utilization of the new runway. We show that the added capacity is underutilized, although taxi-times have decreased. For this, we use new capacity estimation methods and the DELAYS queuing engine for the simulation of operations. We show the need to go beyond traditional capacity estimation and steady-state queuing analysis in studying this problem.

2 - Exploring Different Problem Formulations to Evaluate Environmental Impact of Aviation

Isaac Tetzloff, Graduate Student, Purdue University, 701 W. Stadium Avenue, West Lafayette, IN, 47907, United States of America, isaact@purdue.edu, William Crossley

Engineering analyses can predict noise and emissions of new aircraft; however, evaluating the new aircraft's fleet-level environmental impact needs a representation of how airlines use the new aircraft. This involves a problem to maximize airline profit while meeting demand. Formulations explored include an integer allocation, a linear allocation, and a binary scheduling problem; the desired formulation provides appropriate fleet environmental metrics at reasonable computational cost.

3 - Robust Optimization for Runway Configuration Management
Rex K. Kincaid, Computational Operations Research Director, College of William and Mary, Sloan School of Management, Department of Mathematics, Williamsburg, VA, 23187-8795, United States of America, rrkinc@wm.edu

The Runway Configuration Management (RCM) problem governs what combinations of airport runways are in use at a given time for an airport or a collection of airports. Runway configurations (groupings of runways), operate under Runway Configuration Capacity Envelopes(RCCEs) which limit arrival and departure capacities. The RCCE identifies unique capacity constraints based on which runways are used for arrivals, departures, and their direction of travel. When switching between RCCEs, due to a change in weather conditions or a change in the demand pattern, some decrement in arrival and departure capacities is incurred during the transition. A two-stage computational experiment is conducted to collect data. We report computational experience with two distinct model approaches—-robust optimization, and a deterministic mixed integer linear program. Strengths and weaknesses of each approach are discussed. Test case scenarios are based on data from the John F. Kennedy international airport in New York.

4 - A Two State Dynamic Control Model for the Airport Departure Queue
Ioannis Simaiakis, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 35-217, Cambridge, MA, 02139, United States of America, ioa_sim@mit.edu, Hamsa Balakrishnan

We formulate the airport surface congestion management problem as a dynamic control problem. There are two main control challenges: the random delay from the control point (the gate) to the server (the runway) and the desire to avoid threshold policies. We represent the process by a two-state semi-Markov process, and use ground surveillance data to illustrate its applicability. Finally, we use this modeling framework to derive and characterize optimal pushback policies to control congestion.

■ WB58

W - Providence II - Lobby Level

Joint Session MAS/Tutorial: Modern Design of Experiments – Recent Advances in Screening Methods

Sponsor: Military Applications Society/Turorial

Sponsored Session

Chair: Tom Donnelly, SAS Institute Inc, Newark, DE, United States of America, tom.donnelly@jmp.com

1 - Modern Design of Experiments – Recent Advances in Screening Methods
Tom Donnelly, SAS Institute Inc, Newark, DE, United States of America, tom.donnelly@jmp.com

Attendees will be introduced to recently published Design of Experiments for screening factors. Relative to traditional regular fractional-factorial designs these new designs - non-regular fractional-factorial, definitive screening, and alias-optimal designs - allow experimenters to run fewer trials or learn more about interactions or quadratic behavior. Graphical comparisons between these alternative methods and traditional designs will show the new ones to be superior or strong competitors.

■ WB59

W - Providence III - Lobby Level

Models of Service Co-creation Processes

Sponsor: Service Science

Sponsored Session

Chair: Ralph Badinelli, Professor, Virginia Tech, Department of Business Information Technology, Virginia Tech 0235, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

Co-Chair: Robert Burgess, Georgia Tech, College of Managemenet, Atlanta, GA, 30308, United States of America, Robert.burgess@mgt.gatech.edu

1 - Optimally Improving Service System's Organizational Behavior
Robin Qiu, Penn State, Department of Information Science, Malvern, PA, 19355, United States of America, robinqiu@psu.edu

We show how to quantitatively model the organizational behavior of an automobile service compnay. An approach to optimally improving this service organizational behavior will be presented.

2 - Dynamic Knowledge Management with Rotating Personnel Resources in a Service Setting
Robert Burgess, Georgia Tech, College of Managemenet, Atlanta, GA, 30308, United States of America, Robert.burgess@mgt.gatech.edu, Craig Hill

Many service environments struggle with knowledge management and its continuity going forward. Some organizations are further constrained by gaining and losing their operating personnel based on a finite planning horizon. This presentation reports on the investigation of this problem as it specifically impacts several organizations on college campuses.

3 - Adaptive Replication: The Reutilization of Knowledge Assets in Fast Changing Environments
Stefano Miraglia, Imperial College Business School, Tanaka Building, South Kensington Campus, London, SW7 2AZ, United Kingdom, stefano.miraglia@imperial.ac.uk, Andrea Prencipe, Andrew Davies

Reusing knowledge entails dealing with two opposing forces: while the advantages of replication push for reproducing knowledge exactly, exogenous changes impose some adaptation. This qualitative study analyzes two large firms that have been dealing with replication and adaptation for decades. Findings show that replication and adaptation are treated as interplaying rather than opposed. The new concept of 'adaptive replication' is introduced to explain such interplay.

4 - Fuzzy-control Models of Knowledge-based Intelligent Service
Ralph Badinelli, Professor, Virginia Tech, Department of Business Information Technology, Virginia Tech 0235, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

This paper presents conceptual models and simulation experiments of an agent's epistemology and decision-making in service systems by modeling the agent as a fuzzy controller. For each engagement, an agent must make resource-commitment decisions with incomplete knowledge of the resource requirements and the value of the outcomes the service engagement. Through fuzzy models we capture an agent's abductive and inductive reasoning in adapting to knowledge-based intelligent-service offerings.

■ WB60

W - College Room - 2nd Floor

First-order Methods for Convex Programming and Their Applications

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Guanghui Lan, Assistant Professor, University of Florida, Industrial & Systems Engineering, Gainesville, FL, United States of America, glan@ise.ufl.edu

1 - A Block Decomposition Algorithm for Solving Large-scale Conic Optimization Problems
Camilo Ortiz, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30318, United States of America, camiort@gatech.edu, Renato D. C. Monteiro, Benar F. Svaiter

A recent work by Monteiro and Svaiter (2010) studied the complexity of block decomposition methods for solving monotone inclusion and convex optimization problems. These methods and their corresponding complexity bounds are reviewed. We also report very encouraging computational results comparing our methods with the second order algorithm SDPNAL (X. Zhao et al.) and the boundary point method introduced by J. Povh et al. The results on various large scale conic problems are quite promising.

2 - Minimizing Condition Number via Convex Programming
Zhaosong Lu, Assistant Professor of Operations Research, Simon Fraser University, zhaosong@sfu.ca, Ting Kei Pong

We consider minimizing the condition number of a positive semidefinite matrix over a nonempty closed convex set. We show that it can be solved as a convex programming problem. We then propose a first-order method to solve the latter problem. We also propose a convex relaxation for finding positive definite preconditioners for a positive definite matrix. This relaxation turns out to be exact when finding optimal diagonal preconditioners.

3 - Level Methods Uniformly Optimal for Composite and Structured Nonsmooth Convex Optimization
Guanghui Lan, Assistant Professor, University of Florida, Industrial & Systems Engineering, Gainesville, FL, United States of America, glan@ise.ufl.edu

In this talk, we present optimal first-order methods for large-scale convex programming (CP) without requiring the input of any problem parameters. More specifically, we present the accelerated level method and demonstrate that it can uniformly achieve the optimal iteration complexity for solving nonsmooth, weakly smooth, smooth, minmax, composite and regularized problems etc. We then present a variant of this level method uniformly optimal for solving certain bilinear saddle point problems.

■ WB61

W - Sharon Room - 2nd Floor

Networks in Planning

Contributed Session

Chair: Simme Douwe Flapper, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, s.d.p.flapper@tue.nl

1 - A Graph-Based Hierarchical Routing Algorithm under ITS
Mahyar Movahednejad, Wayne State University, Manufacturing Engineering Building, 4815 Fourth St., Detroit, MI, 48202, United States of America, mahyar@wayne.edu, Ratna Chinnam

We propose an algorithm to extract a graph-based hierarchical structure in the road network. This algorithm provides an efficient representation of the network for rerouting an en route vehicle in real-time. We then develop a routing algorithm to the extracted hierarchical network. We demonstrate the performance of the proposed algorithm using actual road network data from Southeast Michigan.

2 - Dynamic Vehicle Routing in Networks with Arc Interactions under ITS
Ali Guner, Research Assistant, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, arguner@wayne.edu, Ratna Chinnam, Alper Murat

We consider dynamic routing of a vehicle on stochastic time- and arc-dependent networks using real-time information available through ITS sources. We model arc interactions and congestion states using historical data and forecast state-transition dynamics of the network using time dependent Markov chains. The travel time and delivery performance savings can be very significant, depending on the time of day and state of the network.

■ WB62

W - Independence Room - 2nd Floor

Carbon and Regulation Issues

Contributed Session

Chair: Alvaro Mendoza, Ph.D. Student, Duke University, Fuqua School of Business, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, alvaro.mendoza@duke.edu

1 - Price-Volume Dynamics of Carbon Emission Permits
Ulku Gurler, Department of Industrial Engineering, Bilkent University, Ankara, Turkey, ulku@bilkent.edu.tr

Under the Kyoto Protocol, industrialized nations are required to reduce their carbon emissions. This has generated a market for emission permit trading in Europe and it is expected that similar markets will emerge globally. Based on the past and recent data, we examine the structural properties of traded permit prices and volumes within auto-regressive and Brownian motion process frameworks.

2 - Electricity Planning with Environmental Policy Uncertainty Using ADP – Carbon Policies and Renewables
Bryan Palmintier, PhD Candidate, Massachusetts Institute of Technology, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA United States of America, b_p@mit.edu, Mort Webster

Electric power planners and policy makers use scenario analysis for uncertainty in carbon policy and renewable incentives. These scenarios reduce model dimensionality but may miss truly optimal near-term flexible solutions. Here, we use approximate dynamic programming (ADP) to tractably find such flexible optimums despite the resulting complexity of the stochastic model (discrete, multi-period with recourse, operating reserves). Examples illustrate improved expansion plans with this approach.

3 - Price Vs. Quantities Regulation
Cristian Figueroa, Massachusetts Insitute of Technology, 77 Massachusetts Avenue, E40-149, Cambridge, MA, 02139, United States of America, cfiguero@mit.edu, David Simchi-Levi

We study regulation methods for externalities of a market equilibrium. We consider two methods: pigovian tax and the creation of quotas of the externality and auctioning of its rights. We study both methods in order to compare them, initially we show they are equivalent in a full information, no uncertainty setting. Next, we show that when uncertainties arise, tax induces a lower price under general conditions.

4 - Impact of Carbon Credits Commercialization on Optimal Forest Harvesting
Alvaro Mendoza, Ph.D. student, Duke University, Fuqua School of Business, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, alvaro.mendoza@duke.edu, Robert Clemen

We consider a forest that sells lumber and carbon credits, and develop a stochastic dynamic programming model to find the optimal harvesting and credits commercialization policy. We numerically show, for different carbon price scenarios, that the optimal expected harvest time, profit and carbon sequestered are different from those obtained when the forest only sells lumber or when, in addition to the lumber, receives (pays) payments (penalties) for the carbon sequestered (released).

■ WB63

W - Tryon North - 2nd Floor

Methodological and Application Issues in MCDM Models

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Adiel T de Almeida, Professor, Federal University of Pernambuco, Cx. Postal 7462, Recife, PE, 50.630-970, Brazil, almeidaatd@gmail.com

1 - Project Portfolios Selection Based on MCDM Models
Adiel T de Almeida, Professor, Federal University of Pernambuco, Cx. Postal 7462, Recife, PE, 50.630-970, Brazil, almeidaatd@gmail.com, Rudolf Vetscher

Project portfolio based on multicriteria decision making (MCDM) methods area analyzed. Considerations are given to situations where the decision maker requires compensatory and non-compensatory methods. Several problems regarding the scales used for criteria are considered both in PROMETHEE and additive methods. Applications on Research and Development (R&D) project portfolio are also analyzed regarding as the scaling used for criteria.

2 - Adapted Simos Prodedure for Evaluating Value Functions of Qualitative Criteria in Additive Models
Danielle Morais, Assistant Professor, Federal University of Pernambuco, Av.Acad. Hélio Ramos, s/n, Cidade Universitária, Recife, PE, 50740-530, Brazil, daniellemorais@yahoo.com.br

Due to the difficulties that some decision makers have in evaluating alternatives under qualitative criteria, we propose to adapt Simos procedure to facilitate the elicitation of intra-criteria information. Associating 'playing cards' make easier to obtain the performance of alternatives with a cardinal notion. This approach fits well within additive models which are more sensitive in assessments, increasing the importance of using an appropriate procedure rather than a simple nominal scale.

3 - An MCDM Model for Orders Sequencing
Adiel Almeida-Filho, Assistant Professor, Federal University of Pernambuco, Cx. Postal 7471, Recife, PE, 50630-970, Brazil, atalmeidafilho@yahoo.com.br, Marcos Sobral, Ana Paula Costa

This work presents a model and a case study for the problem of sequencing clients service orders using MCDM to consider traditional sequencing criteria and also strategic criteria which will refer specifically to the case study context, such as risk of supply shortage, transportation issues and technical aspects of the operation. The case study was performed using a Promethee method which considers outranking relations.

4 - Model Structure for Assigning Priorities to Activities in Project Management Based on MCDM Sorting

Caroline Mota, Assistant Professor, Universidade Federal de Pernambuco, Av. Académico Hélio Ramos, s/n - Cidade, Recife, Brazil, carol3m@gmail.com

This study proposes a decision model for helping project managers to focus on the main tasks of a project network based on a MCDA (multiple criteria decision analysis) method. As the environment is very dynamic, the model was built taking into consideration changes that may occur while a project is being carried out, and therefore the model must be reassessed during the project life cycle. An application of the model is presented in order to demonstrate the use of the model.

■ WB64

W - Queens Room - 2nd Floor

Policy: Pandemic Response and Sustainable Operations

Sponsor: Public Programs, Service and Needs

Sponsored Session

Chair: Dionne Aleman, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, aleman@mie.utoronto.ca

1 - Optimality Gaps in Resource Allocation Decisions Caused by Using 'Deterministic' Epidemic Models

Reza Yaesoubi, Post-Doctoral Research Staff, IBM Watson Research Center, 19 Skyline Dr., Hawthorne, NY, 10532, United States of America, reza.yaesoubi@gmail.com, Ted Cohen

We consider an SIR epidemic model in which resource allocation decisions include recommendations for (1) the number of initial susceptibles to vaccinate, and (2) the number of antiviral doses needed during the epidemic. We find that the resource allocation decision informed by a deterministic model may deviate significantly from the optimal decision obtained from an equivalent stochastic model. We will discuss at length the causes of these "optimality gaps."

2 - Design for the Environment – Life Cycle Approach Using a Newsvendor Model

Gal Raz, University of Virginia, Darden Business School, 100 Darden Blvd., Charlottesville, VA, 22903, United States of America, razg@darden.virginia.edu, Cheryl Druehl, Vered Doctori Blass

Introducing environmental innovations in product and process design can affect the product's cost and demand, as well as the environmental performance in different stages of its life cycle, from manufacturing, via use, and all the way to product end-of-life. In this paper, we consider a profit maximizing firm (Newsvendor) deciding on the production quantity and the environmentally-focused design efforts. We further consider the effect of environmental carbon tax policy on the firm's decision.

3 - Alleviating the Cost of an Influenza Pandemic

Ana Cecilia Zenteno, PhD candidate, Columbia University, 342 S. W. Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States of America, acz2103@columbia.edu, Daniel Bienstock

We analyze strategies for mitigating the impact of a severe influenza epidemic on critical social infrastructure. Our approach involves the procurement of additional resources in response to a robust model of the epidemic's evolution. We describe an algorithm analogous to generalized Benders' decomposition that proves fast and numerically accurate. Our goal is to bring insights on the structure of optimal robust strategies and on practical rules-of-thumb that can be deployed during the epidemic.

4 - Using OR to Improve Voting Operations

Theodore Allen, Ohio State University, Columbus, OH, allen.515@osu.edu, W. David Kelton, Muer Yang, Michael Fry

We propose methods to achieve equity in workload allocation problems and focus on applications to direct recording equipment (DRE) machine allocation for voting. Recent elections in the US and elsewhere have been plagued by long lines and charges of systematic bias. We develop algorithms to achieve minimax optimality for deterministic problems and rigorous bounds for formulations involving simulation. We also explore other equity objectives and compare alternatives using numerical examples and real-world election data from a case in which our methods were applied.

■ WB65

W - Kings Room - 2nd Floor

Retailing and Customers

Contributed Session

Chair: Qin Geng, Associate Professor, Kutztown University, 2A DF, Kutztown, PA, 19530, United States of America, qingeng@bus.illinois.edu

1 - An Analysis of Retailer Buy Back Programs

Zhongwen Ma, University of Texas at Dallas, Richardson, TX, 75080, United States of America, zxm093020@utdallas.edu, Jun Zhang

Buy back programs are specially designed to mitigate the uncertainty of future value of consumer electronics. With this program, retailers can guarantee consumers a fixed residual value during a specific period of time. In this paper, we evaluate how the program works by pricing three parameters concurrently: product price, upfront fee and guaranteed refund. We also investigate how consumers' risk preference impacts the policy.

2 - Retailing Shelf Space Allocation: A Critical Review

Mehmet Erdem COSKUN, Mr., McMaster University, 385 Herkimer Street, Hamilton, ON, L8P 2J2, Canada, mehmeterdemcoskun@gmail.com

There are many products in the same category which are competing for a limited space in a retailer's shelves. We conduct an extensive review the existing literature. We focus on how demand is being modelled in this context and present the major optimization models that have been used as well as the different solution approaches that have been employed. We conclude by proposing a practical and general space allocation optimization model and a research agenda in this field.

3 - Customer Arrival Process in an Appointment-based Service System

Daiki Min, Assistant Professor, Ewha Womans University, 52, Ewhayeodae-gil, Seodaemun-gu, Seoul, Korea, Republic of, dmin@ewha.ac.kr

The appointment system is widely used to facilitate customer access to service in many industries including healthcare. Much research has employed queueing models, but they analyzed the system on the basis of independent customer arrivals and ignored the effects of appointment schedules. The objective of this work is to propose a model for understanding the appointment-based customer arrival process and to evaluate several appointment policies under the proposed model.

4 - How to Grow and Maintain a Profitable Customer Base: A Resource Allocation Perspective

Greg King, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, gjking@umich.edu, Xiuli Chao, Izak Duenyas

Striking an appropriate balance between meeting the satisfactions of existing customers and acquiring new customers is a common problem faced by firms that maintain long-term customer relationships. In this paper, we consider the investment decisions that a firm makes dynamically to allocate internal resources towards acquisition of new customers, and retention of existing ones. We use a Markov decision model approach and prove structural properties of the optimal solution.

5 - On-Air Ad Inventory Decisions under Competition

Qin Geng, Associate Professor, Kutztown University, 2A DF, Kutztown, PA, 19530, United States of America, qingeng@bus.illinois.edu, Suman Mallik

We present a model for managing on-air ad inventory in broadcast television under competition. The ad inventory in this industry is sold through two distinct processes: the Upfront, which occurs before the broadcast season, and the Scatter, which occurs during the broadcast season. A firm needs to allocate its total ad inventory to these two markets before knowing either the performance of its shows or the Scatter market price.

■ WB66

W - Park Room - 2nd Floor

Analytics Tools for Logistics II

Contributed Session

Chair: Shaligram Pokharel, Associate Professor, Qatar University, Department of Mech. and Ind. Engineering, Doha, 2713, Qatar, shaligram@qu.edu.qa

1 - Effect of Beacon Orientation on Beacon Placement Strategies in the Ultrasonic Positioning System

Bin Dai, PhD Sstudent, The Hong Kong University of Science and Technology, Industrial Engineering &Logistics Manage, Tower A001, HKUST, Clear Water Bay, Kowloon, Hong Kong - PRC, dbbudstar@gmail.com, Kashek Lee

Beacon placement is critical in designing ultrasonic positioning system. Existing literature only studies placing beacons perpendicularly downward to the target moving plane. In this study, by relaxing the beacon orientation with regular lattices, we find that the hexagon placement is preferred and an improvement with a factor of 7 is readily achievable.

2 - Logistics Warehouse Layout Design

Todd Benanzer, Sr Engineer, Caterpillar, Inc, 1901 S. First St, Caterpillar, Champaign, IL, 61820, United States of America, benanzer_todd_w@cat.com, Chris Ha

Logistics warehouses contain millions of part numbers, moving tens of thousands of parts per day. A combination of automatic and manually operated transport vehicles operate around the clock to make sure all of the material is received, stored, retrieved, and shipped on time. In order to ensure an efficient operation, discrete event simulation can be used to analyze layout and equipment options. Heuristic optimization can be applied to identify the best available designs for the facility.

3 - A Combined Inventory and Vehicle Routing Problem Taking Third Party Logistics Provider Into Consideration

Hadi Sadrsadat, Research Assistant, University of Maryland, Department of Civil & Environmental Eng., 1173 Glenn L. Martin Hall, UMD, College Park, MD, 20742, United States of America, hadisadr@umd.edu, Ali Haghani, Elham Sharifi

This research addresses the optimization of private sector inventory and distribution system. The objective is to obtain the routes for a non-homogenous fleet to meet the customers' demands within their requested time window considering the inventory level at warehouses. The problem takes into account the availability of rental vehicles and subcontracting of transportation service in cases where it is more beneficial to use these services in lieu of vehicles owned.

4 - Analysis of Pricing of Used Products

Shaligram Pokharel, Associate Professor, Qatar University, Department of Mech. and Ind. Engineering, Doha 2713, Qatar, shaligram@qu.edu.qa, Yijiong Liang

We propose a model here to analyze the price of returned products based on their quality and based on the demand on such products by the remanufacturer. The model will focus on developing pricing policy to collect used products based on the quality and the demand quantity of used products. The pricing policy and demand quantity are to be provided to the collectors of the used products. The impact of the model is analyzed through a numerical study.

■ WB67

W - Grand A - 2nd Floor

Applications of Game Theory

Contributed Session

Chair: W. Ross Morrow, Assistant Professor, Iowa State University, Department of Mechanical Engineering, Ames, IA, 50014, United States of America, wrmorrow@iastate.edu

1 - Stochastic Game Models on Organ Acceptance in Liver Transplant

Zhe Li, PhD Student, Northwestern University, 2145 Sheridan Road Room C231, Evanston, IL, 60208, United States of America, lizhe@iems.northwestern.edu, Gordon Hazen, Anton Skaro, James Schummer

The rank of individuals on the U.S. liver transplant wait list is determined by MELD score, which evolves stochastically. A transplant center may accept a donated organ for its patient or leave the patient on the list hoping for a better quality organ and pass the offer to lower ranked individuals. We model this situation as a stochastic game with players as transplant centers. We examine individual benefits under the equilibrium strategies.

2 - A Pricing Model for Private and Premium Brands under Different Supply Chain Coordinations

Seyed ali Hojjat, Graduate Student, Charlton College of Business, University of Massachusetts Dartmouth, 285 Old Westport Road, North Dartmouth, MA, 02747, United States of America, shojjat@umassd.edu, Soheil Sibdari, Ling Ge, Liwen Chen

A game theoretic approach is taken to model the competition between private and premium brands in a two-level supply chain. The existence and characteristics of Nash equilibrium is investigated under different supply chain coordinations in which: 1) both agents have the same bargaining power, 2) one agent moves as the Stackelberg leader, and 3) under a revenue sharing contract. We further identify the criteria under which each scenario may benefit each individual or the supply chain as a whole.

3 - Optimal Network Design for Time-varying Risk Averse Traffic Assignment

Suh-Wen Chiou, National Dong Hwa University, 1 DaHsueh Road, Hualien, Taiwan - ROC, chiou@mail.ndhu.edu.tw

We propose a bilevel program to optimize network performance in a time-varying environment. A risk-averse traffic assignment is considered. Network users face link failure probabilities when choosing their best routes. Numerical case will be discussed.

4 - Regulated Design-and-Pricing in Differentiated Product Markets

W. Ross Morrow, Assistant Professor, Iowa State University, Department of Mechanical Engineering, Ames, IA, 50014, United States of America, wrmorrow@iastate.edu

Game theory provides an ideal framework for integrating models of regulatory policy, engineering technology, marketing strategy, and consumer preferences in differentiated product markets. This talk presents a two-stage regulated design-and-pricing model being developed to assess the interplay between regulatory policies and product design. Applications to analysis of the DOT/EPA's "National Program" that combines fuel economy and Greenhouse Gas emissions intensity standards are discussed.

■ WB68

W - Grand B - 2nd Floor

Shipping and Transportation in Supply Chain

Contributed Session

Chair: Suri Gurumurthi, Visiting Assistant Professor, University of Illinois, Urbana Champaign, 350 Wohlers Hall, 1206 South Sixth Street, Champaign, IL, 61820, United States of America, surig@illinois.edu

1 - A Heuristic Algorithm for the Capacitated Shipping Network Scheduling with Receiving Deadlines

Gang(Gabriel) Wang, Rutgers, The State University of New Jersey, 1 Wanshington Park, Newark, NJ, 07102, United States of America, gangwang@pegasus.rutgers.edu

We study the problem of scheduling a capacitated supply chain network with delivery deadlines. This problem is computationally difficult since it contains generalized assignment problem as a sub problem. We introduce a hybrid heuristic algorithm based on first-fit decreasing, our proposed special case and LP relaxation. This heuristics allows us to avoid dealing with the generalized knapsack problem directly. Empirical observations from over 500 randomly generated test cases are also reported.

2 - through-Store-Transshipment: A Distribution Practice for Retail Full Pallet Demand Fulfillment

Agha Iqbal Ali, Isenberg School of Management\UMASS, 121 Presidents Dr., Amherst, 01003, United States of America, aiali@som.umass.edu, Milad Ebtehaj

Large discount retailers are increasing the practice of full pallet shipments to fulfill demand at their stores. In this paper, we examine the transshipment of pallet-in-pallet-out products through stores selected to serve as transfer points. We employ a clustering and optimization methodology for identifying "through-store-transshipment" distribution channels. The methodology is applied in a computational study for the New England and Mid-Atlantic regions.

3 - Performance-based Logistic Risk Management in Closed-loop Supply Chains

Rommert Dekker, Professor, Erasmus University-Rotterdam, Rotterdam, Netherlands, rdekker@ese.eur.nl, Guangyuan Yang

To mitigate risks of extreme repair costs in closed-loop supply chains with performance-based contracts, we provide purchasing limits (both price and quantity) for the proactive procurement of spare parts, such that extremely expensive repairs can be prevented with limited investment in spare parts. A case study in an aircraft MRO service provider shows our results are very promising, such that the provider has implemented our decision support system in its procurement and repair operations.

4 - Capacity Planning For Collaborative Logistics: Decentralized Equilibria and Coordination Mechanisms.
Suri Gurumurthi, Visiting Assistant Professor, University of Illinois, Urbana Champaign, 350 Wohlers Hall, 1206 South Sixth Stree, Champaign, IL, 61820, United States of America, surig@illinois.edu

For a dynamic multi-commodity logistics network spanning several firms, we show how and why decentralized capacity investment equilibria are inefficient relative to the centralized optimal capacity investments. As a remedy, we are able to demonstrate that a combination of incentive and disincentive mechanisms, based on proportional risk sharing, can help coordinate the capacity investments. We highlight investment behavior for different operating regimes such as Just-in-Time and Make-to-Stock.

■ WB69

W - Grand D - 2nd Floor

New Business Models for Sustainable Operations

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Laurens Debo, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, United States of America, Laurens.Debo@chicagobooth.edu

1 - Collective Extended Producer Responsibility Legislation: Implementation and Design Implications
Luyi Gui, Industrial and Systems Engineering, Georgia Tech, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, luyi.gui@gatech.edu, Atalay Atasu, Ozlem Ergun, Beril Toktay

Extended Producer Responsibility (EPR) is a policy tool that holds producers financially responsible for the post-use processing of their products. EPR implementations are typically collective and the total cost is then allocated among the producers. We study efficient and fair implementation of collective EPR by designing fair and transparent cost allocation schemes. We also analyze the implications of a collective EPR policy in terms of providing design incentives to producers.

2 - Product Reuse in Innovative Industries
Tamer Boyaci, Associate Professor, McGill University, 1001 Sherbrooke St West, Montreal, QC, Canada, tamer.boyaci@mcgill.ca, Michael Galbreth, Vedat Verter

We consider a firm producing a modular product in an industry that experiences technological innovation over time. Innovation affects consumer valuations and firm costs to keep up with advances over time. Investing in reusability allows the firm to acquire used items and reuse in future production. Used products can be remanufactured and/or upgraded to include the innovations that has occurred since the item was originally produced. We examine both profit and environmental impact.

3 - How Cooperative Can Firms be in Green Production?
Fang Tian, Ph.D. Student, University of Southern California, Bridge Hall B6, USC University Park Campus, Los Angeles, CA, 90089, United States of America, tianfang@usc.edu, Laurens Debo, Greys Sosic

Some large manufacturers have established their own recycling channels, while others choose to use common recycling channels. This paper studies the farsighted stable structure for manufacturers to form coalitions when they employ a third-party recycling facility. There are two main findings drawn from our study: the degree of substitute determines the stable structure; cooperation at the end-of-life stage influences the degree of competition among manufacturers in the Oligopoly market.

4 - Optimizing Seed Stock Quantities for Remanufacturable Automotive Replacement Parts
Elif Akcali, Associate Professor, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, akcali@ise.ufl.edu, Ibrahim Karakayali, Sila Cetinkaya

Determining the optimal seed stock for remanufacturable automotive replacement parts is an important problem encountered in the context of service part planning in the automotive industry. To address this problem, we develop stochastic dynamic models to characterize the optimal seed stock. We begin our analysis by considering a single part in a single-period setting and extend our work to consider multiple parts n a multi-period setting.

Wednesday, 12:45pm - 2:15pm

■ WC01

C - Room 201A

Sourcing/Procurement and Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt/ Supply Chain Operations

Sponsored Session

Chair: Cuihong Li, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States of America, Cuihong.Li@business.uconn.edu

1 - Managing Salesforce under Demand Censorship
Leon Chu, University of Southern California, Marshall School of Business, University Park Campus, Los Angeles, CA, 90089, United States of America, leonyzhu@usc.edu, Guoming Lai

We study the optimal sales force compensation under demand censorship. Under classic regularity condition, the step function is the optimal contract format. Furthermore, depending on whether the effort is additive or multiplicative, the optimal effort level may be higher or lower than the first-best effort level, and the agent may earn a demand censorship rent while the agent earns zero rent when the demand information is available.

2 - Auctions for Leftovers and Returns - B2B Secondary Markets
Wedad Elmaghraby, University of Maryland, College Park, MD, United States of America, Wedad_Elmaghraby@rhsmith.umd.edu, Anand Gopal, Ali Pilehvar

Using data collected from a large reverse logistics company who offers their clients auction services to facilitate the sale of overstock, returned or salvaged items, we study the behavior of these secondary market auctions. We empirically study the bidding behavior in these auctions and characterize how a buyer's purchase decision and his willingness to pay is driven by certain bundles characteristics.

3 - Sourcing through Intermediaries
Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, karan@girotra.com, Elena Belavina

Inspired by the rise of sourcing intermediaries like Li and Fung Ltd., we examine the advantages and disadvantages of sourcing through intermediaries. Our analysis illustrates that sourcing through an intermediary reduces the supplier-side incentives for self-interested, inefficient behavior by limiting the immediate gains from such behavior and by providing more long-term sourcing business in its absence.

4 - Managing Risk of Supply Disruptions: Incentives for Capacity Restoration
Xinxin Hu, Assist Professor, Indiana University, 1309 E 10th Street, Kelley School of Business, Bloomington, IN, 47405, United States of America, hux@indiana.edu, Ling Wang, Haresh Gurnani

We compare two different strategies, Restoration Incentive strategy and Supplier Diversification strategy, taken by the retailers in response of the supplier's possible investment on capacity restoration in the case of disruption.

5 - Sourcing for Quality: Pricing, Inspection, and Cooperation
Cuihong Li, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269, United States of America, Cuihong.Li@business.uconn.edu, Hsiao-Hui Lee

A buyer may use different instruments to manage the quality of a sourced product: She can provide price incentive for the supplier to exert quality improvement effort, use inspection to screen out nonconforming products, or spend her own resource on cooperating with the supplier to improve the product quality. We investigate the use of the three instruments, considering both complementary and substitutable relationships between the buyer's cooperation effort and supplier's improvement effort.

■ WC03

C - Room 202A

Inventory Management II

Contributed Session

Chair: Alireza Kabirian, California State University-Northridge, College of Engineering, Northridge, CA, United States of America, a_kabirian@yahoo.com

1 - Influence of the Suppliers' Capacity and Warehouse Capacity for Western and Asian Companies
Kai Luo, PhD Candidate, HEC Paris, 1, rue de la Libération, 78351 Jouy en Josas, Paris, France, kai.luo@mailhec.net, Laoucine Kerbache, Ramesh Bollapragada

We build models to study both Western and Asian companies having one product produced locally and the other produced far away. These models share a common basic model: a three-period, two-stage, two-product, two capacitated suppliers, single capacitated retailer model. The problems of the Western and Asian companies are formulated as a three-period problem and a multi-period problem respectively. Optimal and heuristic solutions are discussed and managerial insights are provided.

2 - A Model for Delivery Mode Splitting in a Two-Stage Supply Chain
Cinthia Perez, PhD Student, University of Florida, 450 Weil Hall, Gainesville, FL, 32611, United States of America, ccperez@ufl.edu, Joseph Geunes

Although splitting shipments across multiple delivery modes typically increases total shipping costs, it may offer certain benefits that can more than offset these costs. These benefits include a reduction in lead time variance and a corresponding reduction in the probability of stockouts at the downstream stage. We consider a two-stage supply chain inventory model that permits characterizing and quantifying the critical tradeoffs and potential benefits associated with delivery mode splitting.

3 - Applying Delivery Window Optimization for Inventory Models
Maxim Bushuev, Kent State University, Business Administration Building, A419, Kent State University, Kent, OH, 44242, United States of America, mbushuev@kent.edu

Delivery window optimization approach id used to solve stochastic inventory problems. The model includes stockouts and overloads (when inventory level exceeds a certain amount). The optimal solution includes the optimal order quantity and the reorder point which minimize the total expected cost.

4 - Economic Lot-Size Scheduling: An ERP View
Alireza Kabirian, California State University-Northridge, College of Engineering, Northridge, CA, United States of America, a_kabirian@yahoo.com

We develop and solve a mathematical programming model for the pricing and production planning of multiple items on a single machine. The demand of each product depends on the prices of all products. Multiple resources are shared for the production of these items. The acquisition cost of each resource depends on the quantity acquired. The model aims at maximizing net profit as a function of sales revenue and costs of holding the items in stock, machine setup, and resources acquisition.

■ WC04

C - Room 202B

Robust and Stochastic Network Optimization

Contributed Session

Chair: Hairong Lv, IBM Research, Building 19A, Zhongguancun Software Park, Haidian District, Bejing, China, lvhr@cn.ibm.com

1 - Robust Network Design Problems
Long Zhao, Doctoral Student, University of South Florida, Department of Industrial and Management Syste, Tampa, FL, United States of America, longzhao@mail.usf.edu, Bo Zeng

We consider robust network flow problems and propose a new class of two-stage robust optimization. For different uncertain sets we propose different solution strategies, including linear reformulation and a general branch and bound algorithm. Numerical experiments are conducted to show or compare efficiency of different algorithms.

2 - Portfolio Size and 0-1 Variables in Stochastic Portfolio Networks Using Digital Portfolio Theory
Ken Jones, PortfolioNetworks.com, 4300 NW 23rd Avenue Ste 125, Gainesville, FL 32606, United States of America, kenjones@portfolionetworks.com

We use zero-one variables to control portfolio size in stochastic portfolio networks. Digital Portfolio Theory represents return processes as digital signals and uses power spectral density to describe risk. The variance of long and short horizon returns is included in the mean-variance portfolio selection decision adding a time dimension to portfolio theory. DPT is effective in identifying size constrained optimal portfolios. Lower risk optimal portfolios have fewer feasible size possibilities.

3 - Algebraic Methods for the Stochastic Shortest Path Problem
Douglas Shier, Math Sciences, Clemson University, Clemson, SC, 29634, United States of America, shierd@clemson.edu, Katherine Hastings

We consider stochastic networks in which arc lengths follow discrete probability distributions. Using an algebraic formulation, we analyze algorithms for determining exactly or approximately the distribution of the shortest path length between two specified nodes. This algebraic viewpoint unifies known algorithms and also provides a mechanism for establishing majorization results between these approximations and the exact distribution. Bounds on the expected path length are also derived.

4 - Time-dependent Reliable Shortest Path Problem
Xing Wu, Northwestern University, 2145 Sheridan Rd, RM A316, Evanston, IL, 60201, United States of America, xingw@northwestern.edu

Reliable shortest paths are those requiring the least time to ensure a desired on-time arrival probability in a stochastic network. Link travel time distributions depend on the entry time. We give a dynamic programming formulation and a label-correcting algorithm. An approximation method using second-order stochastic dominance and a Fourier transform based convolution scheme are proposed. Numerical experiments are conducted to explore the right balance between efficiency and accuracy.

5 - Design Power Supply Scheme in Power Distribution Network with Network Flow Model
Xinjie Lv, IBM Research, Building 19A, Zhongguancun Software Park, Haidian District, Bejing, 100193, China, lvxinjie@cn.ibm.com, Feng Gao, Jinyan Shao, Tianzhi Zhao, Hairong Lv, Jin Dong

Power supply scheme is a very important task to keep power network operation safe and reliable. As there are huge electrical equipment and complex network topology in distribution network, designing a suitable power supply scheme is difficult. With network flow model, automatic power supply scheme design is implemented based on distribution network analysis, operational data analysis and many constraints.

■ WC06

C - Room 203B

Classic Scheduling II

Contributed Session

Chair: Ali Allahverdi, Kuwait University, Department of IMSE, P.O. Box 5969, Safat, 13060, Kuwait, ali.allahverdi@ku.edu.kw

1 - Tight Lower Bound for a Class of Two-Machine Flow Shop Problems
Mohamed Haouari, Prof, INSAT Tunis, INSAT Centre Urbain Nord BP 676 - 1080, Tunis, Tunisia, mh6368@yahoo.com, Mohamed Kharbeche

We present an assignment-based lower bound that is valid for a wide class of two-machine flow shop problems with a regular additive performance criterion. Also, we propose valid inequalities that aim at tightening the linear programming relaxation of two important special cases. Finally, we provide empirical evidence that these new bound consistently outperform state-of-the-art lower bounds.

2 - Total Tardiness for the Two Stage Assembly Flowshop Scheduling Problem
Ali Allahverdi, Kuwait University, Department of IMSE, P.O. Box 5969, Safat, 13060, Kuwait, ali.allahverdi@ku.edu.kw, Harun Aydilek

The two stage assembly flowshop scheduling problem with the objective of minimizing total tardiness is addressed. We propose an insertion based algorithm, a genetic algorithm, and a combination of both. Computational experiments reveal that the combination of both insertion and genetic algorithms performs as the best.

■ WC07

C - Room 204

Simulation and Optimization

Contributed Session

Chair: Ozan Kocadagli, Research Assistant, MSGSU/TUBITAK, Ciragan Cad. Cigdem Sok. No.1 MSGSU, Fen-Edebiyat Fakültesi Istatistik Bölümü, Istanbul, 34347, Turkey, ozankocadagli@msgsu.edu.tr

1 - Paint Bank Sequence Optimization on Assembly in an Automotive Manufacturing Plant

Ahad Ali, Assistant Professor, Lawrence Technological Univeristy, 21000 West Ten Mile Road, Southfield, MI, 48188, United States of America, aali@ltu.edu

Automotive assembly plants have many different available options to release the order from the paint shop to assembly. The paint bank sequence impacts on assembly shop. This study develops a sequencing algorithm for the paint-to-assembly bank. It addresses the impact of changes to the product mix as well as to the vehicle options through performance analysis on the final assembly schedule based on paint shop disruption. The results provide improvement in production as well as less interruption.

2 - Hierarchical Full Bayesian Learning for Neural Networks

Ozan Kocadagli, Research Assistant, MSGSU/TUBITAK, Çiragan Cad. Çigdem Sok. No.1 MSGSU, Fen-Edebiyat Fakültesi Istatistik Bölümü, Istanbul, 34347, Turkey, ozankocadagli@msgsu.edu.tr

The aim of this study is to estimate parameters and hyperparameters in the Neural Networks by the hierarchical full Bayesian approach. For this learning process, a novel Markov chain Monte Carlo (MCMC) method is proposed. This method maximizes the joint posterior distribution of the network parameters and hyperparameters.

3 - Bayesian Model for Spatial Count Data with Excess Zero: US Natural Fluoride Concentration Estimation

Seonghye Jeon, PhD Candidate, Georgia Institute of Technology, 600 Garson Dr. NE, Apt 9304, Atlanta, GA, 30324, United States of America, sjeon8@mail.gatech.edu

Water fluoridation is listed as one of the ten greatest public health achievements of the 20th century. However, fluoride can occur naturally in water well above recommended levels, which can have several long-term adverse effects. Therefore, assessing the county level natural fluoride concentration and providing water fluoridation guideline based on the assessment plays an important role in public oral health community.

■ WC08

C - Room 205

Integer Optimization

Contributed Session

Chair: Tao Wu, Research Engineer, Meda Engineering, 31439 Mound Road, Apt. H, Warren, MI, 48092, United States of America, danielwu9999@gmail.com

1 - Duality Gap Reduction and Optimality Condition for Binary Quadratic Programming

Baiyi Wu, PhD Student, The Chinese University of Hong Kong, L204, Kuo Mou Hall, Sha Tin, Hong Kong - PRC, baiyiwu@gmail.com, Duan Li

For binary quadratic programming (BQP), the Lagrangian function with its multiplier vector set at the optimal dual value from SDP relaxation gives the best convex quadratic function, fstar(x), to bound all feasible points above its epigraph. By cell enumeration, we find the closest point from the integer set to minimum solution space of fstar(x). By identifying the 2nd, 3rd closest and so on, we further generate a sequence of improved bounds and derive an optimality condition for termination.

2 - Computing an Integer Point in a Polytope is in the Class PPAD When Such a Point Exists

Chuangyin Dang, City University of Hong Kong, Deparment of MEEM, CityU of HK, HK, Hong Kong, Hong Kong - PRC, mecdang@cityu.edu.hk, Yinyu Ye

Let P be a polytope satisfying that each row of the defining matrix has at most one positive entry. Given that P contains an integer point, by introducing an integer labeling rule in an augmented set and applying a triangulation of the Euclidean space, we show that computing an integer point in P is in the class PPAD. Furthermore, based on the labeling rule and the augmented set, a simplicial method is developed to determine whether there is an integer point in P.

3 - The Solver GCG - An Easy Way to Use Branch-and-Price

Gerald Gamrath, PhD Student, Zuse Institute Berlin, Takustrasse 7, Berlin, 14195, Germany, gamrath@zib.de, Marco E. Lübbecke

We present GCG, a generic branch-and-price solver that builds on the non-commercial constraint integer programming framework SCIP. While problem specific implementations of branch-and-price are widely used, only few general purpose software is available in this area. After a short introduction to the Dantzig-Wolfe decomposition, we discuss the design of GCG and present results for three classes of combinatorial optimization problems.

4 - A Mathematical Programming Approach to Political Redistricting with Compactness and Contiguity

Hayri Onal, Professor, Department of Agricultural and Consumer Economics, Univ of Illinois at Urbana-Champaign, Urbana, United States of America, h-onal@illinois.edu, Kevin Patrick

We present a linear integer programming approach to partition indivisible spatial units and configure a specified number of political districts around selected centers so districts have almost equal populations; are contiguous and compact; and consider minority representation when possible. We present empirical applications to legislative districting cases for Illinois. Results show that the model-generated districts are more compact than the actual plan while improving minority representation.

5 - A New Optimization Framework for Solving Mixed Integer Programming Problems

Tao Wu, Research Engineer, Meda Engineering, 31439 Mound Road, Apt. H, Warren, MI, 48092, United States of America, danielwu9999@gmail.com, Leyuan Shi

We develop a new approach, where nested partitions (a heuristic) is combined with exact methods for solving mixed integer programming problems. The merit of the approach is that a strong bound generated by exact methods can provide a good guideline on partitioning and sampling in nested partitions ensuring an efficient solution process.

■ WC09

C - Room 206A

Demand Learning and Model Uncertainty in Revenue Management

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Denis Roland Saure, University of Pittsburgh, Pitssburgh, PA, 15261, United States of America, dsaure@pitt.edu

1 - Optimal Stopping with Bayesian Learning in Revenue Optimization

Huseyin Topaloglu, Cornell University, 223 Rhodes Hall, Ithaca, NY, United States of America, ht88@cornell.edu, Chao Ding, Paat Rusmevichientong

We consider a multi-dimensional Bayesian learning model that learns failure rates of a product from sale data, and decides if and when it is optimal to stop selling the product. We establish structural results for the optimal policy and develop bounds on the value function. Numerical results indicate that our approximations perform well.

2 - Dynamic Pricing and Advance Selling under Demand Learning

Rene Caldentey, New York University, New York, NY, United States of America, rcaldent@stern.nyu.edu, Victor Araman

We consider the problem faced by a retailer that is planning to introduce a new product into the marketplace under incomplete demand information. To improve his demand forecast and inventory decisions, the retailer decides to open an advance selling channel that allows buyers to place orders (at a reduced price) before the product is launched. The seller uses this advance demand information to adjust inventory and pricing decisions.

3 - Consumer Rebates for Solar Technology Adoption

Georgia Perakis, Massachusetts Institute of Technology, Cambridge, MA, United States of America, georgiap@mit.edu, Maxime Cohen, Ruben Lobel

We study the problem of designing consumer subsidies for adopting solar technology from both the government and industry side. We introduce and study a model where the government sets subsidies to achieve an adoption target level while minimizing its cost, whereas industry optimizes its profit. We consider both deterministic and stochastic demands as well as the version combined with pricing.

4 - Optimal Learning in Sequential Combinatorial Optimization
Denis Roland Saure, University of Pittsburgh, Pitssburgh, PA, 15261, United States of America, dsaure@pitt.edu, Juan Pablo Vielma, Sajad Modaresi

We study the problem of a firm that maximizes periodic revenues by solving a sequence of combinatorial formulations with stochastic demands. With no prior information on demand distributions, the firm faces an exploration-exploitation dilemma with a combinatorial number of actions on each period. We develop a family of dynamic policies that judiciously balance the implied tradeoff, and prove their performance cannot be improved upon in a precise mathematical sense.

■ WC10

C - Room 206B

Topics in Finance

Contributed Session

Chair: Nicolas Merener, Universidad Torcuato Di Tella, 1010 Saenz Valiente, Buenos Aires, Argentina, nmerener@utdt.edu

1 - Performance of the Markowitz's Portfolio Selection Model Depending on the Accuracy of the Input Data
HongSeon Kim, Yonsei University, Yonsei-Ro, Seoul, Korea, Republic of, caasman@naver.com, Seongmoon Kim

This paper investigates performance of the Markowitz's portfolio selection model depending on the accuracy of the input data. According to our empirical research, the more accurate input data leads to the better performance. In detail, the return for the portfolio is significantly affected and the variance of the return for the portfolio is marginally affected by the accuracy of the input data.

2 - Do Family CEOs Perform Better Than Outside CEOs in a Transition Economy?
Di Cai, PhD Candidate, School of Management, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, 710049, China, xjtucd@126.com, Difang Wan, Jin-hui Luo

Drawing on agency theory, stewardship theory and principal-principal perspective, this study examines whether family CEOs perform better than outside CEOs in a transition economy. Based on a sample of 351 Chinese family listed firms during 2004-2007, our results show that family CEO is positively associated with firm performance. Further analyses reveal that this positive association is significant only for firms with low separation of ownership and control or having multiple large shareholders.

3 - Option Valuation of the Value of Signaling to be a Socially Responsible Corporation
naoya takezawa, professor, Nanzan University, 18 Yamazato-cho, Showa-ku, Nagoya-shi, Aichi-ken, Nagoya, 466-8673, Japan, ntakezaw@nanzan-u.ac.jp

This paper attempts to evaluate the premium on firms that act socially responsible from the perspective of the financial market. These firms are considered to be sustainable in the sense that they invest and operate in a socially responsible manner. The return distribution of a portfolio of socially responsible firms is evaluated utilizing an option evaluation technique.

4 - Post Performance of IPO Stocks: A Study in Indian Context
Venkata Vijay K Pasupuleti, Doctoral Student, Indian Insitute of Management Indore, Rau, Pigdamber, IIM Indore campus, E 116, Indore, 453331, India, f07venkatav@iimidr.ac.in, Vijay Kumar Gupta

Study impact of liquidity, underpricing and ownership up on short term and long term performance of the IPOs in Indian market. Underpriced IPOs had higher dependence on underpricing provided for long term and short term performance, whereas overpriced IPO stocks depends on long term liquidity characteristic for long term performance.

5 - Distributed Production and the Rise of Emerging Markets in CME Soybean Futures Prices
Nicolas Merener, Universidad Torcuato Di Tella, 1010 Saenz Valiente, Buenos Aires, Argentina, nmerener@utdt.edu

Motivated by the growing weight of emerging economies we study the effect of distributed production in Chicago Mercantile Exchange prices. We empirically estimate the sensitivity of CME soybean futures prices to local rain precipitation in Argentina and the US Midwest. We find that the aggregation of local information into CME prices reflects a globally integrated market for soybeans, and that sensitivities to local rain have correlated over time with varying shares of global production.

■ WC11

C - Room 207A

Advances in Learning and Dynamic Optimization

Sponsor: Applied Probability

Sponsored Session

Chair: Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu

Co-Chair: Vivek Farias, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, vivekf@mit.edu

1 - Basis Function Selection in ADP: Bellman Error Minimization
Michael Veatch, Gordon College, 255 Grapevine Rd, Wenham, MA, 01984, United States of America, Mike.Veatch@gordon.edu

After approximating the value function in approximate dynamic programming, we address how to improve the approximation by adding basis functions. Least square Bellman error methods are applied to assess large numbers of candidate functions. The method is applied to queueing networks.

2 - ADPs for Natural Gas Storage Valuation Based on Approximate Linear Programming Relaxations
Selvaprabu Nadarajah, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, snadarajah@cmu.edu, Nicola Secomandi, Francois Margot

Real option valuation of natural gas storage contracts gives rise to an intractable Markov Decision Process (MDP). We derive novel Approximate Dynamic Programs (ADPs) for this MDP from partitioned surrogate relaxations of an approximate linear program. We use our ADPs to estimate lower bounds and information relaxation upper bounds on the storage value. Our lower bounds essentially match the best known lower bounds. Our upper bounds either match or improve those available in the literature.

3 - Dynamic Capacity Allocation to Customers Who Remember Past Service
Adam Mersereau, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, ajm@unc.edu, Dan Adelman

We study the problem faced by a supplier deciding how to dynamically allocate limited capacity among a portfolio of customers who remember the fill rates provided to them in the past. We approach the problem using approximate dynamic programming (ADP), to obtain a policy that trades off customer characteristics to rationalize the fill rates the firm should target for each customer.

4 - Pathwise Optimization for Linear Convex Systems
Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu, Vivek Farias, Vijay Desai

We describe the pathwise optimization method, an approach for obtaining lower bounds on the minimal cost of a general class of linear-convex control problems. Our method delivers tight bounds by tractably identifying an optimal information relaxation penalty function. We demonstrate our method on a high-dimensional financial application. We provide theory to show that the bounds generated by our method are provably tighter those of some other commonly used approaches.

■ WC12

C - Room 207BC

Stochastic Optimization in Energy

Contributed Session

Chair: Ebisa Wollega, Student, University of Oklahoma, 207 Wadsack Dr. Apt F, Norman, OK, 73072, United States of America, ebisa@ou.edu

1 - Adaptive Sampling in Stochastic Programming and its Application to Economic Dispatch for Power Systems
Berk Ustun, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, ustunb@mit.edu, Panos Parpas, Mort Webster

We discuss the application of Markov Chain Monte Carlo methods as a variance reduction technique in Stochastic Dual Dynamic Programming. We introduce an open source implementation of our algorithm and compare it to existing variance reduction methods in Stochastic Programming. We illustrate how to use the algorithm to solve a economic dispatch problem for power systems, which accounts for the uncertainties in the demand and availability of intermittent resources.

2 - Multistage Energy Planning – Risk Neutral and Risk Averse Approaches
Wajdi Tekaya, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, United States of America, wtekaya@gatech.edu, Murilo Pereira Soares, Alexander Shapiro, Joari Paulo da Costa

Stochastic Dual Dynamic Programming algorithm is a popular approach to tackle large scale linear multistage stochastic problems like the one considered in multistage energy planning problems. In the risk neutral approach, the objective is to minimize the expected value of the total cost along the planning period, subject to feasibility constraints. In this talk we consider the adaptive and regular risk averse approaches and show their contributions compared to the risk neutral method.

3 - Entry Decisions of Energy Portfolio Investment under Tradable Carbon Dioxide Permit
Jianjun Deng, Research Assistant, Missouri University of Science and Technology, 600 W. 14th St., 223 Engineering Management Building, Rolla, MO, 65401, United States of America, jddxc@mst.edu, Zhen Liu

Tradable carbon dioxide permit is an important policy to control carbon dioxide emission. This paper studies optimal investment decisions to build renewable power plants for the generator based on the price fluctuation of tradable permit and electricity. We model this problem as stochastic control and optimal stopping problem with objective to maximize the expected long term profit. We conduct numerical experiments in the case study section.

4 - Ensemble Based Uncertainty Analysis and its Application for Renewable Power Forecasting
Meng Zhang, Staff Researcher, zmbj@cn.ibm.com, 19A Diamond Building, 8 West Dongbeiwang Road, Beijing, 100193, China, zmbj@cn.ibm.com

The ensemble Kalman filter is introduced to help on improving the forecast skills of renewable power forecasting, which includes both the wind and solar power generations, considering their daily outputs are highly dependent on the nonlinear and stochastic processes of various weathers. In this case study, the uncertainty of the renewable power forecasting, is modeled by a ensemble group, in which particular uncertain structures have been found during the evolution of the weathers.

5 - An Application of Experimental Design to a Multicriteria Optimization: A Case for Energy Forecasting
Ebisa Wollega, Student, University of Oklahoma, 207 Wadsack Dr. Apt F, Norman, OK, 73072, United States of America, ebisa@ou.edu

The objective of this presentation is to demonstrate how experimental design can be used in a goal programming multi-criteria stochastic optimization. A case problem for U.S. energy forecasting is selected. A linear goal programming is developed. Then, the experimental design procedures are shown in the process of solving the problem.

■ WC13

C - Room 207D

Applied Topics in Revenue and Yield Management

Contributed Session

Chair: Robert Russell, Professor, Univ of Tulsa, Finance & Operations Management, 800 S Tucker Drive, Tulsa, OK, 74104, United States of America, rrussell@utulsa.edu

1 - Booking Limit Control by Offer Sets with Discrete Choice Model
Yingjie Lan, Assistant Professor, Beijing University, Guanhua School of Management, Beijing, 100871, China, ylan@pku.edu.cn

We propose a practically convenient and near-optimal control structure for single leg revenue management with customer choice behavior. This kind of control structure mimics the popular booking limit policy with independent demand model. We analyze the structural properties of this new type of policy, and propose an approximate model to solve for such policies. Numerical experiments are conducted to illustrate the effectiveness of such kind of control policies.

2 - Optimizing Vacation Exchange
Dasong Cao, Sr. Analytics Research Scientist, Wyndham Exchange and Rental, 7 Sylvan Way, Parsippany, NJ, 07054, United States of America, dasong.cao@rci.com, Srinidhi Melkote, Arjun Madhavan, Preeti Modgil, Ryan Connelly, Sneha Thakkar

Vacation exchange business is generally to maximize exchanges while seeking fairness. RCI, a subsidiary of Wyndham Exchange and Rentals, is the global leader in vacation exchange. Through RCI Weeks Program, a member deposits a unit of inventory, it is assigned a value called Deposit Trading Power which can then be applied towards exchanging into another unit. "Pricing" is to set the right exchange Trading Power. We present optimal pricing strategy using Linear and Integer Programming models.

3 - The Dynamic and Stochastic Knapsack Problem with Postponement Options
Tianke Feng, Mr., University of Florida, 323 University Village APT 8, Gainesville, FL, 32603, United States of America, fengtk@ufl.edu, Joseph Hartman

The Dynamic and Stochastic Knapsack Problem has wide applications in yield management and finance. Existing research focuses on cases where decisions must be made upon a request's arrival, while in many applications the decision-maker can delay decisions and maintain a queue of requests. We analyze a variety of polices for this problem and identify optimal threshold policies in a special case. We illustrate the benefit of delay through applications in yield management and capital budgeting.

4 - Modeling a Rental Car Pricing and Relocation Problem
Robert Russell, Professor, Univ of Tulsa, Finance & Operations Management, 800 S Tucker Drive, Tulsa, OK, 74104, United States of America, rrussell@utulsa.edu, Tim Madden

A rolling horizon linear programming model is developed to provide decision support and to help to integrate the pricing and relocation decisions for one-way car rentals. Computational requirements, results, and implementation difficulties are reported for a regional test problem for a major car rental company.

■ WC14

C - Room 208A

Stochastic Optimization in Short-Term Power Generation II

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Steffen Rebennack, Assistant Professor, Colorado School of Mines, Engineering Hall 310, Golden, CO, 80401, United States of America, srebenna@mines.edu

1 - A Two-stage Stochastic Economic Dispatch Model with Minimum Frequency Constraints
Yen-Yu Lee, Ph.D. Candidate, University of Texas at Austin, 2 501 Speedway, Austin, TX, 78712, United States of America, yenyu@mail.utexas.edu, Ross Baldick

A new economic dispatch model is proposed as a two-stage stochastic linear program. This model optimizes the expected operation cost under various types of uncertainties. The post-contingency transmission constraints are considered to guide the locational allocations for reserves. In addition, minimum frequency constraints are enforced to incorporate the effects of under-frequency load shedding. Small- and medium-scale system examples are provided to demonstrate the value of the model.

2 - Using Benders on a Stochastic Unit Commitment Model to Estimate Demand Response Cost Savings
Jennifer Van Dinter, PhD Candidate, Colorado School of Mines, 816 15th Street, Golden, CO, 80401, United States of America, jvandinter@mines.edu

Electric utilities must dispatch their generators in order to meet uncertain customer demand and satisfy spinning reserve requirements. This reserve mandate forces utilities to operate generators below their efficient levels, increasing fuel consumption. We explore potential operating costs savings from the implementation of demand response, or load shedding, using a two-stage stochastic unit commitment model solved using Benders Decomposition.

3 - Should Electricity Surpluses be Stored or Destroyed?
Yangfang Zhou, PhD Student, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, yangfang@andrew.cmu.edu, Alan Scheller-Wolf, Nicola Secomandi, Stephen Smith

One logical way to deal with electricity surpluses is to store them in efficient facilities for future sale. Based on analytical and empirical analysis, we discover a different strategy: buying electricity when price is negative and disposing of it using inefficient storage. We support this finding by deriving the optimal policy structure of a storage facility trading in a market with stochastic price, and then numerically evaluating the value of storage using data from NYISO.

4 - Forward Information in Hydropower Scheduling
Daniel Haugstvedt, Norwegian University of Science and Technology, Department of Industrial Econ and Techn Mgm, Alfred Getz v 3, Trondheim, NO-7491, Norway, daniel.haugstvedt@iot.ntnu.no

Reservoirs give hydro power producers the option to store water for release in periods were the expect price is higher. It's profitable to wait with production if the discounted forward price in a future period is higher than the spot price and it's possible to store the water. Using hourly production data from 13 hydropower plants, we investigate how the forward curve is used to plan production.

■ WC15

C - Room 208B

Decision Support Models and Sensitivity Analysis III

Sponsor: Decision Analysis

Sponsored Session

Chair: Lorenzo Peccati, Universitá Bocconi, Department of Decision Sciences, Via Roentgen, Milano, 20139, Italy, lorenzo.peccati@uni-bocconi.it

1 - Transforming Quantitative Business Decisions Using Mathematica's MANIPULATE Function

Nikolaos Adamou, The City University of New York / BMCC, Business Management, 130 Barrymore Blvd, Franklin Square, NY, 11010, United States of America, nikolaoskadamou@gmail.com

This paper will demonstrate that Mathematica's MANIPULATE function is a highly flexible tool in quantitative business decision-making. Non-linearity becomes as flexible as linearity. It can also extend sensitivity analysis from its traditional usage to cover the entire spectrum of coefficients that may change simultaneously.

2 - Calculating Sensitivity Information While Optimizing

Genetha Gray, Sandia National Laboratories, P.O. Box 969, MS 9159, Livermore, CA, 94551-0969, United States of America, gagray@sandia.gov

In its purest form, optimization produces a single "best" point and does not take uncertainty into account. Most current approaches to achieving both optimization and UQ take a serial approach. First, an optimal solution is identified. Then, a series of runs dedicated to UQ analysis are completed. In this work, we will discuss an approach which achieves both simultaneously by combining tools from numerical optimization and Bayesian statistics.

3 - Sensitivity Analysis for Reliability-based Decisions

Kaycee Wilson, University of Oklahoma, 9800 Harmony Dr., Midwest City, OK, 73130, United States of America, jo245@aol.com, Kash Barker

Many large-scale systems in the U.S. and around the globe are aging past the useful life of their planned design. Efficient maintenance decision making is essential for extending the useful life of these systems. This research includes the incorporation of reliability-based decision making with consideration of uncertainty in parameter estimation in a multiobjective framework. This framework is extended to include system-level objectives through coordination of subsystem maintenance decisions.

■ WC16

C - Room 209A

Applications in Open Pit Mining

Sponsor: Energy, Natural Resources and the Environment/ Mining

Sponsored Session

Chair: W. Brian Lambert, PhD Candidate, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, wlambert@mines.edu

1 - Improving the Tractability of Open Pit Block Sequencing Models via Exact Techniques and Heuristics

Alexandra Newman, Associate Professor, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, anewman@mines.edu, Kevin Wood

Open pit block sequencing formulations lend themselves to stronger and more tractable formulations through techniques such as variable definition, variable elimination via preprocessing, and simple heuristics that identify initial solutions or even provide good quality final solutions. We present an overview of and justification for such techniques, provide numerical results, and discuss problem arenas other than precedence constrained knapsack models for which these techniques are relevant.

2 - Heuristics to Expedite the Solution Time of the Open Pit Block Sequencing Problem

W. Brian Lambert, PhD Candidate, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, wlambert@mines.edu, Alexandra Newman

An open pit mine optimizes profits by maximizing the extracted orebody's net present value. Solving an integer program (IP) with time-indexed binary variables for each block representing if, and when, the block is extracted, is an exact method to determine the block extraction sequence. We present heuristics to identify an initial integer feasible solution and an algorithm to enable further variable reductions, and show that both of these expedite the IP solution time.

3 - Implementation of Bienstock and Zuckerberg's Algorithm for the Open-pit Mine Scheduling Problem

Gonzalo Muñoz, Universidad de Chile, Blanco Encalada 2120, Santiago, Chile, gmunoz@dim.uchile.cl, Marcos Goycoolea, Maurice Queyranne, Eduardo Moreno, Daniel Espinoza

In this talk we present our implementation of Bienstock and Zuckerberg's algorithm for solving the open-pit mine scheduling problem. We'll show different features used to get a better performance of the algorithm, such as pre-processing methods to shrink the problem, exploiting the structure of the graph that represents a multi-period mine to speed-up the algorithm, etc. Finally we'll show experiments over real instances, identifying which features make a difference on building a good algorithm.

4 - MineLib an Open Library of Test-instances for Open-pit Mining

Daniel Espinoza, Assistant Professor, Universidad de Chile, 701 Republica, Santiago, Chile, daespino@dii.uchile.cl, Marcos Goycoolea, Eduardo Moreno, Alexandra Newman

OR-techniques have been proposed to tackle mining operations since the 60's, however, a common problem for researchers is the lack of real instances where to test proposed methodologies, and that can serve as a benchmark for all to use. In this talk we present the first such set, available on-line to all for research purposes, and present some results for two clasical mining problems: The ultimate pit design, the sequencing problem over time with resource constraints.

■ WC17

C - Room 209B

Techniques in Decision Analysis

Contributed Session

Chair: Victor Richmond Jose, Assistant Professor, Georgetown University, 37th and O Sts NW, Washington, DC, 20057, United States of America, vrj2@georgetown.edu

1 - Z-Theory: Nonlinear Risk Assessment in Decision Making

Behnam Malakooti, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, OH, United States of America, behnam.malakooti@case.edu

This paper introduces z-theory for assessing nonlinear risk and alternative ranking. Robustness and simplicity of z-utility for assessing nonlinear functions is discussed. It is also shown how z-theory overcomes disadvantages of classical expected utility theory in explaining nonlinear utility functions. Theoretical foundation of z-theory for decision problems under risk is presented and practical examples for different risk behaviors (risk prone, neutral and risk averse) are explained.

2 - Optimal Insurance Demand under Reference Dependent Risk Attitude

Babak Zafari, George Washington University, 2815 9th Street S., Apt 81A, Arlington, VA, 22204, United States of America, zafari.babak@gmail.com

Models of insurance demand based on expected utility and dual theory have been vastly studied. This article examines the robustness of their classical results by using mean-risk model obtained from Disappointment Without Prior Expectation. The results show a more realistic pattern of risk taking behavior compared to other models.

3 - Risk: A Regret Perspective

Chin Hon Tan, University of Florida, Industrial and Systems Engineering, Gainesville, FL, 32611, United States of America, chinhon@ufl.edu, Joseph Hartman

Conventional risk measures that are based on reward alone are inadequate in addressing the risk preferences of individuals. Research in psychology suggests that risk preferences are influenced by feelings of regret. However, research on regret as a risk measure has largely been restricted to just two notions of regret: absolute regret and relative regret. We introduce a general framework for modeling regret and obtain stochastic dominance results for regret-theoretic and mean-risk models.

4 - Sequential Search with Ordinal Ranks and Cardinal Values: Theory and Experimental Evidence

Asa Palley, Duke University, The Fuqua School of Business, 100 Fuqua Drive, Box 90120, Durham, NC, 27708, United States of America, asa.palley@duke.edu

We consider a sequential search problem where the DM observes only the relative ranks of up to N options, whose true values are i.i.d. random variables, and seeks to maximize the expected discounted value of the option that she selects. We show that the optimal policy converges as we relax the applicant limit and compare the results to a closely related full information problem. Experimental results suggest that subjects tend to stop too soon and obtain significantly lower payoffs than optimal.

5 - Scoring Deterministic Forecasts in Decision Analysis Using Scale-Free Measures

Victor Richmond Jose, Assistant Professor, Georgetown University, 37th and O Sts. NW, Washington, DC, 20057, United States of America, vrj2@georgetown.edu

The field of decision analysis relies heavily on the use of forecasts in many of its applications. Though elicitation and evaluation of deterministic forecasts have been studied extensively, we present some new and interesting results related to scale-free measures such as MAPE, sMAPE, and relative error. Some properties of these functions and their implications are discussed.

■ WC18

C - Room 210A

Topics in Production and Scheduling

Contributed Session

Chair: Yasaman Mehravaran, PhD Candidate, Oergon State University, School of Mech, Indust, and Mfgr Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, mehravay@onid.orst.edu

1 - An Efficient k-step Lookahead Search Algorithm for Scheduling Parallel Mode Cluster Tools

Jin Young Choi, Associate Professor, Ajou University, San 5, Woncheon-dong, Yeongtong-gu, Suwon, Korea, Republic of, choijy@ajou.ac.kr, Hwang Ho Kim

We present an efficient k-step lookahead algorithm for scheduling parallel mode cluster tools that can process multiple types of lots at the same time. It consists of two main steps for selecting a prominent candidate node with (i) shorter cycle time and (ii) less possibility of deadlock. It is examined for its performance by generating some example configuration of cluster tools.

2 - Optimizing Dynamic Inventory Replenishment and Substitution for Two Products with Positive Leadtimes

Jianjun Xu, Zaragoza Logistics Center, Edificio Nayade - Portal, Calle Bari 55 - Plaza, Zaragoza, 50197, Spain, jxu@zlc.edu.es, Shaohui Zheng, Youyi Feng, David D. Yao

We carry out a structural analysis for a family of two products to be replenished and supplied to a market with demand uncertainty. The ordering times are not negligible and not the same for the products. A high-end product can substitute for the low-end product. We discover the structural properties of optimal policies for dynamic replenishment and substitution of inventory management.

3 - Dual Resource Scheduling with Distinct Setup and Run Labor

Yasaman Mehravaran, PhD Candidate, Oergon State University, School of Mech, Indust, and Mfgr Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, mehravay@onid.orst.edu, R. Logen Logendran

We propose a metaheuristic algorithm to solve an unrelated-parallel machine scheduling problem in which both machines and labor are constrained. The goal is to minimize the work-in-process inventory while maximizing the service level. Different skill levels are considered for labor and the skill required for performing a job's setup is different from its run. The setup is considered to be sequence-dependent and job releases are dynamic.

■ WC19

C - Room 210B

Empirical Analysis in Economics

Contributed Session

Chair: Paul Kattuman, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, CB4 2BE, United Kingdom, p.kattuman@jbs.cam.ac.uk

1 - An Empirical Analysis of Data Breach Litigation

Sasha Romanosky, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, sromanos@andrew.cmu.edu, Alessandro Acquisti, David Hoffman

Data breach disclosure laws have prompted a flurry of lawsuits by victims of identity theft. Using data collected from Westlaw and PACER, empirically analysis federal data breach lawsuits from 2000-2010. Docket analysis is a method of empirical legal research using legal complaints and judicial rulings. We use discrete choice regression models to estimate the probability that a data breach will result in a lawsuit and the probability that, once filed, the plaintiff will achieve a settlement.

2 - Hybrid Neural Network Model in Forecasting Retail Sales

Elizabeth Haran, Professor, Salem State University, 352 Lafayette Street, Salem, MA, 01970, United States of America, elizabeth.haran@salemstate.edu, Youqin Pan, Zaiyong Tang

This paper tries to demonstrate the feasibility and potential of applying empirical mode decomposition (EMD) in forecasting retail sales during recessions. The hybrid forecasting method integrating EMD and Neural Network was employed to predict retail sales .Findings indicate that EMD-Neural Network can significantly improve forecasting performance.

3 - Estimating Real Money Balances for U.K: A Simultaneous Equation Approach

Abul Jamal, Professor, Southeastern Louisiana University, College of Business, Hammond, LA, 70402, United States of America, ajamal@selu.edu, Yu Hsing

Equilibrium real balances and interest rates have been the subject of extensive research. Most studies presume the supply of money to be fixed by the central bank and that the interest rate is solely determined by the demand for money. In this paper we specify both the demand for and supply of money in the U.K. is estimating the real money balances.

4 - The Equity Pledge of Controlling Shareholder of Companies Listed on China's GEM

Jie Xiong, School of Management, Xi'an Jiaotong University, School of Management Box 2230, No.28 Xianning West Road, Shaanxi, Xi'an, China, xjstca@163.com, Dong Qian, Jue Guo

This study investigated the effects of the controlling shareholder's behavior of equity pledge on the value of company listed on GEM and behavioral choices of the controlling shareholder based on the real option theory. Monte Carlo simulation analysis results indicated the relationship between pledge discount rate and equity pledge ratio of controlling shareholder, the risk level to select and the value of companies listed on GEM.

5 - Significant Concentration

Paul Kattuman, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, CB4 2BE, United Kingdom, p.kattuman@jbs.cam.ac.uk

The 80 : 20 rule speaks to the ubiquity of dominance. In empirical work, the concentration ratio is used to summarise the extent to which a market is dominated. Four growth models map to the same probability distribution for the concentration ratio. Based on this, we analyse dominance in competitive systems with positive feedback. Using an urn model and probabilistic lock-in, we find the trade-off between initial asymmetry in market shares and feedback strength for market dominance.

■ WC20

C - Room 211A

Global Optimization - Applications

Sponsor: Optimization/Global Optimization

Sponsored Session

Chair: Syed Mujahid, University of Florida, 303 Weil Hall, Gainesville, United States of America, smujahid@ufl.edu

1 - Beam Angle Selection in Radiation Treatment Planning – A Challenging Global Optimization Problem

Robert Meyer, University of Wisconsin-Madison, Madison, United States of America, rrm@cs.wisc.edu, Siyang Gao, Weiwei Chen, Leyuan Shi, Warren D'Souza, Hao Howard Zhang

An important element of radiation treatment planning for cancer therapy is the selection for a given patient of a set of 5-9 incident radiation beam angles. Machine learning tools are used in conjunction with a Nested Partitions framework for this global optimization problem.

2 - A Global Optimization Technique for Spectral Peak Deconvolution of Polyhydroxy Fullerenes

Vijay Pappu, University of Florida, Gainesville, FL, United States of America, psnvijay@ufl.edu, Panos Pardalos

Recently, Polyhydroxy Fullerenes (PHFs) have been effective in non-invasive Cancer imaging and treatment. As PHFs find applications for commercial use, accurate characterization of the same becomes critical. In this talk, we present peak deconvolution techniques applied to FTIR spectra of PHFs to accurately characterize them. A constrained nonlinear least-squares formulation is presented for this problem and solved to global optimality using penalty methods.

3 - Linear Matrix Factorization: An MIP Based Approach

Syed Mujahid, University of Florida, 303 Weil Hall, Gainesville, United States of America, smujahid@ufl.edu, Panos Pardalos, Pando Georgiev

Data representation is one of the important and interesting topics in the field of data analysis. The most common approach to represent data is decomposing the data into a linear matrix form. In this talk, we will present a mixed integer programming (MIP) approach for some of the special cases of data representation problem. Moreover, we will discuss the advantages and disadvantages of using MIP accproach over the traditional approaches in finding the global optimal representation.

■ WC21

C - Room 211B

Modeling and Optimization of Risk

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Michael Zabarankin, Associate professor, Stevens Institute of Technology, Castle Point on the Hudson, Hoboken, NJ, 07030, United States of America, mzabaran@stevens.edu

1 - A Risk-based Linear Separation Model

Yana Morenko, Department of Mechanical and Industrial Engineering, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States of America, yana-morenko@uiowa.edu, Pavlo Krokhmal

We propose a linear separation model that minimizes the risk of misclassification and reduces to LP problem with p-order conic constraints, and generalizes the model of Bennett and Mangasarian (1992). The proposed solution approach is based on reformulation of p-cones as second order cones when p is rational. An algorithm for "minimal" SOCP representations of rational order p-cones is given. A case study on several popular data sets illustrating the developed model is conducted.

2 - Optimal Sensor Placement: Theory and Application

Anton Molyboha, scientist, Chicago, United States of America, anton.molyboha@gmail.com

A framework of optimal sensor placement for threat detection is presented. It includes a range of statistical models and optimization approaches tailored to specific threat detection applications.

3 - Risk Averse Decision Making under Catastrophic Risk

Bogdan Grechuk, Professor, University of Leicester, United Kingdom, bg83@leicester.ac.uk

An axiomatic framework for risk averse decision making under catastrophic risk is presented. It embraces the safety first principle inconsistent with the classical expected utility theory.

4 - General Deviation Measures: Theory and Application

Michael Zabarankin, Associate professor, Stevens Institute of Technology, Castle Point on the Hudson, Hoboken, NJ, 07030, United States of America, mzabaran@stevens.edu, Bogdan Grechuk

This talk discusses recent progress in the theory and application of general measures of deviation.

■ WC22

C - Room 212A

Complementarity Problems: Theories and Applications

Sponsor: Optimization/Nonlinear Programming

Sponsored Session

Chair: Lanshan Han, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47907, United States of America, han144@purdue.edu

1 - Continuous-Time Point-Queue Models in Dynamic Network Loading

Jong-Shi Pang, Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Avenue, Urbana, IL, 61801, United States of America, jspang@illinois.edu

This is the beginning of a mathematically rigorous study of the continuous-time dynamic user equilibrium problem using the mathematical paradigm of differential complementarity systems. Here, we focus on the investigation of continuous-time point-queue models and identify desirable properties that they should possess and discuss their numerical solution.

2 - Nonparametric Estimation of Shape Constrained Functions: A Constrained Optimization Approach

Jinglai Shen, Assistant Professor, Department of Math and Statistics, University of Maryland Baltimore County, 1000 Hilltop Circle, Baltimore, MD, 21250, United States of America, shenj@umbc.edu

This talk addresses spline estimation of shape constrained functions in statistics and engineering. Two spline estimators are discussed: penalized splines (ie P-splines) and smoothing splines. The P-splines yield size dependent complementarity conditions; a critical uniform Lipschitz property is established. The latter estimator is formulated as a constrained optimal control problem that leads to a complementarity system. A nonsmooth Newton method is used for numerical resolution.

3 - Generalized Nash Equilibria in Decentralized Network Interdiction Games

Andrew Liu, Assistant Professor, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, andrewliu@purdue.edu, Nelson Uhan

In a decentralized network interdiction game, agents seek to reduce the capabilities of adversaries in a shared network. Due to a lack of coordination and potentially conflicting objectives, the system-wide outcome of equilibria may be suboptimal compared to that of centralized actions. This motivates studying the price of anarchy (PoA) with respect to generalized Nash equilibria (GNE) in these games. We will discuss properties of the GNE and PoA in decentralized network interdiction games.

4 - Equilibrium Dynamic Traffic Assignment with Departure Time Choice Using Cell Transmission Model

Kien Doan, Graduate Student, Purdue University, 550 Stadium Mall, West Lafayette, IN, 47907, United States of America, kdoan@purdue.edu, Lanshan Han, Satish Ukkusuri

In this study, we focus on solving the simultaneous route and departure time choice problem in general networks with multiple O-D pairs by embedding the cell transmission model to formulate the traffic propagation . Complementarity theory is applied to analyze the solution existence and other properties of the formulations. Extensive computational experiments are conducted to demonstrate the benefits of the proposed formulations on various test networks.

■ WC23

C - Room 212B

New OR Techniques for Homeland Security

Contributed Session

Chair: Samrat Chatterjee, University of Southern California, 3710 McClintock Avenue, RTH 322, Los Angeles, CA, 90089-2902, United States of America, samrat.chatterjee@usc.edu

1 - Determining the Optimal Number of Robots in a Single Operator Multi-Robot Environment

R. Darin Ellis, Associate Professor, Wayne State University, 5050 Anthony Wayne Dr, College of Engineering, Detroit, MI, 48201, United States of America, rdellis@wayne.edu, Alper Murat, Mehmet Burak Senol

We develop a model to determine the optimal number of intelligent unmanned systems (i.e. robots) a user can manage (i.e. fan-out). Autonomy advances increase the affordable neglect time, enabling management of multiple robots. Earlier work proposed simple models that are not consistent with observations. Here, we consider additional aspects (e.g. mission achievement, environment, utilization) and offer a deterministic optimization model to estimate more accurate results for predicting fan-out.

2 - Tools for Investigating Cargo Screening Processes – Scenario Analysis to Agent Oriented Simulation

David Menachof, Peter Thompson Chair in Port Logistics, The University of Hull, Hull University Business School, Logistics Institute, Kingston upon Hull, HU6 7RX, United Kingdom, d.menachof@hull.ac.uk, Peer-Olaf Siebers, Galina Aickelin, Uwe Aickelin

2 key stakeholders with diverse interests are involved in decision-making processes regarding port operations. Port operators seek a smooth flow of ops., while the border agency's main concern is national security, but not without limits to cost. Cost Benefit Analysis (CBA) is a tool that aids in finding the right balance between service, security, and costs. We review major approaches to CBA and introduce Agent-Oriented Discrete Event Simulation as an innovative approach for this purpose.

3 - Multistage Sampling of Terrorist Threat Scenarios
Samrat Chatterjee, University of Southern California, 3710 McClintock Avenue, RTH 322, Los Angeles, CA, 90089-2902, United States of America, samrat.chatterjee@usc.edu, Stephen Hora

This study focuses on the development of statistical sampling methods to support terrorist threat scenario quantification decisions amidst uncertainties. A multistage sampling approach is proposed to address concerns related to scenario size, importance, and stratification.

■ WC24

C - Room 213A

Mixed Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Jean-Philippe Richard, Associate Professor, University of Florida, 303 Weil Hall, Gainesville, United States of America, richard@ise.ufl.edu

1 - Base-2 Expansions for Linearizing Products of Functions of Discrete Variables
Warren Adams, Professor of Mathematical Sciences, Clemson University, O-327 Martin Hall, Clemson, SC, 29634, United States of America, wadams@clemson.edu, Stephen Henry

An approach for representing functions of discrete variables, and their products, using logarithmic numbers of binary variables is presented. The resulting forms are important for reformulating general discrete variables as binary, and also for linearizing mixed-integer generalized geometric and discrete nonlinear programs where it is desired to economize on the number of binary variables.

2 - Convexification Techniques for Linear Complementarity Constraints
Trang Nguyen, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, trang@ufl.edu, Mohit Tawarmalani, Jean-Philippe Richard

We describe a convexification technique for linear programs with linear complementarity constraints that generalizes the reformulation-linearization technique of Sherali and Adams and has similar convergence properties. We then consider certain complementarity problems appearing in KKT systems. For such problems, we show that all nontrivial facet-defining inequalities can be obtained through a simple procedure that aggregates constraints and use McCormick relaxations of bilinear terms.

3 - Design and Verify: A New Scheme for Generating Cutting-Planes
Santanu S. Dey, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30318, United States of America, santanu.dey@isye.gatech.edu, Sebastian Pokutta

A cutting-plane procedure for integer programs usually involves invoking a black-box procedure (like Gomory-Chvatal procedure) to compute a cutting-plane. In this talk, we describe an alternative paradigm of using the same cutting-plane black-box: First, we design an inequality independent of the cutting-plane black-box. Then we verify that the designed inequality is a valid inequality using the cutting-plane black-box. We undertake a systematic study of properties of verifiable inequalities.

4 - Discrete Entropy and the Complexity of Stochastic Integer Programming
Karthekeyan Chandrasekaran, Georgia Institute of Technology, College of Computing, Atlanta, GA, United States of America, karthe@gatech.edu, Santosh Vempala

We consider random integer programs defined by linear constraints whose normal vectors are chosen independently from any spherically symmetric distribution. We show that with high probability, a program defined by O(n) constraints has an integer solution provided the corresponding polytope contains a ball whose radius is larger than a universal constant. For a polytope with m constraints in n-dimensional space, with $n < m < 2^{O(n)}$, a ball of radius about Omega(sqrt(log (2m/n))) suffices.

■ WC25

C - Room 213BC

Revenue Management with Consumer Behavior Models

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Ozalp Ozer, Associate Professor, The University of Texas at Dallas, School of Management, 800 West Campbell Road, Richardson, TX, 75080, United States of America, oozer@utdallas.edu

Co-Chair: Yanchong Karen Zheng, Assistant Professor, Massachusetts Institute of Technology, Sloan School of Management, Cambridge, MA, 02139, United States of America, yanchong@mit.edu

1 - Event Revenue Management with Resale
Yao Cui, PhD Student, Ross School of Business, University of Michigan, Ann Arbor, United States of America, cuiyao@umich.edu, Izak Duenyas, Ozge Sahin

We develop a consumer behavior model of ticket purchase/resale in which buyer's purchasing decision in the primary market is based on the outcomes of the resale market and valuation uncertainty. We analyze the optimal dynamic pricing strategy in the presence of a secondary market. We compare market structures and revenues resulting from dynamic pricing and options. We show that not only options improve the revenues but also the improvement is resulting from the shrinkage of the resale market.

2 - Optimal Timing of Sequential Distribution: The Impact of Day-and-Date Strategies
Hyoduk Shin, Assistant Professor, Northwestern University, Kellogg School of Management, Evanston, IL, 60201, United States of America, hyoduk-shin@kellogg.northwestern.edu, Terrence August

The window between a film's theatrical and video releases has been declining with some studios now testing day-and-date strategies (i.e., when a film is released across multiple channels at once). We present a consumer choice model and study the optimal video release time, examining trade-offs between substitutable products (theatrical and video forms), the possibility of purchasing both, and the timing of consumption. We demonstrate when the day-and-date strategy can be optimal for studios.

3 - Strategic Purchase with Regret and Misperception of Availability
Yanchong Karen Zheng, Assistant Professor, Massachusetts Institute of Technology, Sloan School of Management, Cambridge, MA, 02139, United States of America, yanchong@mit.edu, Ozalp Ozer

We study the impact of consumers' regret and misperceived product availability on a firm's inventory decision under a markdown policy. We show that both late-purchase regret and misperception of availability make it less necessary for the firm to use inventory rationing, whereas early-purchase regret encourages rationing. In addition, the firm can leverage these behavioral issues on the consumer side to substantially increase its profitability.

■ WC26

C - Room 213D

Outsourcing in IT

Contributed Session

Chair: Biao Liu, Peking University, Peking University, Beijing, China, Beijing, BJ, 100871, China, biao_liu@pku.edu.cn

1 - The Impact of Knowledge Gap on China's Vendor Success in IT Service Outsourcing
DU Zhanhe, PH. D., the School of Management, Xi'an Jiaotong University, No. 28 at Xianning West Road of Xi'an, Xi'an, 710049, China, laodu.008@stu.xjtu.edu.cn, Zongming Zhang

There are a large knowledge gap between China's vendors and their offshoring clients due to the different culture, technology, business, relationship, and process knowledge. Knowledge gap affects China's vendor success through some mediators such as knowledge transfer, partnership, and control. Absorptive capacity has strong moderating effects on the above relationships.

2 - Contract Design and Information Value in IT Service Outsourcing
Zongming Zhang, PHD, Xi'an Jiaotong University, No.28, Xianning West Road, Shaanxi, Xi'an, 710049, China, zhang.zongming@stu.xjtu.edu.cn, Xiuwu LIAO, Shulin LIU

We analyze contracting issues and information value arising in IT service outsourcing. Depending on whether the service provider's effort information and cost information are symmetric or not, we investigate how service outsourcing contracts can be designed in four scenarios. And the value of effort information and cost information is discussed.

3 - An Operational Model of Data Center Operators and its Application to Staffing and Quality Monitoring

Masahiro Asaoka, Fujitsu Laboratories Ltd., 4-1-1 Kamikodanaka, Nakahara-ku, Kawasaki, 211-8588, Japan, asaoka.masahiro@jp.fujitsu.com, Hideki Yamanaka

In data centers, fundamentally manual operations that cannot be logged in detail (e.g. hardware visual checking, visual monitoring of running automatic operations, etc.) are still remaining and thus it is hard to grasp the accurate load of operators based on logs. To overcome the situation, we have developed a system predicting the load of operators based on operation instructions and an operational model of operators without logs so as to assist staffing and quality monitoring.

■ WC27

C - Room 214

Managing Service Systems

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Achal Bassamboo, Northwestern University, Evanston, IL, United States of America, a-bassamboo@kellogg.northwestern.edu

Co-Chair: Ramandeep Randhawa, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States of America, Ramandeep.Randhawa@marshall.usc.edu

1 - Overflow Networks: Approximations and Implications to Call Center Outsourcing

Ohad Perry, IEMS, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, ohad.perry@northwestern.edu, Itai Gurvich

Motivated by call-center outsourcing problems, we consider a network with multiple call centers overflowing some of their calls to a central call center. Relying on a separation of time scales, we establish heavy-traffic approximations and prove an asymptotic-independence result which facilitates expressions for the customer waiting-time distributions. The asymptotic independence is shown to be useful in solving some call-center optimization problems.

2 - Staffing Multiclass Service Systems: Problem Formulations and Consistency Constraints

Seung Bum Soh, Kellogg School of Management, 2001 Sheridan Rd., Evanston, IL, 60201, United States of America, seung-soh@kellogg.northwestern.edu, Itai Gurvich

In the presence of multiple customer classes, the problem of minimizing staffing costs subject to quality of service targets raises conceptual issues already in the formulation stage. We make a first step in studying the question of "good" formulations by introducing a notion of consistency amongst customer classes and examining its implications on the outcomes of the capacity planning. The solution to the resulting staffing and routing problems help us capture the "cost of consistency."

3 - Considering Service Quality in a Two-Stage Service Process

Azin Farzan, Doctoral Student, University of Washington, Box 353226, Foster School of Business, Seattle, WA, 98195-3226, United States of America, afarzan@uw.edu, Yong-Pin Zhou

We analyze service quality in a two-stage service process. Cost depends on both staffing and effort in a multiplicative way. Waiting time at each stage is determined by local staffing level, but customer satisfaction is determined by effort at both that and the preceding stages. We consider decentralized and outsourcing scenarios and devise a coordination mechanism that is robust. We also investigate the role of pooling when multiple first-stage clients outsource to the same second-stage firm.

4 - The Value of Static Pricing in Queueing Systems with Uncertain Arrival Rates

Ramandeep Randhawa, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States of America, Ramandeep.Randhawa@marshall.usc.edu, Moshe Haviv

We consider revenue and social optimization in an M/M/1 queue with price and delay sensitive customers, and study the performance of static, or arrival rate independent, pricing. We find that the value of static pricing depends both on the objective criterion and the customers' delay sensitivity. In particular, the performance increases in the delay sensitivity and is always better under revenue optimization, where in some cases static pricing may capture more than 99% of the optimal revenue.

■ WC28

C - Room 215

Lifecycle Issues in Environmental Operations

Contributed Session

Chair: Kashek Lee, Associate Professor/Associate head, Department of Industrial Engineering and Logistics Management, The Hong Kong University of Science and Technology, Rm4545,HKUST,Clear Water Bay, Kowlloon, Hong Kong - PRC, nlee@ust.hk

1 - Impact of Optimal Blend Models on Estimated Uncertainty in Biodiesel Lifecycle Carbon Footprint

Ece Gulsen, Massachusetts Institute of Technology, E38-435 292 Main Street, Cambridge, United States of America, ece@mit.edu, Randolph Kirchain, Elsa Olivetti

Biodiesel industry operates with access to global feedstock supply. In addition to cost and quality management of the final fuel blend, recent regulations limit estimated lifecycle greenhouse gas emissions that are highly uncertain. Uncertainty-aware optimal blend models are shown to reduce uncertainty while controlling the final fuel cost and quality.

2 - Invasive Species Control Based on a Cooperative Game

Esra Buyuktahtakin, Assistant Professor, IME Department, Wichita State University, Wichita, KS, United States of America, esra.b@wichita.edu, Zhuo Feng, George Frisvold, Ferenc Szidarovszky

We study a long-term dynamic model for controlling invasive species using the theory of cooperative games, with the application to the case of buffelgrass control in the Arizona desert. The interest groups are concerned about the damages to three different valued and threatened resources including saguaros, buildings and vegetation. The model decides the optimal allocation of labor and budget to these resources to control the population of the species in a multi-period planning horizon.

3 - Pollution Reduction Policies under Uncertainty and Their Costs

Motoh Tsujimura, Doshisha University, Kamigyo-ku, Kyoto, 602-8580, Japan, mtsujimu@mail.doshisha.ac.jp

We investigate pollutant reduction policies under uncertainty. We consider two kinds of policies distinguished by their costs. One incurs proportional reduction cost and the other incurs fixed and proportional reduction costs. To solve these problems, we formulate the agent's problems as a singular stochastic control problem and a stochastic impulse control problem, respectively. Using this analysis, we show optimal pollutant reduction policies and present numerical analysis.

4 - Performance Enhancement of the Engineered Particles for Geoengineering

Kashek Lee, Associate Professor/Associate head, Department of Industrial Engineering and Logistics Management, The Hong Kong University of Science and Technology, Rm4545,HKUST,Clear Water Bay, Kowlloon, Hong Kong - PRC, nlee@ust.hk, Bin Dai

Engineered particles have many advantages in geoengineering to stabilize climate change. In this study, the performance of the engineered particles is enhanced from the radiation shielding and aerodynamics by material selection and structure design, respectively. We find that the improvement with a factor of around 1000 is readily achievable.

■ WC29

C - Room 216A

Operations / Finance Interface

Contributed Session

Chair: Sandun Perera, School of Management, The University of Texas at Dallas, Richardson, TX, 75080, United States of America, scp080020@utdallas.edu

1 - Do Merged Firms Benefit from Inventory Pooling?

Nagihan Comez, Assistant Professor, Bilkent University, Bilkent, Ankara, 06800, Turkey, comez@bilkent.edu.tr, Basak Tanyeri

We test the basic inventory pooling theory predictions on mergers/acquisitions using firm-level data for 246 same-industry mergers carried out in U.S. between 1981-2009. Our results provide empiric support for the theory: the inventory turnover of mergers improve relative to their industry, following the successful completion of mergers and the improvement in inventory turnover is inversely related with the pre-merger demand correlation between merging firms.

2 - Dynamic Financial Hedging Strategies in Storable Commodity Inventory Systems
Zhan Pang, Lancaster University, Department of Management Science, Lancaster, United Kingdom, z.pang@lancaster.ac.uk, Qing Ding, Panos Kouvelis

We address a dynamic financial hedging problem in storable commodity inventory systems in a mean-variance framework. We formulate this problem as a dynamic program and characterize the structure of the optimal joint inventory control and hedging strategies. Our results shed new light into the financial risk management of operational systems.

3 - Impact of Product Recalls on Shareholder Wealth
John Ni, Indiana University, Kelley School of Business, 1309 E 10th Street, Bloomington, IN, 47405, United States of America, jzni@indiana.edu, Barbara B Flynn, F. Robert Jacobs

The recalls of lead-paint related toys in 2007 caused serious concerns among consumers and investors. To estimate the impact of a recall announcement on firm value, we applied event study methodology to compute the abnormal returns around the date when a recall is announced, using data on recalls announced by the Consumer Product Safety Commission. To explain the difference in abnormal returns, we used cross-sectional regression to examine a number of firm- and recall-related characteristics.

4 - Market-reaction-adjusted Optimal Central Bank Intervention Policy in the Foreign Exchange Market
Sandun Perera, School of Management, The University of Texas at Dallas, Richardson, TX, 75080, United States of America, scp080020@utdallas.edu, Alain Bensoussan, Hongwei Long, Suresh P. Sethi

We study a central bank intervention problem in the foreign exchange market when an intervention temporarily affects the market dynamics. Motivated by empirical observations, we assume that the market observes and reacts to the interventions by the central bank. Impulse control theory is used to prove a verification theorem with QVI and to solve the problem of finding the optimal times and amounts of interventions. We also discuss a practical instance of the problem and solve it numerically.

■ WC31

C - Room 217A

Health Systems Modeling and Decision Making

Sponsor: Health Applications

Sponsored Session

Chair: Eva Enns, PhD Candidate, Stanford University, 117 Encina Commons, Stanford, United States of America, evaenns@stanford.edu

1 - Population Sampling in Dynamic Healthcare Policy
Lauren Cipriano, Stanford University, Huang Engineering Center, Stanford, United States of America, cipriano@stanford.edu, Thomas Weber

The desirability of a health program may decisively depend on population trends. We consider the decision about treating a certain cohort in a time-varying population with imperfectly observable dynamics. To reduce uncertainty it is possible to collect costly samples. We determine an optimal sampling policy and apply our results to hepatitis C screening of a population with linear prevalence dynamics.

2 - A Multi-agent Supply and Demand Model for Providing Health Care to a Marginalized Population
Greg Werker, University of British Columbia, 3869 W. 18th Avenue, Vancouver, BC, V6S 1B4, Canada, greg.werker@sauder.ubc.ca, Martin Puterman

Motivated by Vancouver's Downtown Eastside – a small geographic area with many health agencies operating independently – we propose individual models to represent provision of mental health, addictions treatment, and primary care services. These models are linked at the system level by a multi-agent model containing both competitive and cooperative elements. We present mechanisms to encourage cooperative actions that benefit the clients.

3 - Using Models to Identify Risk-appropriate Cancer Screening
David Hutton, University of Michigan, Ann Arbor, MI, United States of America, dwhutton@umich.edu

Cancer screening guidelines are often based on national population averages. But, there are particular population groups that have higher-than-average risks for specific cancers or cancer-precursors. I will describe three examples of how models can be used to help evaluate cost-effectiveness of cancer screening interventions. I will describe how the flexibility afforded by models can allow researchers to quickly and easily evaluate targeted cancer screening programs.

4 - Measures of Risk in Disease Transmission Networks
Eva Enns, PhD Candidate, Stanford University, 117 Encina Commons, Stanford, United States of America, evaenns@stanford.edu, Margaret Brandeau

The contact network structure through which an infectious disease spreads influences the evolution of an epidemic, both in the expected total number of infections and the speed at which the disease spreads. We explore measures of risk relating to network structure and discuss implications for disease control policies.

■ WC32

C - Room 217BC

Research Supporting Sustainability

Contributed Session

Chair: Zhi Tao, Kent State University, 475 Terrace Drive, Kent, OH, 44242, United States of America, ztao@kent.edu

1 - Optimization of a Two Step Aluminum Recycling Production Process
Tracey Brommer, Massachusetts Institute of Technology, 292 Main Street, Room E38-435, Cambridge, MA, 02142, United States of America, tbrommer@mit.edu, Elsa Olivetti, Randolph Kirchain

A large aluminum producer is considering the construction of a waste upgrading facility that would feed into a recycling plant. A recourse optimization model was developed to maximize recycling of the waste material in the presence of demand uncertainty. The challenges faced by the company stem from the variable supply of incoming materials and demand for final products as well as perishable intermediate products. The model's ability to maximize material use is evaluated through simulation against actual production data.

2 - Plant Root Optimization
James Heppell, Southampton University, University Road, Southampton, SO17 1BJ, United Kingdom, jph106@soton.ac.uk, Tiina Roose, Joerg Fliege, Konstantinos Zygalakis

To maximise sustainable crop production, we optimise fertilised placement and root structure of plants using models from Roose and Zygalakis for plant root growth. We report the performance of several optimization techniques on this multi-objective, multi-variable problem.

3 - Planned Obsolescence and Recycling Costs with Product Take Backs
Effie Stavrulaki, Associate Professor, Bentley University, 175 Forest Street, Waltham, MA, 02452, United States of America, estavrulaki@bentley.edu, Michael Pangburn

Legislation that requires a firm recycle its end-of-life products may encourage the firm to defer recycling costs by increasing product durability, counter to the strategy of planned obsolescence (i.e. decreasing durability). We consider the tension between planned obsolescence and recycling costs, in a 2-period setting. We analyze how recycling costs impact optimal product durability, and consider how differences in recycling costs across the first and second periods affect the firm's policy.

4 - Environmental Cost Based Operation Decisions
Zhi Tao, Kent State University, 475 Terrace Drive, Kent, OH, 44242, United States of America, ztao@kent.edu

This paper integrates carbon emissions in the joint economic-lot -size model under deterministic conditions and investigates how a jointly optimal ordering are beneficial for both environmental conscious parties in a single vendor and a single buyer setting. Our sensitivity analysis provides insights on the management of relationship between buyer and vendor in a environment conscious society.

■ WC33

C - Room 217D

Statistical Decision Making and Quality Estimation in Energy Manufacturing Application

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Seungchul Lee, Postdoctoral Research Fellow, The University of Michigan, 1035 H.H. Dow, 2300 Hayward St., Ann Arbor, MI, 48109, United States of America, seunglee@umich.edu

Co-Chair: Jeonghan Ko, Assistant Professor, University of Nebraska, Lincoln, W338 Nebraska Hall, Lincoln, NE, 68588, United States of America, jko2@unl.edu

1 - Remaining Useful Life Prediction and Optimal Replacement Policy for Battery

Seungchul Lee, Postdoctoral Research Fellow, The University of Michigan, 1035 H.H. Dow, 2300 Hayward St., Ann Arbor, MI, 48109, United States of America, seunglee@umich.edu

Next-generation battery technologies will constitute the enabling tools that would lead to information-rich batteries, thus allowing the transparent assessment of a battery's health as well as the prediction of a battery's remaining-useful-life (RUL) and its subsequent impact on vehicle mobility. Therefore, we will present how to estimate RUL and how to find the optimal replacement policy for batteries using the total time on test (TTT plot).

2 - Assembly Strategies for Product Remanufacturing with Variable Quality Returns

Xiaoning Jin, PhDCandidate, University of Michigan, Ann Arbor, MI, United States of America, xnjin@umich.edu, S. Jack Hu, Jun Ni

This paper studies optimal policy for modular product reassembly in remanufacturing where a firm receives product returns with variable quality and reassembles products of multiple classes to orders. Higher quality modules are used to substitute for lower quality modules during reassembly. We show that the optimal reassembly and substitution follows a threshold–based control policy.We compare the optimal policy to the exhaustive assembly policy and show the great benefit in substitution.

3 - Sustainable Smart Battery

Seyed Mohamma Rezvanizaniani, University of Cincinnati, 515 ludlow ave, Cincinnati, Oh, 45220, United States of America, rezvansd@mail.uc.edu

A sustainable smart battery is the result of merging the new battery technology with smart enabling tools. The smart battery is an "information-rich" energy-storage device with enhanced capabilities. The enhanced capabilities include: embedded service capabilities; remote smart monitoring for hard-to-access applications; and online management of batteries during their life-cycle to ensure mobility.

4 - Electric Power Resource Planning: A Continuous-Discrete Modeling Approach

Rhythm Suren Wadhwa, NTNU, Richard Birkelands Vei 2B, Trondheim, Norway, rhythm.s.wadhwa@ntnu.no, Seungchul Lee

In this study, we propose to develop a comprehensive simulation based decision making framework to determine the most desirable combination of resource investments for electric power generation. The distributed power system considered here has two major components including energy generation via wind farm and fossil fuel. The proposed approach has been successfully demonstrated for the electric utility resource planning in Sor-Trondelag, Norway.

■ WC34

C - Room 218A

Technology Investment Decision Making in Hospitals

Sponsor: Health Applications

Sponsored Session

Chair: Andrew J. Henry, Virginia Tech, 110 Durham Hall, Blacksburg, VA, 24060, United States of America, ajhenry@vt.edu

Co-Chair: Christian Wernz, Assistant Professor, Virginia Tech, 205 Durham Hall (0118), Blacksburg, VA, 24061, United States of America, cwernz@vt.edu

1 - Achieving Strategic Balance in Hospital Equipment Investments: Money versus Mission

Don Kleinmuntz, Executive VP, Strata Decision Technology, 2001 S First St STE 200, Champaign, IL, 61820, United States of America, dnk@strata-decision.com

Hospitals confront a growing need for newer, better medical technology, along with many other demands on scarce funds. This talk will describe my experience implementing an OR-based approach that is now used on a routine basis by hundreds of US hospitals to strategically allocate funds to competing technology projects. I will provide insight into the processes hospitals use to implement this model, along with the challenges that they encounter.

2 - An Agent-based Model Approach to Study Accountable Care Organization

Pai Liu, University of Southern California, 956 W 23 St, Los Angeles, CA, 90007, United States of America, pailiu@usc.edu, Shinyi Wu

Accountable Care Organization (ACO) has been widely discussed as a strategy to control the rapidly rising healthcare costs and improve the quality of care, while there is no consensus on how to build an ACO. We proposed a conceptual framework using agent-based modeling to study the relationships between the design of the ACO and its capability of achieving its environed goals.

3 - Investment Decision Making in Hospitals: A System Dynamics Approach

Andrew J. Henry, Virginia Tech, 110 Durham Hall, Blacksburg, VA, 24060, United States of America, ajhenry@vt.edu, Christian Wernz, Peter Mayer

We develop a system dynamics model to evaluate technology investment decisions in a healthcare setting. Our model provides financial justification for decisions based on area and need populations, capacity, variable costs and revenue, success rates, and market share over a time horizon. The model takes into account a dynamic market share as well a success rate based on a learning curve. Overall, the model provides a structured way of thinking about the impacts of a costly technology investment.

■ WC36

C - Room 219A

Joint Session DM/HAS: Data Mining and OR in Healthcare Problem and Clinical Decision Support

Sponsor: Data Mining/Health Applications

Sponsored Session

Chair: Sung Won Han, Researcher, University of Pennsylvania, 423 Guardian Dr, Philadelphia, PA, United States of America, hansungw@mail.med.upenn.edu

1 - Unified Framework for Change Point Model by Reproducing Kernel Hilbert Space-based Spline

Sung Won Han, Researcher, University of Pennsylvania, 423 Guardian Dr, Philadelphia, PA, United States of America, hansungw@mail.med.upenn.edu, Mary Putt, Theresa Busch

The biological data such as blood flow shows a non-linear curve with change points, which cannot be fitted by a unique parametric model. Thus, we suggest the reproducing kernel Hilbert space-based spline, which is a unified framework for many change point models. Since the spline can be considered as the mixed effect model, we use the Bayesian approach for the estimation. We investigate the performances of them by simulation study and apply them to the data from Photodynamic therapy for cancer.

2 - A Location Problem for Trauma Centers and EMS Transportation Resources

Taesik Lee, Assistant Professor, Korea Advanced Institute of Science and Technology, Department of Industrial & Systems Eng., 335 Gwahangno, Yuseong-gu, Daejeon, Korea, Republic of, taesik.lee@kaist.edu, Soo-Haeng Cho, Hoon Jang, John Turner

Providing appropriate care to major injury patients requires such patients be transported to a Trauma Center within 60-min. In this talk, we discuss a location problem for trauma centers and EMS transportation resources. This problem can be modeled as a capacitated facility location problem coupled with a chance constrained probabilistic model. We use our methodology to simultaneously locate trauma centers and EMS transportation resources to better serve the citizens of the Republic of Korea.

3 - Designing Optimal Association Rules for Decision-Making in Healthcare

Allison Chang, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg. E40-149, Cambridge, MA, 02139, United States of America, aachang@mit.edu, Dimitris Bertsimas, Cynthia Rudin

In many healthcare applications, it is advantageous to use methods that not only predict well, but are also easy to explain to patients and medical professionals. Associative classification has emerged as a means of combining the interpretability of association rules with the predictive power of classification. We propose a novel mixed integer optimization (MIO) approach for this task and report empirical evidence using medical datasets to demonstrate the performance of this method.

■ WC37

C - Room 219B

Statistical Process Control and Economic Design

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Justin Chimka, University of Arkansas, 800 W Dickson St, Fayetteville, United States of America, jchimka@uark.edu

1 - Economic Design for Individual Observations of a Poisson Process

Ryan Black, University of Arkansas, 800 W Dickson St, Fayetteville, United States of America, rwblack@uark.edu, Justin Chimka

That probability of Type I error is not evenly distributed beyond upper and lower control limits is chief among consequences of the c chart being theoretically inappropriate for Poisson distributed defects. Furthermore the normal approximation to the Poisson is of little use when c is small. These practical and theoretical concerns should motivate the computation of true errors associated with individuals control assuming the Poisson distribution.

2 - Economic Design of the Optimal Parameters in the Presence of Skewness

Paul Goethals, Department of Mathematical Sciences, United States Military Academy, West Point, NY, 10997, United States of America, pgoetha@clemson.edu, Greg Boylan, Byung Rae Cho

Many of the statistical quality tools developed for process or product optimization assume that the underlying characteristic observations are normally distributed. For a wide number of responses, however, the presence of non-zero skewness may negatively influence generating optimal solutions. This research specifically addresses the implementation of alternative statistical methods for monetary gain when working with asymmetric process distributions.

3 - Statistical Process Control for the Fractal Dimension of a Time Series

Jingjing Tong, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, United States of America, tong@uark.edu, Justin Chimka

The fractal dimension (FD) of a time series can be estimated to measure its self-similarity or complexity. By arbitrarily dividing a series of data in time and estimating the FD of each part one can monitor observations of complexity or self-similarity using statistical process control methods. For example the FD associated with a series of temperature data assumedly in control appear well suited to the individuals control chart with respect to distribution assumption and Type I error.

■ WC38

H- Johnson Room - 4th Floor

Methodologies for VRP

Contributed Session

Chair: Javier Faulin, Associate Professor, Public University of Navarre, Department of Statistics and OR, Los Magnolios Building-1st fl, Pamplona, NA, 31006, Spain, javier.faulin@unavarra.es

1 - A Comprehensive Empirical Analysis of Value Addition of GIS in Vehicle Routing

Hindupur Ramakrishna, Professor, University of Redlands, 1200 E. Colton Avenue, Redlands, CA, 92373, United States of America, Hindupur_Ramakrishna@redlands.edu, Avijit Sarkar

Geographic information systems (GIS) are being increasingly used to facilitate the solution of complex real-life problems in vehicle routing. The extent of use of GIS and its contributions vary and pointers to the value added by GIS infusion are scattered in the literature. Using an experimental design approach, this work empirically analyzes the value added by a GIS in vehicle routing by solving a standard set of vehicle routing problem instances with and without GIS intervention.

2 - A Review of Simulation Techniques to Solve the Vehicle Routing Problems

Javier Faulin, Associate Professor, Public University of Navarre, Department of Statistics and OR, Los Magnolios Building-1st fl, Pamplona, NA, 31006, Spain, javier.faulin@unavarra.es, Angel A. Juan, Scott E. Grasman, Alejandro Garcia del Valle, Miguel A. Llorente

The use of Simulation tools is very well-known in solving many problems in Transportation and Traffic, but it is rather new in the resolution of Vehicle Routing Problems. Nevertheless, some contributions have recently been developed to provide algorithms which using Monte Carlo Simulation allow the obtaining of good solutions for different VRP models. Here, we make a review of those methods and discuss their efficiency in solving the Capacitated and Stochastic VRPs.

■ WC39

H - Morehead Boardroom -3rd Floor

Software and Platform Management

Sponsor: E-Business

Sponsored Session

Chair: Terrence August, Assistant Professor, University of California-San Diego, Rady School of Management, La Jolla, CA, 92093, United States of America, taugust@ucsd.edu

1 - Commercialization of Platform Technologies

Daewon Sun, University of Notre Dame, Notre Dame, IN, United States of America, dsun@nd.edu, Hemant Bhargava, Byung Cho Kim

We examine product line design, price discrimination, and launch timing to manage the growth vs. revenues dilemma for a platform firm that serves two markets, the user and developer markets, such that participation in one market depends positively on the size of the other market, but where there remains uncertainty in the extent of developer participation.

2 - A Text Mining Framework for Automatic Alliance Discovery

Yilu Zhou, George Washington University, 2121 I Street, NW, Washington, DC, 20052, United States of America, yzhou@gwu.edu, Yi Zhang, Nicholas Vonortas

Strategic alliances among organizations are one of the central drivers of innovation and. However, discovery of alliances has relied on manual search and has limited scope. We address the limitation by proposing a text mining framework that automatically extracts alliances from news articles. The model not only integrates meta-search, entity extraction and shallow and deep linguistic parsing techniques, but also proposes an innovative relation extraction method to deal with the extremely skewed and noisy data and further improve the precision using various linguistic features.

3 - Who Should be Responsible for Software Security? A Comparative Analysis of Liability Policies

Terrence August, Assistant Professor, University of California-San Diego, Rady School of Management, La Jolla, CA, 92093, United States of America, taugust@ucsd.edu

Vendor liability for software security vulnerabilities has been the center of an important debate gaining government attention in legislative committees. The importance of this question surrounding vendor security liability is amplified when one considers the increasing emergence of "zero-day" attacks. In this paper, we compare the effectiveness of three software liability policies: vendor liability for damages, vendor liability for patching costs, and government imposed security standards.

■ WC40

H - Walker Room - 4th Floor

Investments in NPD Stages and Applications of Technologies

Sponsor: Technology Management

Sponsored Session

Chair: Cheryl Druehl, George Mason University, Fairfax, VA, United States of America, cdruehl@gmu.edu

1 - Optimal Portfolio Strategies for New Product Development

Emre Nadar, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, enadar@andrew.cmu.edu, Laurens Debo, Alan Scheller-Wolf

We study the problem of project selection and resource allocation in a multi-stage new product development process with exponential experimentation times, stage-dependent resource constraints, and Bayesian updating. We model the problem as an infinite-horizon Markov decision process, establishing the optimality of a new type of policy, non-congestive promotion. We numerically evaluate the effectiveness of our non-congestive promotion policy as a heuristic in a generic problem.

2 - Optimal Investment in Product Support and New Product Development in Pharmaceutical Industry

Zhili Tian, PhD Candidate, Washington University in St. Louis, Campus Box 1133, One Brookings Drive, St. Louis, MO, 63130-4899, United States of America, tianzh@wustl.edu, Panos Kouvelis

A firm invests in the support of existing product and new product development. The first influences the adoption of the existing product while the second brings new product in the future market. The firm has to balance the investment in the two competing projects. We optimize the investment in these two types of projects. We estimate the new drug adoption model, which is a function of investment in different advertisement vehicles using drugs from Pfizer and the similar drugs in the market.

3 - How Green is Nano?

José Lobo, Research Professor, Arizona State University, W.P. Carey School of Business, Tempe, AZ, 85287, United States of America, Jose.Lobo@asu.edu, Deborah Strumsky

Much of the interest in and support for nanotechnology research is motivated by the expectations that "nano" can play an important enabling role in the development of renewable energy, electric battery, green manufacturing, and environmental clean-up and remediation technologies. But how "green" is "nano"? Using a recently constructed concordance of "green" technologies for US patent data, we have explored how prevalent is the use of nanotechnology in green patented inventions.

4 - A Classification Methodology for Network Sensors by Technological Class

Soumyo Moitra, Software Engineering Institute, 4500 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, sdmoitra@hotmail.com

We consider network sensors used to monitor data traffic to detect anomalies and cyber attacks. Different classes of sensors represent different technological capabilities. From the perspective of network security, we develop a methodology to classify sensors. The aspects related to their features that are significant for network security are considered. A model is developed that assesses the effectiveness of sensors as a function of their features and capabilities.

■ WC41

H - Waring Room - 4th Floor

Corporate Level Strategy

Contributed Session

Chair: Olga Hawn, PhD Candidate in Strategy, The Fuqua School of Business, Duke University, 1 Towerview Drive, Durham, 27708, United States of America, olga.hawn@duke.edu

1 - Corporate Wrongdoing, Corporate Communication Strategies, and Stakeholder Reactions

Michael Hill, The University of Georgia, The University of Georgia, 400 Brooks Hall, Athens, GA, 30602, United States of America, mikehill@uga.edu, Jonathan Bundy

Using a ten-year sample of more than 2,000 "aggressive" earnings restatements, our study investigates the impact of corporate communication responses on stakeholder reactions (i.e., stock prices) to corporate wrongdoing. This research contributes to research on corporate wrongdoing and communication strategies by presenting a theoretical model explaining how information conveyed to key corporate constituents during times of heightened scrutiny influence stakeholders' reactions.

2 - The Difference between Imagination and Learning

Timo Ehrig, Research Scientist, Max Planck Institute, Inselstr. 22, Leipzig, 04103, Germany, ehrig@mis.mpg.de, Rich Bettis

Why are some firms -like Apple- successful in finding and implementing ideas that are different sources of competitive advantage than others are able to find and implement? We present a model to understand the difference between imagination and learning. This model helps us to identify the conditions under which superior cognition can create competitive advantages, and which skills a firm with a potentially superior cognitive insight needs to transform it into competitive advantages.

3 - Knowledge Conflict in Diversified Firms: How Agglomeration Increases Monitoring Costs

Charles Williams, Asst. Professor, Bocconi University, Via Sarfatti, 25, Milano, MI, 20136, Italy, fcharles.williams@gmail.com, Elena Vidal

In this paper we study the market characteristics that can raise costs of managing multiple markets in diversified firms. We explore a key driver of diseconomies of scope for diversified firms: information stickiness in geographically concentrated industries. We argue that competing in concentrated industries requires sticky information that cannot easily be transferred to non-local headquarters. We test this proposition at the industry and firm level using data from multiple archival sources.

4 - The Open-combined Business Model and a Firm's Success

Yongkyun Na, Stanford University, Huang Engineering Center, 475 Via Ortega, Stanford, United States of America, ykna@stanford.edu, Edison Tse

This paper examines by what means a firm from a newly industrialized country became a global company that can maintain a strong incumbent position and relatively secure financial performance in economic downturns. Through the in-depth case study of Samsung Electronics, including its historical evolution, this study suggests that the open-combined business model can be used as a framework to increase an incumbent's abilities to succeed through balancing strategies.

5 - Market Structure and Strategic Corporate Social Responsibility

Olga Hawn, PhD Candidate in Strategy, The Fuqua School of Business, Duke University, 1 Towerview Drive, Durham, 27708, United States of America, olga.hawn@duke.edu, Hyounggoo Kang

While the literature has generally explained why companies would engage in corporate social responsiblity (CSR) and how CSR can affect competition by generating competitive advantage, it has yet to identify the conditions under which the market structure can affect CSR, while CSR activities of a firm and its competitors can in turn impact output and prices. We build an economic model that demonstrates how the trade-offs that firms face in the market may affect their CSR choices.

■ WC42

H - Gwynn Room - 4th Floor

Interface Between Information Systems and Marketing

Sponsor: Information Systems Society

Sponsored Session

Chair: Xinxin Li, Assistant Professor, University of Connecticut, 2100 Hillside Road U1041, Storrs, CT, 06269, United States of America, xinxin.li@business.uconn.edu

1 - News, Networks and Users: Network Properties and Online News Consumption

William Rand, University of Maryland, College Park, MD wrand@umd.edu, Chrysanthos Dellarocas, David Anderson, Zsolt Katona

In order to successfully transition to digital and social media, newspapers need to have a better understanding of how users consume news online. We test the hypothesis that both network properties and content quality affect news consumption by analyzing a large clickstream dataset using traditional regression models, agent-based modeling and discrete choice models. We show that content organizations need to spend effort on both content creation and content linking to be successful.

2 - Price Dispersion and Loss Leader Pricing: Evidence from the Online Book Industry

Xinxin Li, Assistant Professor, University of Connecticut, 2100 Hillside Road U1041, Storrs, CT, 06269, United States of America, xinxin.li@business.uconn.edu, Bin Gu, Hongju Liu

We develop a theoretical model to analyze pricing strategies of retailers with asymmetric cross-selling capabilities and empirically test our model predictions using data from the online book retailing industry. We find that retailers with better cross-selling opportunities have higher incentives to adopt loss leader pricing on high demand products. Price dispersion rises when demand increases, mainly driven by the price difference between retailers with different cross-selling capabilities.

3 - A Dynamic Analysis of Competition between Content Creators in Social Media

Anjana Susarla, Carnegie Mellon, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, anjanas@andrew.cmu.edu

The economics of digital publishing overturns existing patterns of content production and distribution. We examine the context of YouTube to analyze how competition between content creators is shaped by (i) the collective dynamics of crowd sourcing, (ii) the role of social influence and (iii) linkages between content creators.

4 - Optimal Keyword Auctions with Costly Positions

De Liu, University of Kentucky, Lexington, KY, 40506, United States of America, de.liu@uky.edu, Jun Li, Shulin Liu

Search engines incur hidden costs whenever an advertisement negatively affects user experiences. Viewing such costs as provision costs of keyword advertising, we characterize the optimal mechanism for keyword advertising in a general framework that accommodates advertiser/position-specific click-through rates and provision costs. We obtain explicit allocation and payment rules for three specific settings in which advertisers can be optimally allocated using simple scoring rules.

■ WC43

H - Suite 402 - 4th Floor

Hybrid Models for Energy and the Environment

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Pedro Linares, pedro.linares@upcomillas.es

1 - Hybrid Modeling for Electricity Policy Assessments

Renato Rodrigues, Assistant Researcher, Institute for Research in Technology - IIT, C/ Santa Cruz de Marcenado 26, Madrid, 28015, Spain, renato.rodrigues@iit.upcomillas.es

This work presents a Hybrid electricity policy evaluation instrument capable of addressing energy and environmental assessments. The supply-side electricity generation detail is considered concurrently with the heterogeneity in time of the electricity market through the explicit inclusion of load duration curves within both Top-down and Bottom-up components.

2 - General Equilibrium, Electricity Generation Technologies and the Cost of Carbon Abatement

Sebastian Rausch, Dr., Massachusetts Institute of Technology, 77 Massachusetts Avenue, Bldg E19-411, Cambridge, MA, 02139, United States of America, rausch@mit.edu

The complexity of an integrated representation of economic and electricity systems make simplifying assumptions appealing, but there is no evidence in the literature on how important the pitfalls may be. The aim of this paper is to provide such evidence, drawing on numerical simulations from a suite of partial and general equilibrium models that share common technological features and are calibrated to the same benchmark data.

3 - An IP Approach for Evaluating Energy R&D Funding Decisions with Optimal Budget Allocations

Jeremy Eckhause, LMI/University of Maryland, 2000 Corporate Ridge, McLean, VA, 22206, United States of America, jeckhause@lmi.org, Danny Ray Hughes, Steven Gabriel

Using real options techniques for R&D project selection to mitigate risk can increase overall project value. Employing SDPs do not easily accommodate the inclusion of optimal a priori budgets or side constraints. We formulate an IP whose solution is equivalent to existing SDP models but incorporates these additional features. The IP formulation solves what is otherwise a nested two-level problem where the lower-level problem is an SDP. We compare the performance of the IP to that of the SDP.

4 - Regional Electricy Market Impacts of GHG Emission Limits: Evidence from a Bottom-Up Top-Down Model

Ian Sue Wing, Associate Professor, Boston University, Department of Geography & Environment, 675 Commonwealth Avenue, Boston, MA, 02215, United States of America, isw@bu.edu, Karina Veliz-Rojas

US greenhouse gas (GHG) emission limits would raise electricity prices by forcing costly efficiency investments and interfuel substitution away from coal. We assess the impacts on regional power markets and economic welfare using a computable general equilibrium (CGE) model that integrates bottom-up electricity supply detail at the state level. We draw implications for the effects of EPA's proposed command-and-control approach to reducing GHG emissions from the electricity sector.

■ WC44

H - Suite 406 - 4th Floor

Optimization Methods and Applications

Contributed Session

Chair: Carolina Saldana, Research Coordinator, Universidad Extenado de Colombia, Cr 1 No 70-54 apto 803, Bogota, Colombia, jenny.saldana@uexternado.edu.co

1 - The IDR Method for Solving Large, Parameterized Linear Systems of Equations

Matthias Miltenberger, PhD Student, Zuse Institute Berlin, Takustr. 7, Berlin, 14195, Germany, miltenberger@zib.de

Induced Dimension Reduction (IDR) methods as new iterative solvers are a promising approach when dealing with general matrices. In many practical problems the need for solving several similar linear systems of equations one after another occurs. Often the concept of Krylov Recycling can be applied to such a sequence to accelerate the solution process. This presentation gives an introduction to IDR methods and shows how recycling techniques can be incorporated into them.

2 - Development of a System Identification Method by an Optimal Control Approach

Jinkun Lee, Pennsylvania State University, 1435 Harris St, State College, United States of America, leejinkun@gmail.com, Vittal Prabhu

In the optimal control theory, the minimization of cost functional is based on the system dynamics which is provided as a form of velocity function in many cases. In this work, we are focusing on finding out this system dynamic function which is unknown by an observation of cost functional trajectory which minimizing the variance by an specific controller. This work may contribute to the system identification process of a complex system without identifying all its component systems.

3 - Solving Data Related Models Within GAMS

Timo Lohmann, GAMS Development Corp., 1217 Potomac St. NW, Washington, DC, United States of America, lohmann.tmo@googlemail.com, Michael Bussieck, Michael Ferris

In many applications, optimization of a collection of problems is required where each problem is structurally the same, but in which some of the data defining the instance is updated. Such models are easily specified within modeling systems, but have often been slow to solve. We describe a new GAMS language extension, GUSS, that allows efficient solving of these problems. The utility of this approach is shown in an application: SDDP. We compare the results using GUSS with ILOG CPLEX Concert.

4 - Semidefinite Programming Applied to Economic Order Quantity Problems

Carolina Saldana, Research Coordinator, Universidad Extenado de Colombia, Cr 1 No 70-54 apto 803, Bogota, Colombia, jenny.saldana@uexternado.edu.co, Carlos Ivan Gonzalez

This work is a research contribution in the direction to finding new ways to solve (S, s) type basic problems, as is the Economic Order Quantity (EOQ) one in an effective way. To that end alternative methods of semidefinite relaxation of dynamical programs using binary.

5 - A Successive Nested Partitions Method for Constrained Optimization

Jin Sun, Staff Researcher, IBM Research China, Building 19# Zhongguancun Software Park, 8 West Dongbeiwang Rd., Haidian District, Beijing, 100094, China, sunjinsj@cn.ibm.com, Bin Zhang, Wenjun Yin, Jin Dong, Ming Xie

A successive nested partitions method is developed by embedding the nested partitions method into the Lagrangian relaxation framework. A heuristic method is developed to initialize the search of each iteration, and avoids computing from the very beginning and thus can save computational efforts. Numerical testing demonstrates the effectiveness of the successive nested partitions method.

■ WC45

H - Suite 407 - 4th Floor

Inspection and Test

Contributed Session

Chair: Seong-joon Kim, Hanyang University, 702-2 Engineering Center, 17 Haengdang-dong, Seongdong-gu, Seoul, 133-791, Korea, Republic of, sjkim@psm.hanyang.ac.kr

1 - Optimal Scheduling of Periodic Inspection on Spatially Correlated Infrastructures

Hongfei Li, IBM, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, United States of America, liho@us.ibm.com, Yada Zhu

Periodic inspection and on-condition based maintenance of infrastructures distributed over space are crucial to a city's daily operations. Conventionally reliability centered maintenance planning is either at the component level by considering them independently or requires the configuration of specific system structure. In this paper, we developed optimal inspection scheduling from system level by incorporating spatial correlations of individual components.

2 - Equivalent and Optimum Simple Step-Stress Accelerated Test Plans for the Exponential Distribution

Cheng-Hung Hu, Purdue University, 3132 Courthouse Dr. E., Apt.3C, West Lafayette, IN, 47906, United States of America, hu10@purdue.edu, Bob Plante, Jen Tang

Step-Stress accelerated life test (SSALT) is used in which the stress levels are changed in steps. Our paper considers three questions when designing a SSALT. (1)Can a SSALT be designed so that being equivalent to other stress loadings? (2)Should the higher stress level be set as high as possible?(3)When optimizing a multi-step SSALT, does it degenerate to a simple one with two stress levels? The answers to these questions, under reasonable assumptions, are shown to be a qualified YES.

3 - Optimal Degradation Test Plan in a Nonlinear Random Coefficients Models with Cost Function

Seong-joon Kim, Hanyang University, 702-2 Engineering Center, 17 Haengdang-dong, Seongdong-gu, Seoul, 133-791, Korea, Republic of, sjkim@psm.hanyang.ac.kr, Suk Joo Bae

One goal of reliability assessment is to predict the product's lifetime accurately in time. In this case, degradation tests can be effective alternative when measurement of deteriorate of performance is available and life testing is impossible to be adopted. In this paper, we propose a cost-effective optimal degradation test plan in the context of nonlinear random-coefficients model while meeting precision constraints for failure-time distribution derived from the modeling of degradation paths.

4 - A Short Term Planning Model for Inspection Effort Allocation in Port-of-entry Environment

Liangjie Xue, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, ljxue@asu.edu, J. Rene Villalobos

The inspection resources at Port-of-Entries (POEs) are scarce. Further, there are usually different conflicting objectives involved when making inspection plans, such as minimizing costs related to inspection, minimizing waiting time, and etc. This study develops a multi-objective optimization model based decision support system to generate inspection strategies. The model takes advantage of available information related the units and balances the waiting time and costs related to inspections.

■ WC46

H - Suite 403 - 4th Floor

Corporate-level Organizational Issues

Contributed Session

Chair: Fang Shao, PhD Candidate, Xi'an Jiaotong University, School of Management, Mailbox 1875, Xi'an, 710049, China, xjtu-shaofang@163.com

1 - Organizational Constraints to Adaptation

Brian Wu, University of Michigan, Ross School, Ann Arbor, MI, United States of America, wux@bus.umich.edu, Vikas Aggarwal

We examine the role of internal interdependence in influencing firm-level adaptation ability following an industry shock. Our setting is the U.S. defense industry from 1996-2006. We find that product-level interdependence can impede adaptation; customer-level interdependence, however, can reduce this disadvantage, with post-shock benefits arising from the ability to reposition old products for new customers. The "locus of coordination" can thus help explain post-shock adaptation ability.

2 - Boom, Bust, and Renewal Capability Trajectories

Michael Gary, Australian School of Business, UNSW, Sydney, Australia, sgary@unsw.au.ed

Fieldwork with a startup firm that experienced boom, bust, & renewal was the basis of a simulation model that replicates the firm's historical trajectory. The model shows how excessively rapid growth undermines capabilities & nearly leads to bankruptcy. Transforming & renewing capabilities takes several years; employees must unlearn bad practices before learning superior routines. The findings yield implications for how fast firms should grow, & for future research into capability development.

3 - How the Value Congruence Relates to Innovation in China? The Compensatory Roles of HRPs and POS

Fang Shao, PhD Candidate, Xi'an Jiaotong University, School of Management, Mailbox 1875, Xi'an, 710049, China, xjtu-shaofang@163.com, Yun Fan

We hypothesized that human resource practices (HRPs) and perceived organizational support (POS) would each interact with P-O value congruence (PVC) in relation to organizational innovation (OI). Data from over 300 workers in China related that PVC was positively related to OI when POS was low but not related to OI when POS was high, while HRPs did not moderate the relationship. Results indicated the compensatory nature of POS for low value congruence in its relation to organizational innovation.

4 - Corporate Commitment to Sustainability: A Comparative Analysis of CSR Reporting

Eunsang Yoon, Professor of Marketing, University of Massachusetts Lowell, 1 University Avenue, Lowell, MA, 01854, United States of America, eunsang_yoon@uml.edu, Steven Tello

This paper compares a content analysis methodology and a survey analysis approach to analyze the Corporate Social Responsibility (CSR) reports of globally leading corporations in an effort to evaluate the driving forces of, and the level of strategic commitment to, sustainability. Similarities and discrepancies between the outcomes of applying the two methodologies are discussed to evaluate the intention and acceptability of CSR reporting.

■ WC47

H - Dunn Room - 3rd Floor

Applications of Location Routing Problems

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Shirley Rong Li, PhD Candidate, The University of Alabama, 803, 12th Avenue, RM 10, Tuscaloosa, AL, 35401, United States of America, rli4@crimson.ua.edu

1 - Analysis of a Complex Location Routing Problem

Stephen Hill, Assistant Professor, Weber State University, 3802 University Circle, Ogden, UT, 84408-3802, United States of America, stephenhill@weber.edu, John Mittenthal

In this work we consider a complex product distribution problem that features facility location decisions. This problem is inspired by a real-world problem instance faced by a magazine publisher located in the southeastern United States. We present a heuristic solution approach and demonstrate the effectiveness of the heuristic via a set of computational experiments. Opportunities for future work are identified and discussed.

2 - Minimizing Redeployment in Ambulance Location Models

Cem Saydam, Professor, UNC Charlotte, 9201 Univ City Blvd., Charlotte, NC, 28223, United States of America, saydam@uncc.edu, Hari Rajagopalan, Elizabeth Sharer, Kay Lawrimore

Demand for ambulances fluctuates spatially and temporally. Recent advances in computing enabled EMS managers to practice dynamic redeployment plans. In this paper we address the issue of redeployment and minimal fleet sizes by explicitly considering the number of redeployment trips to be made while meeting the coverage requirements and develop fast heuristics.

3 - Bi-criteria Dynamic Location-Routing Problem for Patrol Coverage

Shirley Rong Li, PhD Candidate, The University of Alabama, 803, 12th Avenue, RM 10, Tuscaloosa, AL, 35401, United States of America, rli4@crimson.ua.edu, Burcu Keskin

This paper addresses a multi-period dynamic location-routing problem. Specifically, we design patrol routes for a fixed number of state trooper cars. The routes start from a subset of given potential stations (PS) and cover critical locations with high crash frequencies. Furthermore, the selected PS may change from one period to the other. The objective is to maximize coverage benefit while minimizing costs. For this problem, we develop a MILP, solve it using heuristics, and provide insights.

4 - Near-optimal Heuristics and Managerial Insights for the Storage Constrained, Inbound Inventory Routing

Malini Natarajarathinam, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, malini@entc.tamu.edu, Jennifer Stacey, Charles Sox

We develop efficient heuristics for determining the route design and inventory management of inbound parts which are delivered for manufacturing, assembly, or distribution operations that have limited storage space for these parts. The shipment frequencies and quantities are coordinated with the available storage space and the vehicle capacities.

5 - Hybrid Heuristic Algorithm for the Capacitated Multi-Echelon Shipping Network Scheduling Problem with Delivery Deadlines

Gang(Gabriel) Wang, Rutgers, The State University of New Jersey, 1 Washington Park, Newark, NJ, 07102, United States of America, gangwang@pegasus.rutgers.edu, Lei Lei

We study the problem of scheduling a capacitated supply chain network with delivery deadlines. This problem is computationally difficult since it contains generalized assignment problem as a sub problem. We introduce a hybrid heuristic algorithm based on first-fit decreasing, our proposed special case and LP relaxation. This heuristics allows us to avoid dealing with the generalized knapsack problem directly. Empirical observations from over 500 randomly generated test cases are also reported.

■ WC48

H - Graham Room - 3rd Floor

Topics in Transportation

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: ManWo Ng, Assistant Professor, Old Dominion University, 1318 Engineering and Computational, Sciences Building, Norfolk, United States of America, mng@odu.edu

Chair: Lili Du, Research Associate, NEXTRANS,Purdue University, 3000 Kent Avenue, West Lafayette, IN, United States of America, ldu@purdue.edu

1 - Information Impacts on Travelers' Route Choice Behavior in a Congested Risky Network

Song Gao, Assistant Professor, University of Massachusetts Amherst, 130 Natural Resources Road, 214C Marston Hall, Amherst, MA, 01003, United States of America, songgao@ecs.umass.edu, Xuan Lu, Eran Ben-Alia

The paper presents laboratory interactive experiments, where in each session, 16 subjects make repeated route choices in a hypothetical network subject to random capacity reductions. There are two scenarios, one with real-time information and the other without. Non-parametric statistical tests are conducted comparing route shares, network travel time and route switches between the two scenarios. A reinforcement learning model is developed to capture subjects' route choice characteristics.

2 - Modeling the Car-Truck Interaction in a System Optimal Dynamic Traffic Assignment Model

Rodrigo Mesa Arango, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47907, United States of America, rmesaa@gmail.com, Satish Ukkusuri

In this paper we propose a formulation to model car-truck interactions in a System Optimal Dynamic Traffic Assignment using Linear Programming. Traffic flow is simulated using a Cell Transmission Model. The formulation is based on assumptions related with the kinematic characteristics of these flows and their interactions. We present numerical results supporting our modeling assumptions.

3 - Sustainable Public Transportation Systems

Maximilian M. Etschmaier, GME International Corporation, 2702 Berryland, Oakton, VA, 221124, United States of America, etschmaier@cox.net

This paper argues that the key to sustainability of public transportation systems is in the sustainment of the asset base. It will show that an approach that emanated from airlines many years ago, combined with object-based modeling, has been used to develop a new quantitative model that can lead to sustainable public transportation. Using object-based programming, this model is directly translated into systems for simulating, optimizing, and controlling public transportation systems, including airlines, public transit, and railroads.

4 - Energy Consumption Efficiency in Multimodal Transportation Networks

Lili Du, Research Associate, NEXTRANS, Purdue University, 3000 Kent Avenue, West Lafayette, IN, United States of America, ldu@purdue.edu, Srinivas Peeta, Dengfeng Sun, Peng Wei

This study proposes a bi-level mathematical model to optimize the operation of a multimodal transportation network by enhancing the system energy consumption efficiency. It captures the interactions between the multimodal transportation network (supply) and intermodal trips (demand). A customized branch-and-bound solution methodology and the sensitivity analysis for the key factors are discussed.

■ WC49

H - Graves Room - 3rd Floor

Joint Session Simulation/MSOM: Operations Applications of Simulation

Sponsor: Simulation/Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Bahar Biller, Professor, Carnegie Mellon University, 5000 Forbes Avenue, Posner Hall 360, Pittsburgh, PA, 15213, United States of America, billerb@andrew.cmu.edu

Co-Chair: Alp Akcay, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, aakcay@andrew.cmu.edu

1 - Contract Complexity and Performance under Asymmetric Demand Information: An Experimental Evaluation

Feryal Erhun, Stanford University, MS&E, Stanford, CA, United States of America, feryal.erhun@stanford.edu, Kay-Yut Chen, Basak Kalkanci

Exploring the tension between theory and practice regarding complexity and performance in contract design is especially relevant. The goal of this paper is to understand why simpler contracts may commonly be preferred in practice despite being theoretically suboptimal. We use simulations and the EWA model to characterize contract decisions and profits. We perform a sensitivity analysis on the parameters of the EWA model to understand potential decision biases and deviations from theory.

2 - Complex Event Modeling Simulation and Analysis for Critical Infrastructure Disruptions

Julie Waters, Section Chief for Advanced Risk Concepts, Office of Risk Management and Analysis, U.S. Department of Homeland Security, 245 Murray Lane SW, Washington, DC, 20528, United States of America, julie.waters@dhs.gov, Nabil Adam

Disruptions to critical infrastructure can cause cascading effects across interdependent systems. This presentation describes ongoing research at the U.S. DHS to provide fast analysis to National leaders of the impacts of multiple, concurrent infrastructure disruptions. Semantic-based dynamic composition of simulations using service-oriented architecture allows for dynamic quality of service and can be applied to any mission area where complex chains of simulations are required.

3 - Designing Simulation Inputs to be Informative Probes

Thomas Reed Willemain, Professor, Rensselaer Polytechnic Institute, Industrial & Systems Engineering, Troy, NY, 12180, United States of America, willet@rpi.edu

Simulationists typically regard inputs as merely anonymous random stimuli. More can be learned by viewing them as probes to discover how to manage operations and to learn more about the advantages of competing system designs. Using small queueing examples, we will illustrate (1) creation of input sequences that produce the best and worst system performance for a single system and (2) mapping of the regions in an input space that favor one or the other of competing designs.

4 - Inventory-target Estimation with Intermittent Demand Data of Limited Length

Alp Akcay, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, aakcay@andrew.cmu.edu, Sridhar Tayur, Bahar Biller

Assuming an intermittent demand process represented by the highly flexible Johnson translation system, we consider a repeated newsvendor setting and study the problem of estimating an inventory target from limited historical demand data. We investigate the impact of correlation between nonzero demand size and the number of preceding zero-demand periods on the inventory-target estimation and propose a simulation-based estimation-optimization approach to solve the problem.

■ WC50

H - Ardrey Room - 3rd Floor

Applied Data Mining

Contributed Session

Chair: ZhiLong Chen, Xiamen University, Department of Management Science, Room 409, Building 13, Xiamen, 361005, China, czl_8802@163.com

1 - Food Security in a Changing Climate

Seth Guikema, Assistant Professor, Johns Hopkins University, 3400 N. Charles St., Ames Hall, Baltimore, MD, 21218, United States of America, sguikema@jhu.edu, Stefanie Falconi, Ben Zaitchik

In this paper we analyze food security, defined as calorie deficit below a UN-defined minimum caloric intake, at the country level. What influences food security? What are the roles of climate and trade in determining food security? How might food security change in the future in response to climate change? We approach this problem with regression and data mining, evaluating both the fit and out of sample predictive accuracy of our models.

2 - Output Analysis of Supply Chain n/w Design by Linear & Nonlinear Dimensionality Reduction Techniques

Akanksha Saxena, International Institute of Information Technology, 26/C Electronics City, Hosur Road, Bangalore, 560100, India, akanksha.saxena@iiitb.net, Peravali Nagadeepthi, G.N. Srinivasa Prasanna

Dimensionality Reduction is a well known problem. Our aim is to reduce the dimensions of Supply Chain Management system Output which is multidimensional data by adapting Linear (Principle Component Analysis) and Non Linear (Isometric Feature Mapping) Pattern Recognition algorithms. This paper will present our Simulation Results.

3 - Churn Prediction Using Bayesian Ensemble in Telecommunications Market

Namhyoung Kim, POSTECH, Informatics Lab. POSTECH, San 31, Hyoja-dong, Nam-gu, Pohang, Korea, Republic of, skagud@postech.ac.kr, Jaewook Lee

Churn prediction becomes a major issue of telecommunications market. In this study, we consider the customer data which are large-scaled and highly imbalanced and the two class of data highly overlap each other. To overcome this problem, we propose a novel principled Bayesian ensemble model and provide generative process based on variational analysis. The results show significantly better performance than the existing methods providing an important predictive property of the generative models.

4 - Market Share Forecasting for Technology Products with Mixed Bayesian Networks

Amit Shinde, Arizona State University, 1249, E Spence Avenue, Apt 238, Tempe, AZ, 85281, United States of America, amit.shinde@asu.edu, Lei Liu, Mani Janakiram, George Runger

Price-demand relationships and related demand forecasting are important elements in supply chain management. A Bayesian network structure is developed to handle multiple competitive products that integrates and extends more traditional models. The short life cycle information of the technology products is incorporated into the model. Experiments on representative, simulated data illustrate the advantages of the approach.

5 - Model of Market Segmentation for the Gas Station Convenience Store Based on Cluster Analysis

ZhiLong Chen, Xiamen University, Department of Management Science, Room 409, Building 13, Xiamen, 361005, China, czl_8802@163.com, ShuiHua Han

The gas station convenience stores have extensive distribution and high consumer mobility, which made us not available to carry on the market segmentation through the geography or demography. Therefore, this thesis proposes a market segmentation model based on cluster analysis. The proposed model facilitates the identification of stores based on category role, which can be measured with the variables from the sales database. Finally the article exploits the clustering method to verify the model.

■ WC51

H - Caldwell Room - 3rd Floor

Decision Support in the Petroleum Industry and General Transportation

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Mikael Rönnqvist, Professor, NHH, Helleveien 30, Bergen, NO-5045, Norway, Mikael.Ronnqvist@nhh.no

1 - Robust Planning of Production, Inventory and Ship Loading at Refineries

Jens Bengtsson, Norwegian School of Economics and Business Administration, Helleveien 30, Bergen, 5045, Norway, jens.bengtsson@nhh.no, Patrik Flisberg, Mikael Rönnqvist

We present an industrial case where ships/tankers are loaded with products (blend of components from refinery operations) and where the planning problem also include production and blending operations. All operations should be integrated as e.g. late arrival of tankers may overflow component tank capacities and hence reduce or stop refinery operations. We apply a robust optimization model and solution approach to establish efficient operational plans.

2 - Inventory Management of Spare Parts in an Energy Company

Mario Guajardo, PhD-student, Norwegian School of Economics and Business Administration, Helleveien 30, Bergen, NO-5045, Norway, mario.guajardo@nhh.no, Jens Bengtsson, Mikael Rönnqvist

We present a case study of inventory management of spare parts in a large supplier of oil and gas. Inventory of spare parts is held to assist the repair and replacement of equipments. The inventory includes a large number of items stored in several on-shore and off-shore locations. The demand for these items is uncertain. We study how to determine inventory levels for each spare part and analyze the potential in how risk pooling between the inventory locations can be implemented.

3 - Decoupled and Integrated Planning Models for Divergent Supply Chain in an Oil Company

Martin Kylinger, PhD-student, Linköping University, 581 83, Linköping, 581 83, Sweden, martin.kylinger@liu.se, Mario Guajardo, Mikael Rönnqvist

We study an oil company with a divergent supply chain. The planning is decoupled into two separate problems. The first is concerned with sales and maximizing profit and the second is with planning production, transportation and inventory to minimize cost. In the real case an internal price system attempts to coordinate the solution of the two problems. We propose and discuss models for decoupled and integrated approaches, and show how they can be used to achieve a more efficient planning.

4 - Route Selection in Advanced GIS

Mikael Rönnqvist, Professor, NHH, Helleveien 30, Bergen, NO-5045, Norway, Mikael.Ronnqvist@nhh.no, Patrik Flisberg, Bertil Liden, Jan Selander

Contracts between transporters and companies are often based on the driven distance. However, this distance can be hard to agree on because of many attributes e.g. length, quality, width, speed limits etc. We present an approach to find optimal weights for more than 30 attributes. We use a large number of detailed ideal routes. Then an inverse optimization model is formulated where the main variables are the weights on attributes. Results from a large countrywide implementation are reported.

5 - Biorefinery Location and Intermodal Transportation Planning

Leila Hajibabai, University of Illinois Urbana-Champaign, Department Civi & Enviromental Engineering, Urbana, IL, 61801, United States of America, hajibab1@illinois.edu, Yanfeng Ouyang

The objective of this paper is to minimize the total cost of biorefinery construction, transportation operations including the public travel and biomass/biofuel intermodal shipments, and capacity expansion for highway links and railroad segments. To solve this optimization problem, a genetic algorithm with embedded Lagrangian relaxation and traffic assignment is developed, and an empirical case study with realistic biomass/biofuel production data for the state of Illinois is applied.

■ WC53

H - South Carolina - 3rd Floor

Mathematical Modeling and Data Mining

Sponsor: Data Mining

Sponsored Session

Chair: Li Zhang, Sr. Credit & Portfolio Manager, Royal Bank of Scotland, 1000 Lafayette Blvd., Bridgeport, CT, 06604, United States of America, lieezhang@gmail.com

Co-Chair: Changjian Huang, UBS AG, 399 Main Avenue, Apt 614, Norwalk, United States of America, cjjhuang@gmail.com

1 - Survival to Default Modelling with Unobserved Heterogeneity

Jonathan Crook, Professor, Credit Research Centre, Business School, University of Edinburgh, 29 Buccleuch Place, Edinburgh, EH8 9JY, United Kingdom, j.crook@ed.ac.uk, Mindy Leow, Tony Bellotti

We estimate hazard functions for default incorporating unexplained heterogeneity using a sample of credit card accounts. It is well known that, theoretically, the omission of a frailty term biases the baseline hazard function and the estimated parameters relating to covariates in such a model. We assess any improvement in predictive accuracy by comparing the accuracy of models which include unobserved heterogeneity with models that do not. We will also note limitations of this approach.

2 - Kernel-Based Longstaff-Schwartz Pricing Methodology for American Options and Other Derivatives

Changjian Huang, UBS AG, 399 Main Avenue, Apt 614, Norwalk, United States of America, cjjhuang@gmail.com, Li Zhang

Longstaff-Schwartz method has proven to be an effective method for pricing American options. However, the type and number of basis function need to be selected properly to achieve good prediction accuracy. In this presentation, we propose a novel kernel-based machine learning along with Monte Carlo simulation methodology to avoid the selection of basis function. Additionally, kernel-based learning can be naturally extended to pricing assets with multiple underlying factors.

3 - Estimating Clearing Functions from Simulation Data Using Regression and Search Approaches

Necip Kacar, PhD Student, North Carolina Satate University, Industrial & Systems Engineering, 400 Daniels Hall College of Engineering, Raleigh, NC, 27695, United States of America, nbkacar@ncsu.edu

We examine the problem of estimating clearing functions that relate the expected output of a production resource as a function of its expected workload from empirical data obtained from a simulation model. We compare several different regression approaches to an iterative optimization-based approach and report computational results.

■ WC55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS: Panel Dicsussion on Educating Analytics Practitioners: M.S. Degrees in Analytics

Sponsor: Analytics/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Michael Gorman, Professor, University of Dayton, School of Business, 2130, 300 College Park, Dayton, OH, 45469, United States of America, Michael.gorman@udayton.edu

1 - New Educating Analytics Practioners: M.S. Degrees in Analytics

MOderator: Michael Rappa, Director and Distinguished University Professor of Computer Science, North Carolina State University, Raleigh, NC, United States of America, michael_rappa@ncsu.edu, Panelists: Kenneth Gilbert, Diego Klabjan, Helmut Schneider

This panel brings together program leaders from four universities to discuss the emergence of Master of Science degrees in the field of Analytics. The panel will highlight educational goals, curricula, skill sets and learning strategies for achieving successful student outcomes for analytics practitioners.

■ WC56

H - Biltmore Boardroom - 2nd Floor

Processes in Health Care

Contributed Session

Chair: Brendan Bettinger, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, United States of America, bettinger.b@neu.edu

1 - Data Standards Adoption in Recall and Outdate Management of a Healthcare Provider

Paiman Farrokhvar, Graduate Research Assistant, University of Arkansas, 4207 Bell Engineering Center, University of Arkansas, Fayetteville, AR, 72701, United States of America, pfarrokh@uark.edu, Nebil Buyurgan, Raja Jayaraman, Ronald Rardin, Vijith Malayil Varghese, Angelica Burbano, Eghbal Rashidi

In this presentation we investigate the impact of data standards on recall and outdate management in healthcare supply chain. Simulation models are developed for various scenarios to compare the performance of different recall and outdate management policies, and to suggest the best practices.

2 - Investigating Causes of Lab Order Cancellations Using Data Mining

Kalyan Pasupathy, University of Missouri, CE732 CS&E Building, Five Hospital Drive, Columbia, MO, 65212, United States of America, pasupathyk@missouri.edu, Zeyana Hamid

Hospital lab orders have high rates of cancellations. These cancellations lead to wasted time and effort. Exploring causes of these cancellations can help to improve efficiency and may also provide insights to improve safety. This research uses data mining to investigate the causes for cancellation of more than 15 thousand orders based on attributes, including person ordering, type of order, patient location, specialty, person cancelling, time elapsed before cancellation, and cancel reason.

3 - The Volunteer's Dilemma in the Provision of Health Care

Brendan Bettinger, Northeastern University, 360 Huntington Avenue, Boston, MA, 02115, United States of America, bettinger.b@neu.edu, James Benneyan

Healthcare coalitions and coordination across organizations are subject to the volunteer's dilemma described in game theory. Each participant benefits when maximum care is provided, but also would prefer others assume more of the responsibility. The rate of failure to provide sufficient care depends on the number of partners, diffusion of responsibility, and degree of coordination. We develop probabilistic models to describe these dynamics and explore conditions affecting care provision failure.

■ WC57

W - Providence I- Lobby Level

Airline Scheduling and Fleet Assignment

Sponsor: Aviation Applications

Sponsored Session

Chair: Mourad Boudia, Amadeus, Sophia Antipolis, France, mourad.boudia@amadeus.com

1 - A Simulation-optimization Model for the Problem of Scheduling Fractional Ownership Jets

Claudio Cunha, University of São Paulo, Escola Politecnica, São Paulo, Brazil, cbcunha@usp.br, Juliana Lopes

We describe a spreadsheet-based model that integrates simulation and optimization for the scheduling of fractional ownership aircrafts. It aims to be used as a strategic planning tool that helps new companies to estimate the required fleet size, the amount of deadhead flight legs, as well as to evaluate the impacts of alternative locations for operational bases.

2 - Airline Rescheduling with Controllable Cruise Times

Sinan Gürel, Middle East Technical University, Industrial Engineering Department, Dumlupinar Bulv. No:1, Ankara, 06800, Turkey, sgurel@ie.metu.edu.tr, Alper Atamtürk, M. Selim Aktürk

Airline operations are subject to frequent disruptions such as unexpected aircraft maintenance requirements or undesirable weather conditions. We consider delays caused by such disruptions and formulate a rescheduling problem that involves swapping aircraft and adjusting cruise stage speed. We give a conic quadratic MIP formulation for the problem of minimizing rescheduling cost, which is the sum of delay, fuel, carbon, passenger, and deadhead costs of the repaired schedule.

3 - A Novel Approach for Schedule Planning and Fleet Assignment
Mourad Boudia, Amadeus, Sophia Antipolis, France, mourad.boudia@amadeus.com, Semi Gabteni, Rodrigo Acuna Agost

Schedule Planning is key to Airline profitability, deciding which markets are served, with which frequency. Additionally, Capacity assignment decisions are required for all flight legs, by solving the so called Fleet Assignment Problem. This talk addresses the question of the schedule quality indicators, with a focus on fleet assignment robustness, and proposes a novel approach based on demand clustering to better deal with demand forecast volatility.

4 - Competition and Pricing in Airline Scheduling
Luis Cadarso, PhD Student, Universidad Politécnica de Madrid, E.T.S. Ingenieros Aeronàuticos, Plaza Cardenal Cisneros, 3, Madrid, 28040, Spain, luis.cadarso@upm.es, Marìn ¡ngel

The airline schedule design and fleet assignment problems consist of determining departure times and fleet type for each flight. Up to now, they have been solved sequentially. A new approach is proposed accounting for competition and pricing strategies, providing robust itineraries for connecting passengers. We use Taylor's series approach to the non-linear functions. An application of the model for a simplified IBERIA's network is shown.

■ WC58

W - Providence II - Lobby Level

Disaster Relief Planning and Operations I

Sponsor: Military Applications Society

Sponsored Session

Chair: Xiaofeng Nie, Assistant Professor, Nanyang Technological University, 50 Nanyang Avenue, Singapore, Singapore, xiaofengnie@ntu.edu.sg

Co-Chair: Raha Akhavan-Tabatabaei, Assistant Professor, Universidad de los Andes, Cra 1 Este # 19A-40, Bogota, Colombia, r.akhavan@uniandes.edu.co

1 - Earthquake Relief Operations Management for City of Bogota
Raha Akhavan-Tabatabaei, Assistant Professor, Universidad de los Andes, Cra 1 Este # 19A-40, Bogota, Colombia, r.akhavan@uniandes.edu.co, Javier Rios, Ridley Santiago Morales

We propose a simulation model to assess the amount of auxiliary medical resources required in case of a 6.2 magnitude earthquake in the city of Bogota. Using an optimization approach we then find the optimal location for the temporary medical facilities subject to area and accessibility constraints. The results are used by Bogota's Mayors Office for disaster planning and preparedness.

2 - Logistics Network Design for Large-scale Emergency Relief
Yepeng Sun, Ph.D candidate, University of Louisville, 789 Eastern PKWY APT 4, Louisville, KY, 40217, United States of America, y0sun010@louisville.edu, Gerald Evans, Sunderesh Heragu

To build a logistics network for large-scale emergency relief, mathematical models and the relevant algorithms are developed as a large-scale emergency preparedness planning tool to determine the location of warehouses and the assignments between warehouses and demand points, the number of different types of trucks and the routing of trucks. The objective is to minimize the total cost as well as assuring that the relief materials can be delivered to demand points within a limited duration.

3 - A Scenario-based Three-Stage Stochastic Programming Model for Triage Center Location in Disasters
Xiaofeng Nie, Assistant Professor, Nanyang Technological University, 50 Nanyang Avenue, Singapore, Singapore, xiaofengnie@ntu.edu.sg, Aakil Caunhye

Triage centers are used to assign priorities to disaster casualties. To our knowledge, location of these centers has not been studied in the literature. We build a scenario-based three-stage stochastic programming model for triage center location, taking into account information flow phases and uncertainties of disaster situations. A Benders' decomposition-based method is proposed to accelerate solution times.

■ WC59

W - Providence III - Lobby Level

Management of Technological Innovation in the Service Sector

Sponsor: Service Science

Sponsored Session

Chair: Tugrul Daim, Portland State University, P.O. Box 751, Portland, OR, United States of America, tugrul@etm.pdx.edu

1 - Measuring Dynamic Efficiency of Technology Licensing of U.S. Research Institutions Using Time-Lag Factored Data
Jisun Kim, Portland State University, Portland, OR, United States of America, jisunk@pdx.edu, Tugrul Daim, Timothy Anderson

This study evaluates efficiencies and their changes of technology licensing practices of 46 U.S. research institutions using licensing data of the association of university technology manager (AUTM) survey from 1991 to 2007. Data envelopment analysis and Malmquist Index are well-known methods evaluating relative performance of service organizations where widely recognized standard evaluation structures do not exist. However, while Malmquist Index provides insight efficiency changes from one period to the following period, it has limitations of non-circularity and infeasibility. Therefore, this study reviews and compares the current approaches addressing these issues and adopts them to evaluate efficiency changes of licensing practices. Also, time-lag effects of the licensing variables are examined based on the findings form authors' previous study and applies time-lag incorporated licensing data to the evaluation. The result presents dynamic changes and changing patterns of licensing performance.

2 - Technology Roadmap Development Process (TRDP) for the Health Care Service Sector through Integration of Expert Judgment, Bibliometrics and Patent Analysis
Hilary Martin, Intel Corporation, United States of America, hilary.t.martin@intel.com, Fredy Gomez, Joseph Cho, Tugrul Daim

This paper integrates data mining and hierarchical decision modeling tools to generate a technology roadmap. The process is applied on a product that has a feature enabling remote monitoring for patients. Data is collected from an international company and mapped to demonstrate the process.

3 - Examining Health Information Technology Implementations Using Capabilities
Nima Behkami, Oregon Health & Science University, Portland, OR, United States of America, behkamin@ohsu.edu, Tugrul Daim, David Dorr, David Raffo

U.S. healthcare industry is the largest delivery system in the world. The system is facing significant pressures to transform. Use of health information technology can assist by reducing cost and increasing quality of patient care. However characteristics of adopters and quality of implementations are not well understood and are an ongoing challenge. This paper presents a conceptual model to measure prevalence of health information technology capabilities and their impact on delivery of care.

4 - Decision Making Process for Offshore Outsourcing for IT Services
Rosine Hann, Portland State University, Portland, OR, United States of America, rosine@pdx.edu, Tugrul Daim, David Raffo

Western countries information technology and software intensive firms are increasingly producing software and IT services in developing countries. Regardless of the swift advancement of offshore outsourcing, there are array of risks that must be investigated in order for companies to benefit from the offshore outsourcing business model. Numerous significant benefits can be accomplished through the successful management of offshore outsourcing. Several studies presented frameworks that focus on guiding decision makers and information systems managers in performing offshore outsourcing. Yet, none of these frameworks provided a systematic, methodical direction concerning how to implement the entire process of offshore outsourcing for information technology services projects. This paper presents a conceptual framework to investigate offshore outsourcing in the IT services companies in terms of: 1) overall offshore outsourcing process, 2) client - supplier relationship management process and 3) risk management process.

■ WC60

W - College Room - 2nd Floor

Approximation Algorithm and Online Learning in Optimization

Sponsor: Optimization/Linear Programming and Complementarity

Sponsored Session

Chair: Rui Yang, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, ruiyang1@illinois.edu

1 - Online Lot-Sizing Problems with Revenues and Ordering, Holding and Shortage Costs

Michael R. Wagner, Assistant Professor, Saint Mary's College of California, 380 Moraga Road, Moraga, CA, 94556, United States of America, mrw2@stmarys-ca.edu

We study inventory management problems where demands are revealed incrementally and procurement decisions must be made before the demands are realized. There are no probabilistic distributions nor nontrivial bounds to characterize demands. Our objective is to maximize the worst-case profit, where unit revenues and all unit costs are period dependent. These problems are analyzed by utilizing linear-fractional programming and duality theory.

2 - A Matrix-Free Approach for Gaussian Process Maximum Likelihood Calculations

Jie Chen, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, United States of America, jiechen@mcs.anl.gov, Mihai Anitescu

Gaussian processes Maximum Likelihood is limited by its need to use the Cholesky factorization in the computation of the likelihood. In this work, we present a stochastic programming reformulation with convergence estimates for computing the solution of the maximum likelihood problem involving Gaussian processes. For each of the examples presented, we demonstrate that the approach scales linearly with an increase in the number of data sites.

3 - Online Stochastic Matching Problem

Xin Lu, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, luxin@mit.edu, Patrick Jaillet

We study an online stochastic bipartite matching problem motivated by Internet display advertisement applications. Advertisers are interested in various impressions of different types. Impressions arrive online and types are drawn independently from known distributions. We propose two online algorithms with improved competitive ratios under such assumptions. We then discuss generalizations to weighted stochastic matching and b-matching problems.

4 - Interactive Diffusions and Congestion Games

Alfredo Garcia, Associate Professor, University of Virginia, Department of Systems & Information Engineerin, University of Virginia, Charlottesville, VA, 22904, United States of America, agarcia@virginia.edu, Yue Sun

We analyze a congestion game in which players' actions sets are a continuum. We show that an interactive diffusion, in which each player follows an annealing–like process for selecting an action converges (weakly) to Nash equilibrium.

■ WC61

W - Sharon Room - 2nd Floor

Schedules and Timetables

Contributed Session

Chair: Ricardo Giesen, Assistant Professor, Universidad Catolica de Chile, Vicuna Mackenna 4860, Macul, Santiago, Chile, giesen@ing.puc.cl

1 - Effects of Trains Running Ahead of Schedule in a Simulated Network

Hans Sipilä, Royal Institute of Technology (KTH), Teknikringen 72, Stockholm, SE-10044, Sweden, hans.sipila@abe.kth.se, Anders Lindfeldt

Many lines in Sweden have mixed traffic, with both passenger and freight trains operating by defined timetables. In contrast to passenger trains, freight trains can deviate significantly from their timetable by running both ahead and behind schedule. KTH uses micro simulation as a tool for analyzing railway operation. This study evaluates the effect of modeling early departing freight trains. In previous studies at KTH early departing trains have been modeled as running on time in the simulation.

2 - A Quantitative Analysis of Railway Timetable Robustness

Emma Andersson, PhD Student, Linköping University, Bredgatan 33, Norrköping, 602 21, Sweden, emma.andersson@liu.se, Johanna Törnquist Krasemann, Anders Peterson

Robustness in railway timetables often refers to the ability to cope with smaller disturbances, which is important in dense traffic. It can be defined and measured in many ways. Previous empirical studies of the Swedish railway traffic show that the punctuality of different trains differs significantly despite similar prerequisites. We are therefore performing an in-depth analysis of quantitative measures to capture the characteristics of robust train slots that leads to high punctuality.

3 - A Solution Approach for Multiple Part-Type Scheduling in Robotic Cells

G. Didem Batur, Gazi Universitesi Muhendislik Fakultesi Endustri Muhendisligi, Bolumu Kat:8 Oda:804, 06570 Maltepe/ANKARA, dbatur@gazi.edu.tr, Serpil Erol

We focus on the scheduling problem arising in two-machine manufacturing cells in which a set of multiple part-types are repeatedly produced, and the part movements are performed by the help of a robot. For highly flexible CNC machines, it is possible to handle all of the necessary operations of a part by any one of these machines. Besides, the processing times can be adjusted. Cycle time of the cell depends on the robot move sequence as well as the part assignments and processing times of the parts on the machines. As a result, we try to find the robot move cycle, the part sequence and the allocated processing times of the parts on each machine that jointly minimize the cycle time. A simulated annealing based algorithm is proposed in order to solve the problem of determining the best cycle in a two-machine cell. Experimental results show that this approach works well and can be extended for further cases.

4 - A Continuous-Approximation Model to Optimize Common Stations' Density for Skip-stop Operations

Ricardo Giesen, Assistant Professor, Universidad Cato lica de Chile, Vicuna Mackenna 4860, Macul, Santiago, Chile, giesen@ing.puc.cl, Maxime Freyss, Juan Carlos Munoz

The skip-stop strategy allows a rail-transit line operating on a single one-way track to increase its frequency and decrease passenger travel times. A key decision in the design of this strategy is the selection of common stations. We developed a continuous approximation approach model, which allows us to obtain an analytical expression for the optimal density of common stations and their location, depending on demand and other line characteristics.

■ WC62

W - Independence Room - 2nd Floor

Energy in Buildings

Contributed Session

Chair: Zhi Zhou, Argonne National Laboratory, 9700 South Cass Avenue, Lemont, IL, 60439, United States of America, zzhou@anl.gov

1 - Energy Demand and Energy Efficiency of U.S. Commercial Buildings: An Econometric Approach

Lucy Qiu, Stanford University, 64 Abrams Ct., Apt. 103, Stanford, CA, United States of America, yuemingq@gmail.com

The concern around rebound effect is an obstacle for the diffusion of energy efficient technologies. Thus evaluating the net energy savings of adopting energy efficient technologies after the rebound is important. This paper conducts empirical analysis to quantify the net energy savings of adopting energy efficient technologies in U.S. commercial buildings, with a correction of sample bias. It also contributes to the literature of finding price elasticties of energy demand in commercial sector.

2 - Decentralized Operation Strategies for Building Cluster Using Particle Swarm Optimization

Mengqi Hu, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, mengqi.hu@asu.edu, Teresa Wu, Jeffery Weir

The Net-Zero building and smart grid technologies drive research moving from centralized decision on a single building to decentralized decision on building cluster which shares energy resources. In this research, we develop a Particle Swarm Optimization based decentralized decision framework which is capable for study the tradeoff among building cluster. The derived Pareto solutions enable multiple dimensions tradeoff analysis, and assist to determine pricing mechanism and power grid capacity.

3 - Agent-Based Electricity Market Simulation with Demand Response from Commercial Buildings

Zhi Zhou, Argonne National Laboratory, 9700 South Cass Avenue, Lemont, IL, 60439, United States of America, zzhou@anl.gov, Jianhui Wang, Fei Zhao, Audun Botterud

We simulate an electricity market with demand response from commercial buildings by using agent-based simulation techniques. We focus on the consumption behavior of commercial buildings with different levels of DR penetration in different market structures. The results indicate a noticeable impact from commercial buildings with price-responsive demand on the electricity market, and this impact differs with different scales of DR participation under different levels of market competitions.

■ WC63

W - Tryon North - 2nd Floor

Multiobjective Programming

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Melih Ozlen, Lecturer, RMIT University, School of Mathematical and Geospatial Sc, GP.O. Box 2476V, Melbourne, 3001, Australia, melih.ozlen@rmit.edu.au

1 - Approximate Pareto Set for the Biobjective Set Covering Problem

Lakmali Weerasena, PhD Student, Clemson University, O-110, Martin Hall,, Box 340975, Clemson, SC, 29634, United States of America, lweeras@clemson.edu, Margaret Wiecek

The Pareto set of a multiobjective optimization problem is approximated within a specified accuracy. Properties of this approximation are examined. Specific results are obtained for the biobjective set covering problem. An algorithm to approximate all Pareto solutions is proposed with the accuracy resulting from the problem size and data.

2 - Finding Highly Preferred Solutions for Multicriteria Integer Programs

Banu Lokman, Middle East Technical University, Industrial Engineering Department, Ankara, Turkey, banutuna@ie.metu.edu.tr, Murat Koksalan

We develop an algorithm that first approximates the nondominated set with a hypersurface. It then finds a highly preferred hypothetical point on this surface interacting with the decision maker. It defines a small region around the chosen point using Tchebycheff and rectilinear distances and finds all nondominated points in this region. Computational results show that the small set of nondominated points in this region contains highly preferred solutions.

3 - Solving Bilevel Problem Using an Evolutionary Approach

Pekka Malo, PhD, Aalto University School of Economics, Runeberginkatu 22-24, Helsinki, 00100, Finland, pekka.malo@aalto.fi, Ankur Sinha

Bilevel optimization problems are special kind of optimization problems which require every feasible upper-level solution to satisfy the optimality conditions of a lower-level optimization problem. These problems are commonly found in practice which include transportation, game-playing strategy development, coordination of multi-divisional firms, optimal control, and others. In the presentation, we discuss a practical bilevel problem and solve it using an evolutionary approach.

4 - Multi-objective Integer Programming: An Improved Recursive Algorithm

Melih Ozlen, Lecturer, RMIT University, School of Mathematical and Geospatial Sc, GP.O. Box 2476V, Melbourne, 3001, Australia, melih.ozlen@rmit.edu.au, Benjamin A. Burton

This study introduces an improved recursive algorithm to generate the set of all nondominated objective vectors for the Multi-Objective Integer Programming problem. We significantly improve the earlier recursive algorithm of ÷zlen and Azizoglu by using the set of already solved subproblems and their solutions to avoid solving a large number of IPs. We conduct a series of randomised computational experiments to show the amount of savings that can be obtained by this improved algorithm.

■ WC65

W - Kings Room - 2nd Floor

Procurement and Pricing

Contributed Session

Chair: Jenyi (Jay) Chen, Cleveland State University, 1860 E. 18th Street, Cleveland, United States of America, j.chen27@csuohio.edu

1 - Efficient Rationing and Priority Pricing: Risk Allocation of Fluctuating Resources to Varying Demand

Seyed Reza Yousefi, The University of Texas at Austin, 3555 Lake Austin Dr Apt D, AUSTIN, TX, 78703, United States of America, s.reza.y@gmail.com, Huaxia Rui, Andrew Whinston

The present study adds to the literature on designing a producer's optimal allocation scheme in allotting a scarce resource in the presence of fluctuations in both demand and supply, while at the same time, customers are heterogeneous in the sensitivity towards rate of consumption. The proposed mechanism suggests that pricing schedule could be designed as contingent contracts based on priority rankings according to the customers' risk aversion.

2 - Optimal Component Procurement Strategy in Assemble-to-Order Systems with Demand Forecast Updates

James Cao, Ph.D. Student, UC Irvine, 7601 Palo Verde, Irvine, CA, 92617, United States of America, caol@uci.edu, Rick So

This paper examines the role of forecast updating in an assemble to-order environment. We consider a contract manufacturer that needs to procure the required components for a customized product. Once any component is procured, an upper bound is set on any future purchases of other components because the final product needs exactly one part of each component and there is only one ordering opportunity per supplier. Using an analytical model, we derive the optimal procurement strategies.

3 - Economies of Scale in Joint Procurement and Advertising Strategy for Multiple Products

Mingchang Wu, Student, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States of America, mingchang.wu@business.uconn.edu, Lakshman Thakur, Suresh Nair

In practice, one significant problem faced by retailers is how to coordinate inventory procurement with advertising allocation across a range of products so as to exploit economies of scale existing in advertising. This paper investigates this problem and presents an optimal joint procurement and advertising strategy for multiple products which maximizes the aggregate profit.

4 - Procurement Contract Design When Competing Buyers May Collaborate

Jenyi (Jay) Chen, Cleveland State University, 1860 E. 18th Street, Cleveland, United States of America, j.chen27@csuohio.edu, Maqbool Dada, Joice Hu

When selling goods to retailers who serve the same consumer market, a manufacturer can design procurement contracts to its advantage by carefully selecting the contracting elements: multiple ordering opportunities, relative market power of retailers, and permission of retailer trade. We characterize and compare different competition models, and investigate the effect of production costs on the equilibrium strategy.

■ WC66

W - Park Room - 2nd Floor

Logistics in Action

Contributed Session

Chair: Richard Monroe, Associate Professor, East Carolina University, Department of Technology Systems, 402 Science & Tech Bldg, Greenville, NC, 27858, United States of America, monroer@ecu.edu

1 - Cross-dock Operations and Uncertainty

Kanthimathi Sathasivan, Graduate Student, The University of Texas at Austin, 1 University Station C1761, Austin, TX, 78712, United States of America, kanthisatha@gmail.com, Travis Waller

As many companies choose to do cross-docking as a cost cutting measure, they are also faced with uncertainty at several levels in their cross-dock operations. This problem addresses the uncertainties that arise in the Goodwill resource center cross-dock operations which serve several Goodwill stores in the central Texas area. The formulation minimizes the cost and a robust alternative solution method is discussed together with the numerical results of the computational experiments.

2 - Public Logistics Information Platform Pratice in China
Hongwei Ding, SCM Research Manager, IBM Research China, Diamond Building A, ZGC Software Park, Beijing, 100193, China, dinghw@cn.ibm.com, Wei Wang, Xiaoqing Wang, Hongbo Li, Jin Dong, Minmin Qiu

One major reason of the high logistics cost in China is due to the lack of scale of economy given the highly fragmented logistics industry. We developed a public logistics information platform to bring trucking companies, goods forwarders, manufacturers, 3PLs together and provide platform members with services including information sharing, supply/demand synchronization, transportation optimization, etc. It's very effective in helping small companies to grow business and reduce costs.

3 - A Logistics and Distribution Problem in a Farm-to-School Setting in Mexico
Erika Murguia Blumenkranz, Consultant, TIS Consulting Group, Hermosillo, Sonora, Hermosillo, Mexico, erika.murguia@gmail.com, Octavio Sanchez Arocha, J. Rene Villalobos, Gerardo Trevino Garza, Ahumada Omar, Alejandro Sanchez Arocha

We consider a logistics and distribution problem in a farm-to-school setting in Mexico. We present results for the optimization problem and solution of the children's diets, the optimal location of collection, food processing and distribution centers all over Mexico. The system should provide food to 21,025,391 children in elementary and middle school, divided in 135,240 schools in 2,640 cities.

4 - Coordination in Logistics Management: How Much Information Sharing Could be Beneficial?
Hossein Zolfagharinia, School of business and Economics, Wilfrid Laurier University, 75 University Avenue West, Waterloo, Ontario, N2L 3C5, Canada, Zolf1380@wlu.ca, Michael Haughton

In this study, a fairly complex network, in which suppliers, carriers and demand points are playing a role is considered. The goal of this article is to examine the value of information sharing in outsourcing of logistics activities taking demand uncertainty into account. In this regard, the proposed model is investigated under two conditions, namely full and no information sharing conditions. More than two hundred test problems in form of 48 different settings are generated to illustrate how much information sharing could be beneficial and which factors are critical in this respect. The managerial insights are provided at the end.

5 - The Current State of Intermodal Logistics: Trends and Constraints
Richard Monroe, Associate Professor, East Carolina University, Department of Technology Systems, 402 Science & Tech Bldg, Greenville, NC, 27858, United States of America, monroer@ecu.edu

Containerization of raw materials, components and products facilitate the extremely long distances traveled and the multiple modes of transportation which are required in today's global supply network. Given the growth of intermodal logistics, the constraints faced by shipping firms become critical issues. This paper will present recent statistics for intermodal shipping in the U.S. and then discuss specific constraints which are impacting intermodal shipping performance and capabilities.

■ WC67

W - Grand A - 2nd Floor

Systems Analysis

Contributed Session

Chair: David Hoffman, Adjunct Professor, University of Alaska Anchorage, P.O. Box 111829, Anchorage, AK, 99511, United States of America, afdbh@uaa.alaska.edu

1 - On a Simple Comparison Procedure in Analyzing Observational Data
Ying Tat Leung, IBM Almaden Research Center, 650 Harry Road, San Jose, CA, 95120, United States of America, ytl@us.ibm.com, Barbara Jones

In many situations, we are interested in the impact of a single factor on the performance of a system that we can only observe. We consider a naÔve approach in which we perform a simple comparison of the observed system performance at different, known settings of the factor of interest. This procedure turns out to be more accurate than it appears to be.

2 - The Impact of Social Communication Styles on Innovation Potential of Global Participatory Science
Ozgur Ozmen, GRA, Auburn, 3301 Shelby Center, Auburn, AL, 36849, United States of America, ozo0002@auburn.edu, Levent Yilmaz, Jeffrey Smith

We call scientific knowledge creation in cyber-infrastructures Global Participatory Science. Communication preferences are posited as an important factor affecting GPS. Using agent-based modeling, we develop a complex adaptive social communication network model. Social network metrics and knowledge production patterns are used as proxy metrics to infer innovation potential. The objective is to further our understanding of GPS and facilitate developing informed policies fostering innovation.

3 - Fixing Process Inefficiencies Based on Pairs of Systems Factors
David Hoffman, Adjunct Professor, University of Alaska Anchorage, P.O. Box 111829, Anchorage, AK, 99511, United States of America, afdbh@uaa.alaska.edu

Improving processes requires understanding the root sources of inefficiencies. Five systems factors which influence efficiency are delays, errors, variances, capacity and lack of feedback. When any two are combined they create a specific problem. For example, combining variances with capacity create dynamic limits problems. Reverse analyses lead to improvements.

■ WC68

W - Grand B - 2nd Floor

Simulation and Queuing in Supply Chain

Contributed Session

Chair: Jaydeep Balakrishnan, Professor, University of Calgary, Haskayne School of Business, Calgary, AB, T3A, Canada, balakris@ucalgary.ca

1 - A Queuing Model for Inventory Control in a System with Periodic Demands
Sanket Bhat, University of Wisconsin-Madison, 1513 University Avenue, Madison, United States of America, sbhat2@wisc.edu, Ananth Krishnamurthy

We consider a queuing model for a production-inventory system with periodic demands. The production system is modeled as a M(t)/M/1 queue and evaluates the performance trade-offs when the system operates under a periodic base-stock policy. The model captures the effects of congestion on production inventory decisions in capacitated systems.

2 - Modeling and Design of Biopharmaceutical Production Systems
Tugce Martagan, University of Wisconsin-Madison, 1513 University Avenue, Madison, United States of America, martagan@wisc.edu, Ananth Krishnamurthy

Bio-pharmaceutical production systems include complex dynamics that challenge the design of efficient production systems. The study presents analytical models to investigate the performance of upstream production processes. A queuing model is developed to analyze the trade-offs between production capacity, batch size, yield and throughput. The model incorporates the dependency between the batch size and batch failure rate, and captures the impact of various design parameters on throughput.

3 - Design of a Warehouse for an Air Cargo Terminal through Discrete Simulation
Carlos Osorio, Politecnico Grancolombiano, Cl 57 3 00 Este Fac. Ingenierìa, Bogota, Colombia, caosorio@poli.edu.co, Oscar Parra

This paper shows the application of discrete simulation for designing the main air cargo warehouse of one of the biggest airlines in Colombia and South America. The research begins with the evaluation of the operations carried out in the warehouse; the current performance is analyzed using key logistics indicators, and prospective scenarios are then generated and evaluated. Preeliminary results are also reported.

4 - Crossdocking Operations Analysis Using Computer Simulation with Material Handling Considerations
Jaydeep Balakrishnan, Professor, University of Calgary, Haskayne School of Business, Calgary, AB, T3A, Canada, balakris@ucalgary.ca, Chun-Hung Cheng, Kum Khiong Yang, Wing Shuet Wong

Crossdocking is an important distribution strategy in a supply chain management. In this work, the impact of staging in crossdocking operations is examined. Our model also considers the operations of the material handling team explicitly. Two components of processing time for the pallets can be calculated: (1) the waiting time of the pallets at the staging area (2) the processing time of the pallets by the material handling team's forklifts.

■ WC69

W - Grand D - 2nd Floor

Sustainability and Uncertainty in Competitive Supply Chains

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Ekundayo Shittu, Tulane University, A.B. Freeman School of Business, New Orleans, United States of America, eshittu@tulane.edu

1 - Optimal Storage Investment for Efficient Integration of Renewable Energy with Dynamic Pricing

Pavithra Harsha, IBM, 1101 Kitchawan Road, Room 34-225, Yorktown Heights, NY, United States of America, pharsha@us.ibm.com, Munther Dahleh

We address the optimal storage investment problem faced by a renewable generator the purpose of which is to support a portion of a local demand with the goal of minimizing the average cost of electric bills in the presence of dynamic pricing and storage investment. We characterize how the cost and efficiency of storage, dynamic pricing and uncertainty in generation and demand impacts the size of optimal storage and its gain and discuss experimental results on real data.

2 - QoS-Based Capacity Modeling for Intermittent Generating Resources

Xiaoyue Jiang, Assistant Professor, Tulane University, 7 McAlister Drive, New Orleans, United States of America, xjiang@tulane.edu, Geoffrey Parker, Ekundayo Shittu

We propose a network calculus (NetCal) approach to characterize the capacity of intermittent generating resources. Essentially, the power supply and demand dynamics are modeled based on deterministic queuing systems and intermittent generating resources are characterized as queuing servers whose capacity is represented as service curve. Such approach presents an alternative modeling framework under which various capacity planning and management issues can be addressed.

3 - Generation of Correlated Probability Distributions for Future Energy Prices

Rose Zdybel, University of Massachusetts Amherst, UMass/Amherst, Amherst, MA, United States of America, rozoe@msn.com, Erin Baker

We describe an approach for estimating correlated probability distributions over future energy prices, incorporating both past data and detailed forecasts. The approach we take is analogous to the decomposition method used for forecasting with seasonality. Here, however, instead of seasonality, we model general variability. We present an example using forecasts from the EIA for end-user energy prices for distillate oil, natural gas, and electricity.

4 - On Regulation and Efficient Management of Distributed Generation Systems

Ekundayo Shittu, Tulane University, A.B. Freeman School of Business, New Orleans, United States of America, eshittu@tulane.edu, Geoffrey Parker, Xiaoyue Jiang

We propose a framework for the evaluation of the economic and regulatory options for grid penetration of distributed energy resources. We employ two-stage stochastic programming formulation to explore the optimal scheduling of supply from intermittent sources to meet variable systemic load while satisfying operational and technological limitations. We apply this methodology to a case study to demonstrate its effectiveness under different assumptions on regulatory prescriptions.

Wednesday, 2:45pm - 4:15pm

■ WD01

C - Room 201A

Forecasting

Contributed Session

Chair: Akkarapol Sa-ngasoongsong, Phd. Student, Oklahoma State University, 245N. University Place#301, Stillwater, OK, 74075, United States of America, akkarap@okstate.edu

1 - A Multiple Regression Forecasting Method for Short Life Cycle Products

Jesús A. Rodríguez-Sarasty, Pontificia Universidad Javeriana - Cali, Calle 18 No. 118-250, Cali, Colombia, rodriguez@ingenieros.com, Carlos Julio Vidal Holguin

Short life cycle products are increasingly frequent in several industries. These products are characterized by a transitory, non-stationary and highly stochastic demand that cannot be adequately addressed through classical forecasting methods. We propose a multiple regression method that using sales data of similar products in previous seasons helps to forecast the demand in specific time periods. This method can be integrated into a system with multiple replenishments during the sales season.

2 - Forecasting Practices in Food Services Industry: A Survey

Amer Karim, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208-3100, United States of America, akarim@u.northwestern.edu

A survey using a sample of 500 restaurants (excluding fast food) was conducted to provide an understanding of forecasting practices in the food service industry in a large Midwestern state. The findings are consistent with previous research. The results indicated that compared to manufacturing sector, less quantitative technique is used. Time series was the most used method. The managers used short term and medium term forecasting more frequently than long range forecasts.

3 - Forecasting Sales of Slow Moving Items

Evren Tipi, Network Optimization Planning Manager, Lowe's Home Improvement, 13543 Helen Benson Blvd., Davidson, NC, 28036, United States of America, evren.e.tipi@lowes.com, James R. Wilson, Russell E. King, Thom J. Hodgson

We enhance existing forecasting techniques for slow-moving items through addition of a seasonality index, a correction factor, and a modified update frequency. These new methods are shown to outperform the existing methods in terms of traditional forecast accuracy as well as inventory metrics using the sales data from one of the biggest retail companies.

4 - Forming Prediction Intervals for Turning Points in Economic Indices

Robert Pavur, Professor, University of North Texas, Department of ITDS, 1155 Union Circle #305249, Denton, TX, 76203, United States of America, pavur@unt.edu, Youqin Pan

Consumer Sentiments Indices (CSIs), reflecting consumer confidence, are widely considered important indicators of household consumption behavior. This paper explores a methodology to provide insight into the business cycle of the CSIs by developing a methodology to forecast turning points for the index and anticipate changes in the business cycle.

5 - Nonstationary Sales Prediction Based on Hilbert-Huang Transform (HHT)

Akkarapol Sa-ngasoongsong, Phd. Student, Oklahoma State University, 245N. University Place#301, Stillwater, OK, 74075, United States of America, akkarap@okstate.edu, Satish Bukkapatnam

Prediction of sales over time is crucial component of a company's planning framework. However, the sales evolution follows a nonlinear and nonstationary dynamics. In this work, we present a new approach, based on a local gaussian process (LGP) and empirical mode decomposition (EMD) for accurate prediction of automobile sales.

■ WD02

C - Room 201B

Promotions

Contributed Session

Chair: Salma Karray, UOIT, 2000 Simcoe Street North, Oshawa, ON, Canada, salma.karray@uoit.ca

1 - Customer Loyalty Assessment by Using Support Vector Machine
Ali Dehghan, PhD Student, Eastern Michigan University, 1007 East Brooks Apt H, Norman, OK, 73071, United States of America, ali.dehghan3@gmail.com, Theodore Trafalis

Customers with a high level of satisfaction are likely to remain with their existing providers. Such loyal customers hardly switch to another service provider, in other word, they do not churn. In this paper, the applications of Support Vector Machine in assessing the Customer Loyalty are studied.

2 - Optimal Advance Selling Strategies Using Coupons in a Monopoly Market
Gang Wang, UConn Business School, 2100 Hillside Rd, Unit 1041, Storrs, CT, 06269, United States of America, gang.wang@business.uconn.edu

Lately many businesses are advance selling their products or services through some websites, like groupon.com. This new technique has the features of both advance selling and coupon promotion. We build the advance selling model and explore the effect of these coupons on consumer behavior and the seller's profits. We find the condition of marginal cost where the seller makes profit from coupons. We also suggest the optimal advance selling strategies in terms of optimal prices and coupon duration.

3 - Promotion Strategies Using Bayesian Networks
Bumsoo Kim, PhD Candidate, George Washington University, 2201 G Street, NW, Fungar Hall 415H, Washington, DC, 20006, United States of America, bk4498@gwu.edu

In spite of the ease of accessibility to grocery stores, and recent expansion in online grocery shopping, consumers still purchase multiple items over different categories of products in a single shopping trip. Furthermore, with the improvements in IT, it is now feasible for the retailers to collect market basket level data. We use Bayesian Networks to find dependence structures among multiple products and show how a retailer may formulate the most 'efficient' promotion strategy.

4 - Effectiveness of Retail Joint Promotions under Different Channel Structures
Salma Karray, UOIT, 2000 Simcoe Street North, Oshawa, ON, Canada, salma.karray@uoit.ca

We investigate the effects of horizontal joint promotions (HJP) initiated by competing retailers on the supply chain's strategies and profits using a game theoretic model. We find that for low levels of promotional effectiveness, HJP improves each channel member's profits through demand expansion and higher margins under all channel structures. However, a highly effective HJP can only be initiated by decentralized retailers.

■ WD03

C - Room 202A

Stockouts, Backlogging and Lost Sales

Contributed Session

Chair: Burcu Aydin, Research Scientist, HP Labs, 1501 Page Mill Rd. MS 1040, Palo Alto, CA, 93304, United States of America, aydin@hp.com

1 - Models to Assess the Impact of Demand Loss on Ordering Behavior in Multi-Period Inventory Systems
James Lavin, Student, NC State University, 1321 Crab Orchard Dr, Apt #002, Raleigh, NC, 27606, United States of America, jalavin@ncsu.edu, Semra Sebnem Ahiska, Russell E. King, Don Warsing, Anita Vila-Parrish

Stock-outs may cause customers to lose faith in a retailer, potentially driving them elsewhere to meet their future demand. Previous research modeled consumer behavior by lowering future demand using a "disappointment factor" that dependent on the ordering policy. Instead of traditional penalty costs imposed on stock-outs, our model lowers the demand in future periods. We extend of models from the literature to include stochastic demand and flexible ordering policies.

2 - On Optimal Replenishment Policies under Random Lead Times and Partially Retained Demands
Michael Katehakis, Professor, Rutgers University, 1 Washington Park, Newark, NJ, 07102, United States of America, mnk@rutgers.edu, Laurens Smit

We study a continuous review stochastic inventory model for a single product with random lead times and partially retained demands. We formulate the problem of computing optimal values for the reorder quantity, and the order point (Q,r). Further we introduce state aggregation which can be used to obtain efficient computational algorithms.

3 - Performance of the Clark-Scarf Algorithm in Multi-echelon Inventory Systems with Lost Sales
Woonghee Tim Huh, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z4, Canada, tim.huh@sauder.ubc.ca, Marco Bijvank, Ganesh Janakiraman

We study a serial inventory system under periodic review when excess demand at the most downstream stage is lost. First, we show that base-stock policies are asymptotically optimal as the lost-sales penalty cost parameter grows. Next, we propose an approximation procedure to set the values of the base-stock levels with the Clark-Scarf algorithm. This procudure demonstrates excellent cost performance relative to the costs of the optimal policy with an average optimality gap of 2%.

4 - Estimation of Disequilibrium Models under Unobserved Demand Backlogging
Burcu Aydin, Research Scientist, HP Labs, 1501 Page Mill Rd. MS 1040, Palo Alto, CA, 93304, United States of America, aydin@hp.com, Mehmet Sayal, Enis Kayis, Kemal Guler

One of the core concepts in Collaborative Inventory Management is the management of inventory levels according to the forecasted demand and supply of both parties. In this work we investigate a CIM model where the issued forecasts and inventory levels (supply) are available, but the actual demand information is missing. To estimate the demand we define a novel version of the Switching Model where backlogging demand from one period to the next is allowed.

■ WD07

C - Room 204

Queueing Theory and Applications

Contributed Session

Chair: Fang Dong, PhD Candidate, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48105, United States of America, ppfang@umich.edu

1 - Modeling Departure Flow in Nonstationary Markovian Tandem Networks
Ira Gerhardt, Assistant Professor, Manhattan College, 4513 Manhattan College Parkway, Department of Mathematics & Computer Science, Riverdale, NY, 10471, United States of America, ira.gerhardt@manhattan.edu, Barry L. Nelson

We examine a tandem network of queueing nodes fed by a nonstationary external Markovian arrival process. We develop methods for matching downstream interarrival moments to the departure count moments from the immediate upstream node, thereby decoupling the network. We apply these matching techniques at variable time-steps, updating the parameters of the fit at each step and holding them constant until the next update.

2 - Task Release Control Policies for State-dependent Queues
Ketan Savla, Research Scientist, Massachusetts Institute of Technology, 32-D716, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, ksavla@mit.edu, Emilio Frazzoli

We consider novel state-dependent queues where the server offers a state-dependent service and the state evolution is governed by its utilization history. We present results on the throughput of such queues under the task release control architecture. Special attention is given to those controllers that release a new task to the server only when its current state belongs to a specific set. The results rely on the combination of tools from dynamical systems and queuing theory.

3 - Design and Analysis of a Multi-Product Assembly Line

Kamran Moghaddam, Assistant Professor of Systems Engineering, Southern Polytechnic State University, 1100 South Marietta Parkway, Marietta, GA, 30060, United States of America, kmoghadd@spsu.edu, Xu Yang

We discuss the basic steps of design and analysis of a multi-product assembly line. We define the assumption, configuration and specification of the system and develop principle criteria of the system. These criteria will be used to evaluate the performance of the base case as well as three scenarios of the system. In order to improve the performance of this system, we consider different scenarios, and then analyze and compare them based on the defined criteria and assumptions for each scenario.

4 - Dynamic Control of an "N" Queueing Network with Application to Shipbuilding

Fang Dong, PhD Candidate, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48105, United States of America, ppfang@umich.edu, Mark Van Oyen, David Singer

The well-researched "N" network still lacks effective, computationally lightweight policies, especially with non-preemption. We use a Markov Decision Process for benchmarking and to gain structural insights into the optimal scheduling policy. We develop a state dependent threshold policy and benchmark it against other policies to show its excellent robustness and effectiveness. We thereby substantiate the potential benefits of introducing operational flexibility into shipbuilding.

■ WD08

C - Room 205

Robust Optimization

Contributed Session

Chair: Somayeh Moazeni, PhD Candidate, University of Waterloo, 200 University Avenue West, Waterloo, Canada, smoazeni@math.uwaterloo.ca

1 - A Robust Optimization Approach for Joint Production Planning with Uncertain Demand

Alejandro Lamas, PhD Student, Facultés Universitaires Catholiques de Mons/Université Catholique de Louvain, Voie du Roman Pays 34, Louvain-la-neuve, 1348, Belgium, alejandro.lamas@student.uclouvain.be, Philippe Chevalier

We address the problem of the joint production plan of two companies, where the global cost of the system is reduced by the presence of economies of scale. However, this globally optimal solution could imply disparity in the results for each company. Assuming that customer demand is uncertain, we propose a novel robust optimization approach, which goal is to find the best trade-off between a global performance and limited disparities between the results of each participant.

2 - Solving the Robust p-hub Median Problem

Paul Berglund, University at Buffalo, Department of ISE, Buffalo, United States of America, berglund@buffalo.edu, Changhyun Kwon

The deterministic p-hub median problem for a transportation network is to choose p network hubs and allocate nodes to hubs so as to minimize the total cost, given known node-to-node travel costs and demand levels. A robust version of this problem is, when travel costs and/or demands fall into some uncertainty set U, to choose p hubs so as to minimize the worst case total cost over all possible elements of U. This is an NP-hard problem; a heuristic is used to find a good quality solution.

3 - On Constraint Estimation for Robust Optimization in Supply Chains

Abhilasha Aswal, International Institute of Information Technology, 26/C Electronics City, Bangalore, 560100, India, abhilasha.aswal@iiitb.ac.in, Ganesh Perumal, G.N. Srinivasa Prasanna

Our robust optimization approach to supply chain mgmt uses polyhedral formulation of uncertainty where the constraints correspond to the economically meaningful correlations between uncertain parameters. As part of our larger study in supply chain optimizations, we present newer work, focusing on constraint estimation which leads to a multidimensional generalization of the 1-D German Tank problem. We present a new UMVU estimator whose convergence time is polynomial in accuracy.

4 - Random Delayed Lot-sizing Model

Wei Yuan, PhD Candidate, University of South Florida, IMSE, 4202 E. Fowler Avenue,ENB118, Tampa, 33613, United States of America, weiyuan@mail.usf.edu, Bo Zeng

We consider a lot-sizing problem with random delay as well as random demand. A two stage robust optimization mode is developed and a cutting plane algorithm is implemented. Computational results will be presented using a concrete example.

5 - A Regularized Robust Optimization Approach for Portfolio Execution

Somayeh Moazeni, PhD Candidate, University of Waterloo, 200 University Avenue West, Waterloo, Canada, smoazeni@math.uwaterloo.ca, Yuying Li, Thomas Coleman

Uncertainty set is a crucial component in robust optimization. However, its specification is often unclear. Here, we concern instability of the robust solution to variations in the uncertainty set for the portfolio execution cost problem. We first illustrate potential instability of the classical robust optimization to variations in the uncertainty set. We then propose a regularized robust optimization approach based on regularizing the uncertainty set. Improvement in stability is discussed.

■ WD09

C - Room 206A

Trends in Pricing in the Transportation and Hospitality Industries

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Tom Gorin, PROS Pricing, 3100 Main Street, Houston, TX, 77002, United States of America, tgorin@prospricing.com

1 - The Future of Revenue Management: An Update from 2007

Stowe Shoemaker, Division of Research - University of Houston, Houston, TX, United States of America, sshoemaker@uh.edu

In 2007 Milla and Shoemaker published a paper on the future of revenue management in the hotel industry. The paper was based on in-depth interviews with key industry executives. The focus of the discuss at INFORMS will be an updated version of this paper. Specifically, interviews will be conducted in from July 1 - November 1 with hospitality industry executives to answer the following issues: (1) how is revenue management practiced by their organization (i.e., at property level or cluster level) (2) how has the practice of revenue management changed over the last five years (3) what problems do they face implementing revenue management (4) what, if any, initiatives are they currently working on/implementing, (5) how do they see RM changing in the future, and (6) other issues that come up in the analysis.

2 - Air Canada & ExPretio: Fare Families in the Air Transportation Industry

Richard Cleaz-Savoyen, Revenue Analysis Manager, Air Canada, 7373 Côte Vertu Ouest, Bat 2, Zip 1252, Ville St Laurent, QC, H4S1Z3, Canada, Richard.Cleaz-Savoyen@aircanada.ca, Anne Mercier, Louis-Philippe Bigras

In 2004, Air Canada opted for more pricing transparency, introducing the concept of Fare Families: during the entire booking window, a choice set of products would be available, at fares which could vary over time. After much experimentation, this strategic decision proved successful. In partnership with ExPretio, Air Canada recently conducted in-depth customer behavior analyses based on choice models. We will present insights on demand response to the unique pricing concept of Fare Families.

3 - Optimization Model for Joint Pricing and Seat Inventory Control: Multiple Products, Multiple Periods

Claire Cizaire, MIT, 77 Massachusetts Avenue, Room 35-217, Cambridge, MA, 02139, United States of America, cizaire@mit.edu, Peter Belobaba

Pricing and revenue management have traditionally been considered separately, despite the fact that prices and booking limits both affect a passenger's choice set. We developed deterministic and stochastic approaches to simultaneously optimize the price levels and booking limits for an airline with two fare products. The clearly defined attributes of the two fare products remain the same over the booking horizon, but the prices are allowed to vary.

4 - Analytics of Price Optimization Solutions

Seonah Lee, Revenue Analytics, 3100 Cumberland Blvd, Suite 1000, Atlanta, GA, 30339, United States of America, slee@revenueanalytics.com

Price optimization under limited capacity problems can be formulated into a quadratic optimization problem (QP). Using the analytical properties of the optimal QP solution, we propose an alternative algorithm to the conventional quadratic optimization. In this study we apply the alternative price optimization algorithm to the hotel length of stay rate optimization problem. Initial computational study shows that the performance of the alternative algorithm is comparable to existing QP algorithms.

■ WD11

C - Room 207A

Analysis, Applications and Computations with Many Server Systems

Sponsor: Applied Probability

Sponsored Session

Chair: Jose Blanchet, Columbia University, 500 W 120 St, New York, NY, United States of America, jose.blanchet@columbia.edu

1 - Dynamic Steady State for Many-server Queues with Deterministic Service Times

Yunan Liu, Assistant Professor, Columbia University, 500 West 120th Street, New York, NY, 10027, United States of America, yl2342@columbia.edu, Ward Whitt

Considering the GI/D/s+GI model, we demonstrate the invalidity of the interchange of two limits: the steady state of the heavy-traffic (HT) limiting process does not coincide with the HT limit of the steady state of the queueing processes. The number of customers at t converges to a unique stationary distribution as t goes to infinity; on the other hand, the HT fluid sample paths reach a dynamic (periodic) steady state, provided that the system does not start in steady state.

2 - Exact Asymptotic for Infinite-server Queues

Henry Lam, Assistant Professor of Statistics, Boston University, 111 Cummington Street, Allston, MA, 02134, United States of America, khhlam@gmail.com

We derive an exact asymptotic, up to a constant factor, for the tail probability of the number of customers for a G/G/infinity queue at a fixed time under heavy traffic. The main technique is by obtaining fine estimates for the rate of convergence of the corresponding Gartner-Ellis limit via non-homogeneous renewal-theoretic bounds. Our refined asymptotic can be seen to resemble the standard form for sum of i.i.d. random variables, as a result of Gaussian diffusion approximation.

3 - Rare-event Simulation for Multi-server Queues in the Halfin-Whitt Regime

Jing Dong, Columbia University, 500 West 120th Street, RM 325, New York, NY, 10027, United States of America, jd2736@columbia.edu, Jose Blanchet

We develop rare-even simulation methodology to analyze the event of high population overflow of FCFS M/H_d/n queue in the Halfin-Whitt heavy traffic regime. Our algorithm achieves logarithmical efficiency. The key strategy is to study the state of each server as a CTMC and tilt the system to the rare event over a randomized time horizon.

4 - Infinite-size Networks of Infinite Server-queues and Their Applications

Xinyun Chen, Columbia University, S M Mudd Building, 500 West 120th Street, New York, NY, 10027, United States of America, xc2177@columbia.edu, Jose Blanchet

In this talk, we discuss a queueing network model consisting of infinitely many stations each having infinite number of servers. We discuss how these models are useful in insurance and finance. We also characterize fluid and diffusion limit for this network in terms of a suitable SPDE and related measure-valued stochastic processes.

■ WD12

C - Room 207BC

Stochastic Optimization in Transportation

Contributed Session

Chair: Thomas Yeung, Associate Professor, Ecole des Mines de Nantes, 4 Rue Alfred Kastler BP 20722, Nantes, 44000, France, thomas.yeung@mines-nantes.fr

1 - Stochastic Optimization in Transportation Route Design and Timetabling

Bruno Flach, IBM Research - Brazil, Av Pasteur 138/146, Rio de Janeiro, Brazil, bflach@br.ibm.com, Milind Naphade, Sambit Sahu, Pavan Murali, Jing Dai, Ming Li

Providing incentives for an increased usage of public transportation lies among a vast spectrum of measures aimed at reducing GHG emissions and counteracting climate change. However, the widespread adoption of public transportation is often hindered by inefficient routes, poor synchronization, time-consuming and unreliable service. In this work, we study the problem of designing routes and defining an optimal service timetable so as to maximize the quality of service from the users' viewpoint.

2 - Structural Properties to Solve MDP and POMDP Models for Road Maintenance Optimization

Thomas Yeung, Associate Professor, Ecole des Mines de Nantes, 4 Rue Alfred Kastler BP 20722, Nantes, 44000, France, thomas.yeung@mines-nantes.fr, Mariem Zouch, Bruno Castanier

We optimize road maintenance decisions of perfect and multiple imperfect actions with varying effects on the road state and degradation process. We use a Markov decision process and show the optimal policy is of the control limit type and each action is selected. These are used to accelerate the policy iteration algorithm and formulate a heuristic for the partially observed case. Substantial gains in computation time (70%) and objective value (15%) are shown compared to grid-based approximation.

3 - The Multi-depot Heterogeneous Capacitated Vehicle Routing Problem with Stochastic Demand

Mahdi Noorizadegan, University of Warwick, Warwick Business School and DIMAP, Gibbet Hill Road, Coventry, CV4 7AL, United Kingdom, m.noorizadegan@warwick.ac.uk, Bo Chen

We are concerned with a multi-depot heterogeneous vehicle routing problem with stochastic demands and capacities for both depots and vehicles. We extend the Miller-Tucker-Zemlin model and then improve it with additional sets of valid inequalities. Finally, we apply Chance Constrained Programming and Robust Optimization to solve the problem efficiently.

■ WD14

C - Room 208A

Multi-stage Stochastic Programming Applied to Power Systems Scheduling

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Ross Baldick, Professor, University of Texas at Austin, 1 University Station, Austin, TX, United States of America, baldick@ece.utexas.edu

Co-Chair: Luiz Augusto Barroso, Technical Director, PSR, Praia de Botafogo 228 sala 1701 Parte, Rio de Janeiro, RJ, 22250-906, Brazil, luiz@psr-inc.com

1 - On a Sampling-based Decomposition Applied to Hydrothermal Scheduling: Solution Quality and Bounds

Anderson Rodrigo de Queiroz, Phd Student, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, ar_queiroz@yahoo.com.br, David Morton

Sampling-based decomposition algorithms (SBDAs) have been used frequently in the literature to solve hydrothermal scheduling problems. Basically, a sample average approximation of the original problem is created and then solved by these algorithms. It is important to assess the solution quality of the resulting policy. We investigate variance-reducing sampling methods that improve SBDA performance and stopping rules that yield asymptotically valid confidence intervals on policy quality.

2 - Modeling and Forecast of Brazilian Reservoir Inflows under Climate Change Scenarios

Luana Marangon, Student, University of Texas at Austin, Department of Mechanical Engineering, 1 University Station, C2200, Austin, TX, 78712, United States of America, luana_marangon@yahoo.com.br, Elmira Popova, Paul Damien

The hydrothermal scheduling problem is highly dependent on the water inflows at each hydropower generator reservoir. This work will focus on developing a probabilistic model for the inflows based on dynamic linear model. We seek for a suitable model to use as an input for a multistage stochastic algorithm that solves the hydrothermal scheduling problem. We also incorporate climate variables like precipitation, El Nino and other ocean indexes as predictive variables when relevant.

3 - Dynamic Piecewise Linear Nested Decomposition for Nonlinear Stochastic Hydrothermal Scheduling

André Diniz, Researcher, CEPEL, Av. Horacio Macedo 354, Ilha Fundao, Cidade Universitaria, Rio de Janeiro, RJ, 22220040, Brazil, diniz@cepel.br, Michel Ennes, Renato Cabral

We propose a dynamic piecewise linear nested decompositon approach to model nonlinear constraints in the stochastic hydrothermal scheduling problem. Linear approximations are adjusted iteratively as the overall problem is solved, Benders cuts remain valid but upper bounds are re-evaluated during the course of the algorithm. Results show the high accuracy to model the hydro generation function and quadratic thermal costs, with much lower CPU times as compared to a static model of the constraints.

4 - Fast Convex Hull And Stochastic Dynamic Programming Applied to Energy System Hydrothermal Planning

André Marcato, Associate Professor, Federal University of Juiz de Fora, Campus UFJF - Faculdade de Engenharia, PPEE - Sala 206, Juiz de Fora, MG, 36036-330, Brazil, andre.marcato@ufjf.edu.br, Rafael Brandi, Bruno Dias, Tales Ramos, Ivo da Silva Junior, Joao Passos Filho

This work presents a methodology that improves the performance of the Dynamic SP applied to the long term operation planning of electrical power systems. This approach approximates the cost-to-go functions through the Convex Hull algorithm using a dynamic piecewise linear model. So, the linear cuts are included in the linear programming problems by an iterative process, the Fast SDP-ConvexHull. A case study is presented, based on data from the Brazilian system.

■ WD15

C - Room 208B

Data Visualizations for Improved Decision Making

Sponsor: Decision Analysis

Sponsored Session

Chair: David Lengacher, Concurrent Technologies Corporation, 1225 S. Clark Street, Suite 500, Crystal City, VA, United States of America, lengachd@ctc.com

1 - Dashboards for Efficiency Analysis

David Lengacher, Concurrent Technologies Corporation, 1225 S. Clark Street, Suite 500, Crystal City, VA, United States of America, lengachd@ctc.com

Few visual aids are available for understanding the outputs of data envelopment analysis models. We develop conceptual interfaces to communicate a wide array of efficiency measures and their associated slack values.

2 - Smarter Transportation

Bharat Gera, IBM India Software Labs, India, bharatgera2008@gmail.com

The research project (done at IIM Bangalore) by me in transportation analytics deals with advanced Markov Stochastic Models to evaluate incident impacts (average travel time, blocked lanes etc.) in real time. This modeling will be integrated with Traffic Command Centers to optimize the traffic network for reduced incident impacts. Extended Kalman Filter for data cleansing and Service interrupted Queuing approaches are used in the model.

3 - Pattern Recognition and Biased Perceptions of Randomness

Qingxia Kong, PhD Student, National University of Singapore, Department of Decision Sciences, Singapore, Qingxia@nus.edu.sg

When facing complex information and uncertainty, human beings seek patterns to gain the sense of control. We explore in depth how information complexity leads to pattern recognition and thus affects the direction of biased perception of randomness. Using data from both lab and fields, we show that agents exhibit more Hot-hand Fallacy when the information is more complex. We then build a Bayesian Updating model to analytically show that moderate pattern recognition leads to Hot-hand Fallacy and obtain analytical conditions. These results have important implications.

4 - A Framework for Upstream Natural Gas Supply Chain Design: LNG Distribution Network

Fatih Mutlu, Qatar University, College of Engineering, Doha, Qatar, fatihmutlu@qu.edu.qa, Hakan Yildiz

The natural gas supply chain consists of six stages from upstream drilling of the raw gas and downstream of delivering the gas to the consumption points. Qatar is located at the upstream of the supply chain. Due to the geographical barriers, the gas has to be delivered to the importing countries in the form of LNG using high capacity vessels. Qatar made huge investments in building up the world's largest vessel fleet to match increasing export volumes. This effort can be more fruitful with a careful planning of the distribution network. Such planning offers a challenging vehicle routing problem with multiple origin and destination locations and vessels varying in capacities and fuel performances. In addition, the problem brings along unique challenges due to the nature of LNG shipping. The scale, the distances, dynamic nature of demand, and high utilization of resources due to capacity limitations are among such challenges. In this research, we propose to design a framework for this planning problem by considering the multiple objectives that need to be satisfied simultaneously and the unique characteristics of the industry. Operations Research (OR) tools have been extensively used to address and solve such distribution network design and vehicle routing problems. Our methodology is to formulate a structural problem by considering all of the unique aspects of LNG distribution and then to use the (OR) tools to achieve efficient solutions.

■ WD16

C - Room 209A

Applications in Open Pit and Underground Mining

Sponsor: Energy, Natural Resources and the Environment/ Mining

Sponsored Session

Chair: Donal O'Sullivan, PhD Candidate, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, dosulliv@mines.edu

1 - Optimizing Marcellus Shale Mining Operations

Norman Reitter, Advisor, Information Technology, Concurrent Technologies Corporation, 100 CTC Drive, Johnstown, PA, 15904, United States of America, reittern@ctc.com, Steffen Rebennack

The Pennsylvania Marcellus Shale region is booming with shale drilling operations. State government organizations and shale mining companies are faced with decisions that will impact long term economic benefit while balancing natural resource, public safety, and environmental compliance considerations. We present a shale mining optimization problem for strategic and tactical decisions for a mid-sized shale mining company to maximize economic benefit while meeting compliance requirements.

2 - Nested Disaggregation Methods for Open Pit Mine Production Scheduling

Thomas Vossen, University of Colorado, Boulder, CO, United States of America, vossen@colorado.edu, Menkes Van Den Briel, Kevin Wood, Alexandra Newman

The objective of open pit mine production scheduling is to determine a feasible extraction schedule from an open pit mine that maximizes profits over a given planning period. We present different decomposition methods that rely on repeated disaggregation to solve the linear programming relaxation of the corresponding model, together with heuristics to obtain high-quality integer solutions. Experimental results show the potential of our approach.

3 - Dealing with Price Uncertainty in Mine Planning

Andres Weintraub, Professor, University of Chile, Department of Industrial Engineering, Rep'blica 701, Santiago, Chile, aweintra@dii.uchile.cl, Roger Wets, David Woodruff, Rafael Epstein, Jean-Paul Watson, Jaime Gacitua

We consider the problem of uncertainty in future copper prices, reflected through scenarios with probabilites. Imposing non-anticipativity constraints becomes computationally difficult for larger problems. We develop an approach for this problem based on Progressive Hedging, where the problem is decomposed by scenarios, and convergence to a feasible solution is attained through penalizing deviations from non-anticipativity. Positive results were obtained for an open pit mine problem.

4 - Long-Term Extraction and Backfill Scheduling in a Complex underground Mine

Donal O'Sullivan, PhD Candidate, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, dosulliv@mines.edu, Alexandra Newman

We use an integer programming model to optimize production at a complex underground mining operation. Mine managers seek to maximize metal production while using a mixture of mining methods to extract the ore. We apply a sliding time window heuristic to solve for a four year schedule with weekly fidelity.

5 - underground Mining System Development and Production Sequence Optimization

Enrique Rubio, Assistant Professor, University of Chile, Mining, Santiago, Chile, erubio@ing.uchile.cl

A common practice in the mining industry is to decompose the planning process into different tasks, and then to compute the mining sequence and cut off grade profiles over the life of the mine. We describe a novel, integrated way of treating an underground mine sequence and production schedule while considering drift development scheduling, material handling options, and drift development.

■ WD18

C - Room 210A

Project Management

Contributed Session

Chair: Bruce Pollack-Johnson, Associate Professor, Villanova University, 800 Lancaster Avenue, Department of Mathematical Sciences, Villanova, PA, 19119, United States of America, bruce.pollack-johnson@villanova.edu

1 - Controlling the Coevolution of IT Project and Application Portfolios

I. Robert Chiang, Fordham University, 441 E. Fordham Rd, GSB, Bronx, NY, 10458, United States of America, ichiang@fordham.edu, Manuel Nunez

Managing in-flight applications and developing new software capabilities are often considered separate issues in IT literature. However, poorly controlled application enhancement escalates maintenance cost and diminishes project funding; uncoordinated new development leads to functional redundancy and architectural complexity. We propose an optimization procedure to ensure project and application portfolios are periodically adjusted to support managerial objectives and meet resource constraints.

2 - Financial Analysis of Stochastic Activity Networks

Bajis Dodin, University of California Riverside, School of Business Administration, Riverside, CA, 92521, United States of America, bajis.dodin@ucr.edu;, A.A. Elimam

Stochastic Activity Networks (SAN) deal with projects where the required duration or resources for some or all activities are given as random variables characterized by probability distribution functions. In this paper we analyze SAN to study the impact of stochastic variations on the project resource needs, the budget estimates including price bidding and the financial plan for the project over its duration. We provide and illustrate practical procedures for financial planning and management of stochastic projects.

3 - Measuring the Impact of Design Errors on Construction

Kiavash Parvan, Ph.D. Candidate in Project Management, University of Maryland, College Park, 3425 Tulane Dr. Apt#23, Hyattsville, MD, 20783, United States of America, kparvan@umd.edu, Ali Haghani

Design errors are often the chief cause of reworks in construction projects. There is a lack of research on measuring the impact of defects and reworks occurring in design phase on the construction process. This study is the first attempt to quantify this impact. The study employs system dynamics to model and analyze the design and construction process interactions and feedback relations.

4 - Modeling Quality, Cost, and Time in Software Development Project Scheduling and Planning

Bruce Pollack-Johnson, Associate Professor, Villanova University, 800 Lancaster Avenue, Department of Mathematical Sciences, Villanova, PA, 19119, United States of America, bruce.pollack-johnson@villanova.edu, Matthew Liberatore

We use an example of a software development project to illustrate how quality can be modeled as a continuous function of time and cost. Given a project deadline and budget, overall quality can then be maximized using a nonlinear programming model. Alternatively, iso-quality curves can be drawn, to visualize the continuous tradeoffs between time, cost, and quality, and then used to pick a combination that seems best for a particular situation.

■ WD19

C - Room 210B

Topics in Economics

Contributed Session

Chair: Jay Parsons, Optimal Ag Consulting, Inc., 3226 Ledgestone Court, Fort Collins, CO, 80528, United States of America, jay.parsons@OptimalAg.com

1 - SIAPOT - Territory Spatial Planning Optimization Software

Carlos Paternina-Arboleda, Associate Professor, Universidad del Norte, Km 5 via Puerto Colombia, Barranquilla, Colombia, cpaterni@uninorte.edu.co, Luis MontaÒo-Barrios

This work, presents SIAPOT, a mixed-integer optimization platform and graphical user interface software for territorial spatial planning. SIAPOT induces large-scale optimization methods and interaction with geographical databases for the planning of public space segmentation in urban settings. The software was run for a 350,000 people urban area in the north coast of Colombia with very good results.

2 - Computing Supply Function Equilibria via Spline Approximations

Sheng Yu, George Washington University, 1776 G Street NW, Suite 101, Washington, DC, 20052, United States of America, yusir@gwmail.gwu.edu, Enrique Campos-Nanez

The supply function equilibrium (SFE) is a model for competition in markets where each firm offers a schedule of prices and quantities to face demand uncertainty. We propose two methods for computing capacity constrained SFE via spline approximations. A specialized method is developed for duopoly markets with constant marginal costs, and a solution can be found by solving a least squares problem. Splines are also applied to a recently introduced general method to solve it faster.

3 - Survey of Optimization Models for Equity

John Hooker, Carnegie Mellon University, Tepper School of Buisness, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu

There is increasing interest in incorporating some measure of equity in optimization models. This talk briefly surveys mathematical programming formulations of equality and fairness criteria, including Atkinson's measure, McLoone index, Gini coefficient, Hoover index, Theil index, Nash bargaining, Raiffa-Kalai-Smorodinsky bargaining, Rawlsian and lexicographic criteria, and proposals for combining equity and efficiency. The rationale and possible applications for each will be discussed.

4 - Using a Response Surface to Estimate High Profit Combinations for Technology Adoption

Jay Parsons, Optimal Ag Consulting, Inc., 3226 Ledgestone Court, Fort Collins, CO, 80528, United States of America, jay.parsons@OptimalAg.com, Katelyn McCullock

A case study was constructed for the purpose of analyzing the implementation of sexed semen in the dairy industry. Stochastic variables for market, management, and technology were used to construct a response surface to identify and analyze conditions for profitable adoption.

■ WD21

C - Room 211B

Applied Stochastic Programming

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Urmila Diwekar, President, Vishwamitra Research Institute, 368 56-th Street, Clarendon Hills, IL, 60514, United States of America, urmila@vri-custom.org

1 - Real-time Water and Energy Management in Power Plants and Implications in Electricity Markets

Victor M. Zavala, Assistant Computational Mathematician, Argonne National Laboratory, 9700 S Cass Avenue, Argonne, IL, 60439, United States of America, vzavala@mcs.anl.gov, Juan Salazar, Urmila Diwekar, Emil Constantinescu

We propose a real-time optimization framework to integrate water and energy management in power plants. The objective of the framework is to construct optimal bidding curves (power output vs. price) using a first-principles model of the power plant and of the cooling towers under uncertain weather conditions.

2 - Multistage Stochastic Programming Approaches for Strategic Planning under Endogenous Uncertainties

Vijay Gupta, Graduate Student, Carnegie Mellon University, 5000 Forbes Avenue, Chemical Engineering Department, Pittsburgh, PA, 15213, United States of America, vijaygup@andrew.cmu.edu, Ignacio Grossmann

We consider a generic mixed-integer linear multistage stochastic programming model with endogenous (decision-dependent) uncertainties; e.g. process yields, oil and gas reservoir sizes. Solution methods are proposed for large-scale problems in this class exploiting problem structure and practical considerations. Several risk measures are considered to analyze the robustness of the solution.

3 - Optimal Glucose Control Using Finite-element Methods

John Birge, Professor, University of Chicago, Booth School of Business, Chicago, IL, United States of America, john.birge@chicagobooth.edu, Zhen Liu

We consider continuous control of insulin for diabetic patients to minimize cumulative deviations of blood glucose levels from a basal target level. We extend a model of plasma glucose concentration levels to include random responses as well as lagged and noisy observations from a monitoring device. We will discuss alternative solution methods and will provide preliminary computational results.

4 - Optimization under Uncertainty in Biodiesel Production

Urmila Diwekar, President, Vishwamitra Research Institute, 368 56-th Street, Clarendon Hills, IL, 60514, United States of America, urmila@vri-custom.org, Sheraz Abbasi, Juan Salazar

Uncertainties are inherent in biofuel production. In this paper, we present an optimization study in the face of feedstock variability/uncertainty.

■ WD22

C - Room 212A

Nonlinear Optimization: Theory and Applications

Contributed Session

Chair: Yu-Ching Lee, University of Illinois at Urbana-Champaign, 104 S. Mathews Avenue,, Urbana, IL, 61801, United States of America, ylee77@illinois.edu

1 - Complexity of Unconstrained L2-Lp Minimization

Dongdong Ge, Shanghai Jiao Tong University, 535 Fahua Zhen Road, Shanghai, 200052, China, dongdong@gmail.com, Yinye Ye, Zizhuo Wang, Xiaojun Chen

We consider the unconstrained L2-Lp minimization: find a minimizer of |Ax-b|^2+c|x|^p for given matrix A and vector b, and positive parameters c,p. We show that the Lq-Lp minimization problem is strongly NP-hard. We also show that, by choosing parameters carefully, a minimizer, global or local, will have certain desired sparsity. We believe that these results provide new theoretical insights to the studies and applications of the concave regularized optimization problems.

2 - Minty Variational Principle for Set-valued Variational Inequalities

Giovanni Crespi, Associate Professor, University of Valle d'Aosta, Loc. Grand Chemin 73/75, Saint-Christophe, 11020, Italy, g.crespi@univda.it, Matteo Rocca, Ivan Ginchev

It is well known that a solution of a Minty scalar variational inequality of differential type is a solution of the related optimization problem, under lower semicontinuity assumption. This relation is known as "Minty variational principle". In this presentation we study this principle in the vector case for an arbitrary ordering cone and a non differentiable objective function. Further, we extend the Minty variational principle to set-valued variational inequalities.

3 - Implementing Advanced Algorithms in AIMMS

Marcel Hunting, Paragon Decision Technology, Schipholweg 1, Haarlem, 2034 LS, Netherlands, marcel.hunting@aimms.com

The GMP library, introduced in AIMMS 3.5 for building advanced algorithms, has steadily grown over the past years. We show some examples including multi-start and the Quesada-Grossmann algorithm for convex MINLP which has been implemented using only GMP functions and CPLEX callback procedures.

4 - Natural Gas Bilevel Cash-Out Problem: Convergence of a Penalty Function Method

Gerardo Perez Valdes, Postdoctor, Norwegian University of Science and Technology, Sentralbygg I, Alfred Getz veg 3, Trondheim, Norway, gerardo.valdes@iot.ntnu.no, Vyacheslav Kalashnikov, Natalya Kalashnikova, Stephan Dempe

Natural gas pipeline systems present interesting hierarchical settings between the shippers and the pipeline operators. In this work, we have modeled the contending actors in a bi-level linear optimization which is solved by means of an inexact penalization approach, with the lower level modeled as a variational inequality. The convergence of such approach is demonstrated and results regarding its computational implementation are presented and discussed.

5 - On Bi-level Support Vector Machine Parameters Selection Problem

Yu-Ching Lee, University of Illinois at Urbana-Champaign, 104 S. Mathews Avenue,, Urbana, IL, 61801, United States of America, ylee77@illinois.edu, Jong-Shi Pang

Support vector machine is a robust classification/regression method often used in machine learning or data mining. Two design parameters, the insensitive tube size and the weight to error trading off the normed support vector, are selected by users to gain a better performance. The parameters selection procedure can be formulated as a bi-level optimization problem, which is NP-hard. Our work on solving problem with hundreds of data points will be presented and compared with several approaches.

■ WD23

C - Room 212B

Topics in Disaster and Emergency Management

Contributed Session

Chair: Diana Prieto, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, dprieto@mail.usf.edu

1 - Modeling of Critical Infrastructure Interdependency with the Smart Power Grid Subject to Severe Emergency

Pravin Chopade, Research Associate (Ph.D. Student), North Carolina A& T State University, Greensboro, NC, USA, Computational Science and Engineering, 301 Fort IRC Building,1601East Market st, Greensboro, NC, 27411, United States of America, pravinvchopade@gmail.com, Dr. Marwan Bikdash

This paper reports one such prospect brought by the topological analysis of the blackout. By examining the cascading events of the blackout, the paper explores the clues to the inherent relationship between the observed topological property of the Smart power grid and the cascading outages experienced in the grid. We had developed network-flow and graph-theoretic measures that can be used to assess vulnerability.

2 - Non-pharmaceutical Interventions for Pandemic Influenza

Dayna Lee Martinez, University of South Florida, Tampa, FL, United States of America, dlmartin@mail.usf.edu, Tapas Das

Non-pharmaceutical interventions (quarantine, closures) have been shown to reduce infection attack rates and delay the spread in selected pandemic influenza outbreak outbreak scenarios. We investigate the nature of interactions among some of the key intervention parameters, such as initiation thresholds, intervention duration, and compliance levels, and the levels of virus transmissibility.

3 - Real-time Data Collection Strategies for Epidemiological Characterization of Pandemic Outbreaks

Diana Prieto, University of South Florida, 4202 E. Fowler Avenue, ENB 118, Tampa, FL, 33620, United States of America, dprieto@mail.usf.edu, Alfredo Santana, Sharad Malavade, Tapas Das

State Public Health Laboratories (PHLs) determine the strain of circulating viruses in the US. Specimens are generally collected from the sentinel healthcare providers for routine surveillance. However, during the recent H1N1 pandemic, the PHLs also received specimens from non-sentinels. The PHLs tested all the specimens received, extending the desired testing timeline. Using simulation and Bayesian estimation, we suggest strategies for better specimen collection and processing.

■ WD24

C - Room 213A

Topics in Bilevel Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: J. Cole Smith, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, j.cole.smith@gmail.com

1 - Computational Experience Solving Bilevel Integer Programs

Ted Ralphs, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, United States of America, ted@lehigh.edu, Menal Guzelsoy, Scott DeNegre

In this talk, we discuss the MibS framework for solving integer bilevel programs. We first describe the theoretical foundations of the solver then the details of our implementation. Finally, we review computational results on several classes of problems, including generic bilevel integer programs.

2 - Optimizing Exclusivity Agreements in a Three-State Procurement Game

Mike Prince, Graduate Assistant, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, mikeprince4@ufl.edu, J. Cole Smith, Joseph Geunes

We consider a procurement game in which firms compete for limited capacity at multiple suppliers, and one firm can purchase exclusivity rights from any of the suppliers. The resulting formulation is a three-stage MIP that, depending on the follower's goals, may contain an embedded bilevel program. We apply duality techniques to reduce the number of stages, and propose cutting plane algorithms to solve the resulting problems.

3 - Mixed Integer Bilevel Programming Model and Algorithm for a Competitive Product Introduction Problem

Soheil Hemmati, University of Florida, P.O. Box 210020, Gainesville, FL, 32611, United States of America, soheilmn@ufl.edu, J. Cole Smith

Mixed Integer Bilevel Programming (MIBLP) problems arise in the context of non-cooperative games, where each player aims to optimize his own objective, and in particular when "Yes-No" decisions are to be made. We develop an MIBLP model for a setting in which two players aim to maximize their own profit by deciding on the products to be introduced to multiple market segments with different preference lists. We also examine the efficacy of a cutting plane algorithm tailored for the problem.

4 - The SAA Method with Heuristics and Lower Bounds with an Application to the SConFL Problem

S. Raghavan, Smith School of Business, University of Maryland, College Park, MD, 20742, United States of America, raghavan@umd.edu, M. Gisela Bardossy

We consider the Connected Facility Location (ConFL) problem where there are uncertain and independently-activated assignment costs. For circumstances where the number of scenarios growth exponentially and the underlying problem is NP-complete, we propose a sample average approximation strategy yet use a heuristic and lower bounding procedure to solve the sample average problems and construct a confidence interval on the total cost of the stochastic optimal solution.

■ WD25

C - Room 213BC

New Topics in Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Jeannette Song, Professor, Duke University, Fuqua School of Business, Durham, NC, 27708, United States of America, jingsheng.song@duke.edu

1 - Project-Based Supply Chains with Uncertain Demand Timing and Changing Technological Requirements

Hugo Mora, Stanford University, 475 Via Ortega, Stanford, 94305, United States of America, hrmora@stanford.edu, Hau Lee, Carlos Amaro, Warren Hausman

We analyze the incentive conflict between a manufacturer and a subassembly supplier in a project-based supply chain when the buyer considers a possible change in the subassembly requirements. The supplier faces rework/holding costs if subassembly production is early and a change is made, but the manufacturer is exposed to late penalty fees if production is delayed. We design coordinating profit-sharing contracts under asymmetric information regarding both order forecast and rework/holding costs.

2 - Is More, Less? The Impact of Inventory on Sales Among Auto Dealers

Gerard Cachon, Fred R. Sullivan Professor of Operations and Information Management, The Wharton School, 500 Huntsman Hall, 3730 Walnut Street, Philadelphia, PA, 19104, United States of America, cachon@wharton.upenn.edu, Marcelo Olivares, Santiago Gallino

Auto dealers often want more inventory, presumably because more inventory will lead to higher sales. We test this hypothesis using detailed data of inventory holdings of individual General Motor dealerships in seven states over a 6 month period. We use a novel set of instruments - adverse weather at production facilities - to overcome several endogeneity concerns. We find that increasing inventory, while holding offered variety constant, lowers sales but expanding variety increases sales.

3 - In Search of the Perfectly Coordinated Supply Chain: Shared Supply Surplus

Fang Liu, Duke University, 100 Fuqua Drive, No, 27708, United States of America, fang.liu2@duke.edu, Jeannette Song, Tracy Lewis

N-1 retailers contract with one manufacturer for product supply over T periods. The N members each make private investments to utilize the production capacity. Prior to each period, the retailers and manufacturer privately observe the demand and supply conditions and negotiate a quantity and a delivery price. This paper characterizes the set of private investments and capacity allocations that is self supporting and voluntary under unpredictable and unverifiable market conditions.

■ WD26

C - Room 213D

Topics in Outsourcing

Contributed Session

Chair: Toby Lehman, Research Scientist, IBM Almaden Research Center, 650 Harry Road, Mailstop D3-248, San Jose, CA, 95120, United States of America, toby@almaden.ibm.com

1 - Make or Buy: A Different Story

Zhaoqiong Qin, North Carolina Agricultural and Technical State University, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, zqin@ncat.edu

Conventional wisdom says that outsourcing occurs when firms procure the products from upstream suppliers with lower production costs. In this paper, we investigate the effect of outsourcing when one of two competing firms can either outsource the products from the same supplier as the other one or produce the products himself. The results show that the firm can still benefit from outsourcing even if his production cost is lower than the outsourcing cost. We draw the managerial implications.

2 - The Optimal Offshore Outsoucing Strategy in the Presence of Technological Spillover

Yan Zhang, Doctor Candidate, Xiían Jiaotong University, No.28, Xianning West Road, 2341 Box, Xiían, 710049, China, mzb-7881630@163.com, Qin Su

Supposed the outsourcing supplier located in a less developed country with lower wage and technology is also the direct competitor of the buyer,we offer a dynamic game framework and analyze the optimal outsourcing strategy for the buyer. The result shows that outsourcing is optimal for the buyer only if the marginal cost gap between the two sides of outsourcing is greater than a threshold, which is affected by the product substitution, brand equity and the supplier's absorption capacity.

3 - Cost Estimation for Outsourcing of Business Process Services

Toby Lehman, Research Scientist, IBM Almaden Research Center, 650 Harry Road, Mailstop D3-248, San Jose, CA, 95120, United States of America, toby@almaden.ibm.com, Wesley Humphrey

A service provider for business process outsourcing is challenged to estimate the cost of providing service to a prospective client. The targeted precision and the decisions made in the process can vary greatly depending on the variability and reliability of information about the service to be provided. We present a framework that accounts for different types of decisions made in cost estimating, which are based on the nature of the information available to the cost modeler.

■ WD27

C - Room 214

Consumer Behavior in Operations and Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Robert Swinney, Assistant Professor, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, swinney@stanford.edu

1 - Demand Learning and Pricing Strategy with Strategic Consumers
Fuqiang Zhang, Professor, Washington University in St. Louis, Operations & Manufacturing Management, St. Louis, MO, United States of America, FZhang22@wustl.edu, Mike Wei, Yossi Aviv

This paper studies the pricing strategy of a seller who sells a fixed amount of inventory to strategic consumers. The seller learns about the demand through early sales and may adjust price using the demand information. We compare three different pricing strategies for the seller and investigate the impact of demand learning under the presence of strategic consumers.

2 - Selling to Conspicuous Consumers: Pricing, Production and Sourcing Decisions
Necati Tereyagoglu, Doctoral Candidate, The Wharton School, 3730 Walnut Street, Suite 500, Jon M Huntsman Hall, Philadelphia, PA, 19104, United States of America, necati@wharton.upenn.edu, Senthil Veeraraghavan

We model the value of stockouts for products which are consumed conspicuously in a market with uncertain demand and strategic customers. We show that, in equilibrium, firms may offer high availability of goods despite the presence of conspicuous consumption. We show that scarcity strategies are harder to adopt as demand variability increases, and we provide conditions under which scarcity strategies may be successfully adopted to improve profits.

3 - Strategic Bidders Club: Implications for Consumer Learning
Yuri Levin, Queen's University, Goodes Hall, Kingston, ON, Canada, YLevin@business.queensu.ca, Mikhail Nediak, Jeff McGill, Tatsiana Levina

We develop a model of strategic consumer learning of bidding strategies in a market for opaque products, obtain the optimal strategies for the consumers, and study their properties. The effects of consumer cooperation on learning are examined and compared under the following scenarios: exchange of information only, exchange of information with coordinated bidding, and coordinated bidding with risk pooling in the form of outcome-contingent payment scheme.

4 - Strategic Customer Behavior and its Impact on Revenue Management Strategies
Serguei Netessine, Professor, INSEAD, Boulevard De Constance, Fontainebleau, 77300, France, serguei.netessine@insead.edu, Jun Li

We investigate the existence and scale of strategic (forward-looking) consumers using a unique click-stream dataset. We study the timing of consumers' search, view, and purchase decisions, and the effect of availability on these decisions. Finally, we examine the revenue impacts of such behaviors, and the interaction between intermediary's recommendation strategy and hotels' revenue management strategy.

■ WD28

C - Room 215

Emergency Medical Service Systems

Sponsor: Manufacturing & Service Oper Mgmt/ Service Management SIG

Sponsored Session

Chair: Maria Mayorga, Clemson University, Clemson, SC, United States of America, mayorga@clemson.edu

1 - Integrated Dispatching and Districting Policies for EMS Vehicles
Maria Mayorga, Clemson University, Clemson, SC, United States of America, mayorga@clemson.edu, Damitha Bandara

Districting allows an EMS system to reduce the response time of paramedic support to the incident. Furthermore, dispatching policies affect system performance. Therefore, we provide integrated districting-dispatching policies. Several objective functions are considered. An integer programming formulation is used to determine the response area for each unit and a heuristic is used to dispatch units within a service area. Simulation is used to determine the overall performance of the system.

2 - Bounding the Performance of Ambulance Redeployment Policies
Shane Henderson, Professor, Cornell University, School of ORIE, 230 Rhodes Hall, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu, Huseyin Topaloglu, Matthew Maxwell

Ambulance redeployment, AKA system status management, is a method for real-time control of an ambulance fleet. The goal is to reduce the fraction of calls with response times that are outside some time threshold. We present a lower bound on this quantity for all policies and compare it's value to the performance of some policies.

3 - Reformulating the Maximum Available Location Problem: A Case Study on Charlotte Mecklenburg
Hari Rajagopalan, Associate Professor, Francis Marion University, School of Business, Florence, SC, 29501, United States of America, HRajagopalan@fmarion.edu, Elizabeth Sharer, Cem Saydam, Sanjay Mayadunne

In this paper we show that the maximum availability location problem (MALP) can be reformulated with fewer variables and constraints. Our computational experiments demonstrate that the reformulated MALP (rMALP) solves much faster and also lends itself to more efficient heuristic development. Data from Charlotte Mecklenburg is used here.

■ WD30

C - Room 216B

Information in the Supply Chain I

Contributed Session

Neda Khanjari, Northwestern University, 2145 Sheridan Road Room, Evanston IL 60208, United States of America, neda@u.northwestern.edu

1 - The Value of Information Sharing in a Supply Chain
Shubin Xu, Ph.D. Candidate, Lundquist College of Business, 1208 University of Oregon, Eugene, OR, 97403, United States of America, sxu@uoregon.edu, Yue Fang

We study information sharing in a supply chain with a nonlinear demand model that is able to capture more complex patterns in the demand process. We consider various scenarios with respect to the information structure and show that under certain conditions, the value of information sharing is substantial.

2 - The Impact of Partial Information Sharing in a Two-echelon Supply Chain
Matan Shnaiderman, Bar-Ilan University, ., Ramat-Gan, 52900, Israel, Matan.Shniderman@biu.ac.il, Fouad El Ouardighi

We consider a two-echelon supply chain in which during every period each side gathers information concerning future demand. While the literature is saturated with studies of either no or full information sharing, partial levels of sharing exist and have the potential to reduce costs. Each party informs the other party not necessarily of the exact value of his own component of demand, but an interval in which this value lies. We analyze how several levels of information sharing can reduce costs.

3 - Trust and Information Sharing in Supply Chains
Neda Khanjari, Northwestern University, 2145 Sheridan Road Room, Evanston, IL, 60208, United States of America, neda@u.northwestern.edu, Seyed Iravani, Wallace Hopp

We construct a multi-period model with which to examine the role of trust and other social characteristics in a supply chain. Specifically, we focus on trust building in the context of a wholesale salesperson who acts as a representative of a manufacturer and shares demand forecast information with a retailer. We find that salespersons tend to be trusted in long relationships, provided their forecasting accuracy is higher than that of the retailer.

4 - The Impact of the Sales-agent's Efficiency and Demand Information on a Supply Chain
Neda Khanjari, Northwestern University, 2145 Sheridan Road Room, Evanston, IL 60208, United States of America, neda@u.northwestern.edu, Seyed Iravani, Hyoduk Shin

We study the impact of a manufacturer-hired salesperson who promotes consumer demand in a supply chain with one manufacturer and one retailer. We study the effect of the superior demand information of the downstream parties and efficiency of the sales-agent on supply chain profits. We show that the retailer sometimes prefers less efficient sales-agents and his profit can be decreasing in the accuracy of his demand forecast.

■ WD31

C - Room 217A

Partnering with Providers for Practical Implementation

Sponsor: Health Applications

Sponsored Session

Chair: Linda LaGanga, Director of Quality Systems, Mental Health Center of Denver, 4141 East Dickenson Place, Denver, CO, 80222, United States of America, Linda.Laganga@MHCD.org

1 - Operations Management Applications in an Orthopaedic Center

Sanjeev Bordoloi, Associate Professor, University of St. Thomas, 1000 LaSalle Avenue, TMH 443, Minneapolis, MN, 55403, United States of America, sbordoloi@stthomas.edu, David Fischer

Healthcare professionals are increasingly finding the value of Operations Management tools in healthcare practices and starting to partner with academic institutions for operational improvements in clinics. This paper discusses the efforts on an ongoing partnership between academia and an Orthopaedic clinic towards lean applications and productivity improvements.

2 - Utilizing On-call Providers for Optimal Staff Scheduling for Emergency Rooms

Subhamoy Ganguly, University of Colorado at Boulder, 419 UCB, Boulder, CO, 80309, United States of America, Subhamoy.Ganguly@Colorado.edu, Stephen Lawrence

We develop an integer-programming model to provide an effective staffing schedule for emergency rooms, which includes the option of having providers on call. Historical data are used to aggregate patient demand into discrete time buckets and model the stochastic distribution of patient demand within these buckets. This reduces the complexity of the problem without significantly reducing model fidelity. Our model balances staffing costs and service levels, and facilitates sensitivity analysis.

3 - A Simulation Optimization Approach for Data-Driven Clinic Design in the Presence of No-Shows

Michele Samorani, Leeds School of Business, University of Colorado at Boulder, UCB 419, Boulder, CO, 80309, United States of America, michael.samorani@colorado.edu, Linda LaGanga

Given the data of a clinic with a high no-show rate, we aim at finding the appointment scheduling system that maximizes patient access and minimizes clinic overtime and patient waiting time. Our simulation optimization approach finds the best policy to adopt, by determining 1) if data mining should be used to predict whether the patients show, 2) what is the maximum allowed time gap between the visit request and the visit itself, 3) whether to overbook or not and, if so, how many slots to use.

4 - The Landscape of Healthcare: Empirical Models

CJ McKinney, Mental Health Center of Denver, Denver, CO, christopher.mckinney@mhcd.org, Linda LaGanga

Healthcare is delivered in a landscape where resources are allocated along a service continuum that includes the dimensions of delivery setting (inpatient and outpatient) and focus (physical and behavioral health). Effective outpatient care can reduce overall healthcare expenses and improve quality for patients. Emerging models of integrated care consider the interaction between behavioral and physical health and the achievement of high quality outcomes in the context of accountable care.

5 - Operational and Electronic Innovations in a Community Mental Health Center

Linda LaGanga, Director of Quality Systems, Mental Health Center of Denver, 4141 East Dickenson Place, Denver, CO, 80222, United States of America, Linda.Laganga@MHCD.org, Wes Williams, Craig Iverson

We utilize and integrate our electronic medical record into key workflow processes. This provides performance measures for our lean process improvement projects, and guides clinical and administrative workflow. We present selected projects that demonstrate capacity expansion, improved quality of care, and error reduction leading to revenue maximization, and discuss issues related to implementation and employee involvement.

■ WD33

C - Room 217D

Advances in Reliability and Risk Analysis

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Refik Soyer, Professor, George Washington University, Department of Decision Sciences, Washington D.C., 20052, United States of America, soyer@gwu.edu

1 - Generalized Diagonal Band Copulas with Two-Sided Generating Densities

Johan Rene van Dorp, Professor, The George Washington University, 1776 G Street, NW, Suite 101, Washington, DC, 20052, United States of America, dorpjr@gwu.edu

In this presentation we shall study a sub-family of generalized diagonal band (GDB) copulas, separately introduced by Ferguson (1995) and Bojarski (2001). Similar to Archimedean copulas, GDB copulas construction require a generator function. Bojarski's GDB copula generator functions are symmetric probability density functions. In this talk, members of a symmetric two-sided framework of distributions introduced by Van Dorp and Kotz (2003) shall be considered.

2 - A Bayesian Approach for Reliability Growth for Multistage Systems

Thomas Mazzuchi, Professor, George Washington University, 1776 G St. NW, Washington DC, DC, 20052, United States of America, mazzu@gwu.edu

This paper looks at continuing the application of reliability growth models throughout the life of a single shot system using a multi-stage model together with Bayesian inference to offset the problem of small sample test information. The paper examines how the availability of continuously updated reliability predictions can support programmatic decisions throughout a system's life cycle removing decision maker's dependence on estimates formed at the initiation of the program.

3 - Importance of Components for a System

Ehsan Soofi, Professor, University of Wisconsin-Milwaukee, Lubar School of Business, P.O. Box 742, Milwaukee, WI, 53201, United States of America, esoofi@uwm.edu, Nader Ebrahimi, Refik Soyer

We introduce measures of importance of components for a system. The importance is defined by the extent to which the state or life length of a system depends on the states or life lengths of its components. The dependence is measured by an information function that quantifies the expected utility of a variable for predicting another variable. We give measures of importance for the series, parallel, k-out-of n, and cold redundancy systems in terms of mission reliability and life lengths.

4 - When is Failure Preferable to Survival ?

Refik Soyer, Professor, George Washington University, Department of Decision Sciences, Washington D.C., 20052, United States of America, soyer@gwu.edu, Ehsan Soofi, Nader Ebrahimi

During the conduct of a life test, do we want to observe more failures or more survivals? Intuitively speaking, because of the definitiveness of failures,the answer seems to be the former. However, it has been shown that this is not always true and the answer depends on the particular parameter of interest. We show that the existing findings can be generalized and address the question when interest centers around prediction.

■ WD34

C - Room 218A

Joint Session HAS/Homeland Security: Modeling Radiological Events

Sponsor: Health Applications/Homeland Security- Emergency Prep

Sponsored Session

Chair: Eva Lee, Professor & Director, Georgia Insitute of Technology, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

1 - Radiological Preparedness and Population Screening

Eva Lee, Professor & Director, Georgia Insitute of Technology, Atlanta, GA, 30332, United States of America, eva.lee@gatech.edu

This work began in 2006 with the Radiation Study Branch at CDC. The work focuses on radiological emergency response that is critical for radiological/nuclear terrorism incidents or from natural disasters. Key elements involve immediate medical treatment, decontamination, evacuation, sheltering and population screening and monitoring, along with food/water supply. We will present some of our scientific efforts in this area and describe our participation in the Japan Fukishima events.

2 - Modeling and Simulation of Radiation/Nuclear Screening of Small Vessels at U.S. Maritime Ports

George Muller, Pacific Northwest National Laboratory, 902 Battelle Blvd, P.O. Box 999, MSIN K7-20, Richland, WA, 99352, United States of America, george.muller@pnnl.gov, Robert Brigantic

The Domestic Nuclear Detection Office (DNDO) was established to improve the Nation's capability to detect the illegal import of radiological or nuclear (R/N) materials. One focus area is conducting R/N screening of small vessels under surge operations in the maritime environment. This presentation reviews a stochastic, discrete event simulation developed for this purpose and how this information is used to derive resource and cost estimates for establishing capabilities at U.S. maritime ports.

3 - Organizational and Behavioral Factors in Public Preparedness for Radiological Emergencies

Shital Thekdi, Ph.D. Candidate, University of Virginia, 817 Catalpa Ct., Charlottesville, VA, 22903, United States of America, st4dw@virginia.edu, Tom Guterbock, Janet Clements, Jim Lambert

This talk describes: (i) Interagency coordination in radiological emergencies for Rio de Janeiro, Brazil, and (ii) Population behaviors in highway performance of the National Capital Region (NCR) in dirty bomb attacks. The methods are cognitive task analysis for responder agencies, a survey of 2700 citizens, travel modeling based on the origins and destinations of evacuees, and a virtual-reality simulation marketing preparedness resources to the public.

■ WD39

H - Morehead Boardroom -3rd Floor

E-Business

Contributed Session

Chair: Rajorshi Sen Gupta, Graduate Fellow, Texas A&M University, 2124 TAMU, College Station, TX, 77843, United States of America, rajorshi@tamu.edu

1 - A Practical Method of Building Trusted Online Drug Transaction Environment in China

Xiao Yu, Ph.D candidate, School of Information Science and Technology, Tsinghua University, Main Building 611, Beijing, 100084, China, xux03@mails.tsinghua.edu.cn, Yueting Chai, Yi Liu

Purchasing drugs online becomes a trend in China, however is still risky for ordinary people. E-commerce has offered opportunists and lawbreakers a new way to escape government regulation, resulting in the adverse selection effect. We've implemented a pilot project cooperated with State Food and Drug Administration of China, in which we've designed and developed three public infrastructure e-services: Identity Authentication Service, Product Information Service and Electronic Contracts Service.

2 - Wet Marketing on Micro-blog Based on the 4R Theory

Lifang Peng, Professor, Xiamen University, Management School, Xiamen, China, lfpeng@xmu.edu.cn, Yang Xu

With its rapid growth, the popular social network platform micro-blog engenders a new way of marketing called wet marketing. To explore how to do marketing on it, this paper first analyzes the differences between micro-blog marketing and other network marketing ways and conduct a SWOT analysis on it. According to the anlysis, it discusses the significances and applications of 4R marketing theory on micro-blog marketing. Finally, we make a case study on Chang an Ford to verify our discussion.

3 - Competing Across Different Channels: The Case of Online Fitness Service

Lei Wang, University of Connecticut, OPIM Department, Storrs, CT, 06269, United States of America, lei.wang@business.uconn.edu

Instead of traditional channels, more and more firms adopt web channel to deliver their services. In this paper, we develop a two-period model to examine the impact of asymmetric switching cost and customer heterogeneity on the competition between an online fitness service provider and a brick-and-mortar fitness club which are both forward looking. Our results show that, under different switching cost and marginal cost conditions, there exist dominant pricing strategies for both firms.

4 - TransfORming towards Paperless Billing: Incentive Payments or Green Fees?

Rajorshi Sen Gupta, Graduate Fellow, Texas A&M University, 2124 TAMU, College Station, TX, 77843, United States of America, rajorshi@tamu.edu, Mark Musumba

Companies are trying to transfORm their operations in favor of sustainable paperless alternatives. Electronic billing leads to reduced operating costs for companies, offers convenience to customers and is environmentally benign. Despite various kinds of Incentive Payments offered by the companies their customers have been reluctant to go paperless. We analyze the challenges with current programs and propose a Green Fee on customers that could be more efficient than incentive rewards.

■ WD41

H - Waring Room - 4th Floor

Topics in Strategy

Contributed Session

Chair: Andrea Masini, HEC Paris, 1 Rue de la Liberation, Jouy en Josas, France, masini@hec.fr

1 - The Prescriptive Space of Procedural Rationality in Top Management Team Decision Making

Michael Wittland, research associate, University of Cologne, Albertus-Magnus-Platz, Cologne, 50923, Germany, wittland@wiso.uni-koeln.de, Ludwig Kuntz

What makes a decision a good decision? Bringing together the prescriptive theory of group decisions with multiple criteria and TMT-research, we deduce that high levels of goal congruence, willingness to compromise and equally distributed power increase procedural rationality via communication and cohesion. Mediation analysis of data of 70 TMTs of German hospitals supports our theory.

2 - Optimization Model to Maximize the Recovery Factor in Mature Oil Fields: Mexico Case

Lorena Berumen, Professor, Universidad Panamericana, Augusto Rodin 498, Col. Insurgentes Mixcoac, México, D.F., 03920, Mexico, laberumen@up.edu.mx, Irma Glinz, Margarita Hurtado

Improving the recovery factor of conventional oil resources will play a decisive role in offsetting the inevitable decline of oilfields. Even as new discoveries are developed and produced, substantial additional reserves can be secured by enhancing recovery. Consequently, mature fields require a strategy to maximize the expected value of the recovery factor under limited budget conditions.

3 - A Study on Features and Current Status of Diversified Enterprises in Korea

Hyun Kyung Kim, Dr., Statistical Research Institute, Statistics Korea, Daejeon Narakeyum 282-1, Wolpyeong-dong, Seo-gu, Daejeon, 302280, Korea, Republic of, khk144@korea.kr

This research investigates the diversification of Korean enterprises using the "Census on Enterprise Activity" data constructed by Statistics Korea. The empirical results indicate that most Korean enterprises are adding to the ever-increasing diversification on the whole. Also, the characteristics of an enterprise, including industrial classification, the number of employees, total sales, and the location, have a statistically significant impact on the degree of its diversification.

4 - Revisiting the Link between IT Governance and Operations Strategy: An Empirical Investigation

Andrea Masini, HEC Paris, 1 Rue de la Liberation, Jouy en Josas, France, masini@hec.fr, Marco Perona, Alessandro Sicco

We develop and empirically test a model that sheds further light on the nexus between IT governance, operations strategy and organizational performance. The results suggest that companies with more skilled IT departments adopt more focused operations strategies. The analysis also indicates when these firms enjoy better performance compared to firms with weaker IT governance and calls for a better coordination between the IT and Operations functions.

■ WD42

H - Gwynn Room - 4th Floor

Information Security and Risk Management

Sponsor: Information Systems Society

Sponsored Session

Chair: Jackie Rees, Associate Professor of Management, Purdue University, 100 South Grant Street, West Lafayette, IN, 47907, United States of America, jrees@purdue.edu

1 - Risk Mitigation Decisions for IT Security

Lisa Yeo, University of Alberta, 2-24 Business Building, University of Alberta, Edmonton, AB, T6G 2R6, Canada, myeo@ualberta.ca, Erik Rolland, Jackie Rees, Ray Patterson

Enterprises must manage their information risk as part of their larger operational risk management program. Using organizational workflows to examine control placement as part of an information risk management program, we are able to construct optimal control implementation solutions, achieving a guaranteed level of information security assurance. We compare our solution to results from different heuristics under different loss scenarios.

2 - Fraud and Social Networks
Erik Rolland, Professor, University of California-Riverside, Department of Accounting and IS, Graduate School of Management, Riverside, CA, United States of America, erik.rolland@ucr.edu, Dmitry Zhdanov, Ram Gopal, Ray Patterson

We investigate the impact of social networks on fraud detection. We utilize mathematical programming to abstract the problem of fraud detection, and show its equivalence to a well known NP-complete problem. We demonstrate the methodology by using an actual fraud case, and discuss and analyze potential paths to finding the "correct" set of perpetrators that logically explains how the fraud was committed.

■ WD43

H - Suite 402 - 4th Floor

Mixed-integer Programming Problems in the Power Grid

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Daniel Bienstock, Columbia University, 342 S. W. Mudd Building, 500 W. 120th Street, New York, NY, 10027, United States of America, dano@columbia.edu

1 - Designing Electric Power Grids to Minimize Cascading Blackouts
Jeff Linderoth, University of Wisconsin-Madison, Department of Industrial and Systems Engineering, & Department of Computer Sciences, 1513 University Avenue, 3226 Mechanical Engineering Bldg., Madison, WI, 53706-1572, linderoth@wisc.edu, Eric Anderson, Daniel Bienstock

If an exogenous event impacts the operating characteristics of an electric power grid, power flows reroute themselves according to the laws of physics. The re-routed flows may cause lines to become overloaded, setting off stages of additional line failures, resulting in a cascading blackout. We discuss a optimization-based approaches for designing power grids to minimize the impact of cascades caused by line outages.

2 - AC Optimal Transmission Switching
Thomas Dautel, Economist, Federal Energy Regulatory Commission, 888 1st St NE, Washington, DC, 20426, United States of America, Thomas.Dautel@ferc.gov, Richard O'Neill

When solving the AC optimal transmission switching problem, switches at both ends of each transmission line must be considered in order to achieve all potential benefits. We present a problem formulation and data on small cases, and discuss some potential benefits and concerns associated with the AC optimal transmission switching problem.

3 - Probabilistic Distance to Failures in Power Grids
Michael Chertkov, Theory Division & Center for Nonlinear Studies at LANL, Los Alamos, NM, United States of America, m.chertkov@gmail.com

In this talk we review recent work at Los Alamos on algorithms and analysis of probabilistic measure of failures in power grids associated with fluctuations of distributed consumption/generation and exogenous changes in the grid topology.

■ WD44

H - Suite 406 - 4th Floor

Energy

Contributed Session

Chair: Raza Rafique, PhD Student, Rutgers Business School, 123 Sussex Street, Harrison, NJ, 07029, United States of America, rrafique@pegasus.rutgers.edu

1 - A Multiple Period Stochastic Coal Transportation and Inventory Model
Serkan Gunpinar, Doctoral Student, Industrial and Management Systems Engineering, University of South Florida, Tampa, FL, 33620, United States of America, sgunpina@mail.usf.edu, Long Zhao, Bo Zeng

Coal is one of the most important fuels in US energy industry where most coal is delivered by rail and barge. As coal demand is determined by electricity demand, which is very random, we build a multiple stage stochastic programming model to deal with coal transportation and inventory issue. Progressive hedging algorithm is applied and computational results will be presented.

2 - Research on Benefit Sharing of Energy Service Contracting Project Based on Bargaining Game Theory
Dong Qian, School of Management, Xi'an Jiaotong University, Box 2230, Xi'an Jiaotong University, XI'AN, China, qd.2009@stu.xjtu.edu.cn, Jie Xiong, Jue Guo

This paper develops a bargaining model to analyze the benefit sharing between ESCO and the energy using organization in energy service contracts with shared savings structure and provide the equilibrium strategies under three situations. We also discuss the effects of parameters in the benefit function on the benefit sharing.

■ WD45

H - Suite 407 - 4th Floor

Statistics and Quality Control I

Contributed Session

Chair: Shilpa Shinde, Arizona State University, 1249 E. Spence Avenue Apt# 238, Tempe, AZ, 85281, United States of America, shilpa.shinde@asu.edu

1 - A Synthesis of Feedback and Feedforward Control for Stationary and Nonstationary Disturbance Models
Lihui Shi, PhD candidate, University of Washington, Industrial and Systems Engineering, University of Washington, Seattle, WA, 98105, United States of America, shilihui@uw.edu, Kailash Kapur

Feedforward control strategy is applied to combine with feedback control for process adjustment to maintain the process on target value. A periodic variance shift disturbance model is proposed, with integrated moving average, autoregressive and autoregressive moving average as background disturbance models. We evaluate the performance of different control strategies for each disturbance model, by using the mean square error criterion. Sensitivity analysis and robustness analysis are conducted.

2 - An Adaptive Sequential Bayesian Methodology for Process Optimization
Adel Alaeddini, Post Doctorate Researcher, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109, United States of America, alaedini@umich.edu

We present an adaptive sequential Bayesian methodology for response surface optimization (ASBRSO) for industrial experiments with high experimentation cost, and sampling variability. The ASBRSO employs the information from the previous experiments to design the subsequent experiment by simultaneously reducing the region of interest and identifying factor combinations for new experiments. Through extensive simulated experiments we examine the performance of the proposed method.

3 - Identifying the Time of a Step-Change in a Multivariate Process Mean
Gary Mercado, University of Alabama, Box 870226, Tuscaloosa, United States of America, grmercadovelasco@crimson.ua.edu, Marcus Perry

Knowing when a process has changed would simplify the search for and identification of the special cause. In this talk, we propose a kernel maximum likelihood estimator for the time of a step-change in a multivariate process mean when the observations are not required to follow a multivariate normal distribution. The results show that the estimator provides process engineers with an accurate and useful estimate of the actual time of the change in the process mean.

4 - Analysis Methods for Non Regular Fractional Factorial Designs
Shilpa Shinde, Arizona State University, 1249 E Spence Avenue Apt# 238, Tempe, AZ, 85281, United States of America, shilpa.shinde@asu.edu, Bradley Jones, Douglas Montgomery

During the initial stages of experimentation, there are usually a large number of factors to be investigated. Fractional factorial (Regular and Non Regular) designs are particularly useful during this initial screening phase of experimental work. Stepwise regression is one of the most commonly used analysis methods to analyze these screening designs. This paper presents new methods based on stepwise regression which perform better than the standard stepwise regression method.

■ WD46

H - Suite 403 - 4th Floor

Behavioral Operations

Contributed Session

Chair: Wei Huang, Associate Professor, Huazhong University of Science & Technology, Department MS & IM, School of Management, WuHan, 430074, China, whuang@mail.hust.edu.cn

1 - Business Process Management for a Newsvendor

Adam Fleischhacker, Assistant Professor of Operations Management, University of Delaware, 222 Alfred Lerner Hall, Newark, DE, 19716, United States of America, ajf@udel.edu

Upon implementing a new quantitatively driven business process, one quickly discovers that human decision makers will systematically make sub-optimal decisions within that process. Thus, to truly solve the problems faced by practitioners, mathematical models are simply one component of the solution. Using a newsvendor application as motivation, we propose a business process management methodology to bridge the gap between models that seek optimality and models that are implementable.

2 - Supplier Capability Evaluation: Attribute Substitution and Capability Inference

David Hall, PhD Student, Clemson University, 101 Sirrine Hall, Clemson, SC, 29634, United States of America, davidcalebhall@gmail.com, Aleda Roth, M. Johnny Rungtusanatham

Supplier evaluation is an antecedent to supplier selection. Information asymmetry exists between the evaluator and potential supplier. The supplier has incentives to not share information. Nonetheless, the evaluator must judge the potential supplier's capabilities. We empirically examine how and what the evaluator judges supplier capabilities under these conditions.

3 - Inventory Control when Selling to Human Newsvendors

Jin Kyung Kwak, Cornell University, 201 Sage Hall, Ithaca, NY, 14853, United States of America, jkk37@cornell.edu, Yusen Xia, Young-Hoon Park, Srinagesh Gavirneni

We develop inventory control strategies for a supplier who sells a product to human newsvendors. Recent behavioral research revealed significant tendencies in the decision making processes of human newsvendors. If the supplier would incorporate these behavioral tendencies while managing her inventories, her costs would be significantly reduced. Using data from our own experiments, we estimate the possible reductions in supplier costs and determine the factors that significantly impact it.

4 - Credibility Analysis of Online Product Reviews Based on Elaboration Likelihood Model

Wei Huang, Associate Professor, Huazhong University of Science & Technology, Department MS & IM, School of Management, WuHan, 430074, China, whuang@mail.hust.edu.cn, HaiXia Cui, Shu Li

Our study analyzes the effecting factors and influence paths of credible online product reviews by using the elaboration-likelihood model. Firstly, we classifies influence mechanisms or routes into central and peripheral types based on the type of information processed by a reviewer. Secondly, we explains circumstances under which that users of online product reviews may be more influenced by a path. Our study can also help design the credibility evaluation model of online product reviews.

■ WD47

H - Dunn Room - 3rd Floor

Integrated Models for Supply Chain and Logistics Planning

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Aly Megahed, PhD Student, Research and Teaching Assistant, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, aly@gatech.edu

1 - A Comprehensive Tactical Supply Chain Planning Model Using Backorder Penalties

Aly Megahed, PhD Student, Research and Teaching Assistant, H. Milton Stewart School of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, aly@gatech.edu, Marc Goetschalckx

We present a comprehensive model for the tactical planning of multi-echelon, multi-commodity supply chains. The model includes production, transportation, inventory, and sourcing considerations as well as a fully recursive bill of materials for the products and backorder penalties for late deliveries. Numerical experience with solving this model for various cases including a real-world problem instance, is shared. The impact of various cost functions for the backorder penalties is illustrated.

2 - Metaheuristic Solution Algorithms for a Four-layer Location-routing Problem

Mohsen Hamidi, North Dakota State University, Industrial & Manufacturing Engineering, NDSU Department 2485, Fargo, ND, 58108-6050, United States of America, Mohsen.Hamidi@my.ndsu.edu, Kambiz Farahmand, S. Reza Sajjadi, Kendall Nygard

The location-routing problem (LRP) simultaneously considers location, allocation, and vehicle routing decisions to design optimal distribution networks. In this research, metaheuristic solution algorithms for solving a complex four-layer LRP are developed. The four-layer LRP represents a multi-product distribution network consisting of plants, central depots, regional depots, and customers. The LRP integrates location, allocation, vehicle routing, and transshipment problems.

3 - A Capacitated One Warehouse Multi-Retailer Lot-Sizing Problem

Burcu Keskin, University of Alabama, 361 Stadium Dr., Tuscaloosa, AL, 35406, United States of America, bkeskin@cba.ua.edu, John Mittenthal

In this paper, we study a capacitated lot sizing problem (CLSP) for a one warehouse multi-retailer system. Even though the CLSP has been studied in the production context, it has limited coverage in a distribution context. We present a formulation of this problem and investigate the structural properties of the optimal solution. We also develop mathematical programming-based and greedy heuristics. Numerical analysis demonstrates the effectiveness of the solutions in different settings.

4 - A Two-stage Stochastic Programming Model for Transportation Infrastructure Design and Retrofit

Shahrzad Azizzadeh, PhD Candidate, North Carolina State University, 346 Daniels Hall, Raleigh, NC, 27695, United States of America, sazizza@ncsu.edu, Ranji Ranjithan

Natural hazards often disrupt critical lifeline services supported by the transportation infrastructure. A two-stage stochastic programming model is presented to optimize system capacity and recourse decisions considering service demands and many failure scenarios. Two mixed-integer formulations are discussed and an L-shaped decomposition solution approach is presented.

■ WD48

H - Graham Room - 3rd Floor

Single-mode Freight Transportation

Contributed Session

Chair: Mona Kashiha, PhD Student, UNC Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, mkashiha@uncc.edu

1 - Application of Pickup and Delivery Problem in Air-cargo Routing with Alternative Access Airport

Farshid Azadian, PhD Candidate, Wayne State University, 4815 Fourth st, Detroit, MI, 48202, United States of America, f_azadian@wayne.edu, Alper Murat, Ratna Chinnam

This research provides a routing algorithm for handling customers order in a multiple airport region, benefiting from the alternative access airport policy. We introduce a mixed integer model for the problem and present the solution algorithm based on Lagrangian decomposition and successive sub-problem solving.

2 - Air-cargo Consolidation Problem with Pivot Weight

Zichao Li, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, z72li@uwaterloo.ca, James H. Bookbinder, Samir Elhedhli

In the international air cargo business, customers are charged in the following ways when they tender containers to the airline: if total weight is under the pivot weight, shipment is charged at the under-pivot rate; each kg above the pivot weight is charged at the over-pivot rate. We study the optimal air-cargo loading decision under the above pivot-weight scheme. We propose solution methodologies using local branching and heuristics.

3 - Cargo Prioritizatio for Inland Waterway Disruptions

Jingjing Tong, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, United States of America, tong@uark.edu, Heather Nachtmann

In an ongoing project "Supporting Secure and Resilient Inland Waterways" funded by Department of Homeland Security, we are developing a prototype decision support system to provide timely knowledge of what cargo should be prioritized for offloading and what infrastructure exhibits low resiliency in the event of a catastrophic disruption on the inland waterway transportation system. Our presentation focuses on the cargo prioritization factors that have been identified to support this research.

4 - Competition Space in Commodity Flows Bound for the United States

Mona Kashiha, PhD Student, UNC Charlotte, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, mkashiha@uncc.edu, Jean-Claude Thill

Examination of the structure and pattern of commodity flows is a major focus of transportation studies. This research provides geovisualization of a large spatial interaction dataset by combining decision tree techniques and social network concepts. Commodity flow data in this project is compiled from the PIERS database of waterborne import shipments to the United States.

■ WD49

H - Graves Room - 3rd Floor

Simulation Optimization

Sponsor: Simulation

Sponsored Session

Chair: Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, enluzhou@illinois.edu

1 - Simulation Optimization over Discrete Sets with Noisy Constraints

Eunji Lim, University of Miami, 281 McArthur Bldg, Coral Gables, FL, United States of America, lim@miami.edu, Yao Luo

We consider a simulation-based optimization problem where the decision variables are discrete and only noisy measurements of the objective and constraints are available. We propose a method that solves the dual of the original problem using a gradient-based approach. Numerical examples illustrate the effectiveness of the proposed method.

2 - On Interior-point Based Retrospective Approximation Methods for Solving Two-stage Stochastic Linear Programs

Raghu Pasupathy, Virginia Institute of Technology, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, pasupath@vt.edu, Soumyadip Ghosh

We present an interior-point based retrospective approximation framework for solving general two-stage stochastic linear programs. A sequence of convex approximations of the underlying problem are generated and solved with increasing accuracy. The resulting solutions are shown to converge with probability one. A detailed analysis of the complexity of the framework sheds light on how much relative effort should be expended on generating the convex approximations versus their solution.

3 - Guided Stochastic Search for Global Optimization

Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, Urbana, IL, United States of America, enluzhou@illinois.edu, Jiaqiao Hu

Many stochastic search algorithms carry out the following two steps iteratively: sample candidate solutions from a parameterized distribution on the solution space; update the parameter of the distribution using the candidate solutions. We propose to incorporate a quasi Newton's method and an Expectation-Maximization (EM) type method to guide the updating of the parameter of the distribution, effectively combining the faster convergent gradient-type search with the more global stochastic search.

4 - On Stochastic Gradient and Subgradient Methods with Adaptive Steplength Sequences

Farzad Yousefian, PhD Candidate, University of Illinois Urbana-Champaign, 117 Transportation Bldg., 104 S. Mathews Avenue, Urbana, IL, 61820, United States of America, yousefi1@illinois.edu, Angelia Nedich, Uday Shanbhag

We present two adaptive steplength stochastic approximation (SA) schemes for stochastic convex programming. The first scheme optimizes the error bounds to derive a recursive steplength update rule. The second scheme decreases the steplength at epochs related to the meeting of a suitable error requirement. Nonsmooth extensions are addressed through local smoothing techniques. Preliminary numerical results suggest that the schemes perform well compared to standard SA implementations.

■ WD50

H - Ardrey Room - 3rd Floor

Progress in Data Mining Techniques

Contributed Session

Chair: Chaojiang Wu, PhD candidate, University of Cincinnati, 2925 Campus Green Drive, Cincinnati, OH, 45220, United States of America, wuca@mail.uc.edu

1 - High-dimensional Data Clustering by Controlling Decision Errors

Chi-Hyuck Jun, Professor, POSTECH, Industrial & Management Eng., San 31 Hyoja-dong, Pohang, 790784, Korea, Republic of, chjun@postech.ac.kr, Hae-Sang Park, Jeonghwa Lee

Assuming that significant objects follow Gaussian mixture model, the parameters are estimated from the EM algorithm. Then, multiple hypothesis testing is established and the positive false discovery rate as the decision error is estimated. We proposed a soft clustering method that combines principal component analysis and applied to several synthetic data and some real data.

2 - Intrinsic Dimensionality Using Non-linear Dimension Reduction Techniques

Ya Ju Fan, Postdoc Researcher, Lawrence Livermore National Laboratory, 7000 East Avenue, P.O. Box 808, L-560, Livermore, CA, 94551, United States of America, fan4@llnl.gov, Chandrika Kamath

Many nonlinear dimension reduction (NLDR) methods have been proposed to discover the intrinsic, low-dimensional structure in a high dimensional input space. However, determining critical features in data sets that consist of a large number of features is still a challenge. Using both synthetic and real-world data sets, we present a comparison of different NLDR techniques and discuss the insights they provide on the intrinsic dimensionality.

3 - Accelerated Support Vector Machines for Bioinformatics

Hugh Smith, Senior Performance Engineer, PG@E, 3725 Barrington Drive, Concord, United States of America, netizena2003@yahoo.com

The field of Bioinformatics generates high volumes of complex high dimensional data. The use of Support Vector Machines(SVM) to process this data requires significant computer processing power. This paper discusses various software and hardware methods to accelerate SVM processing.

4 - Robust Multi-Kernel Classification of Uncertain and Imbalanced Data

Raghav Pant, PhD Candidate, University of Oklahoma, School of Industrial Engineering, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, rpant@ou.edu, Theodore Trafalis, Kash Barker

In SVM classification, data uncertainty is not generally addressed efficiently. Uncertainty can often be found in rare events, where added difficulty of imbalanced data exists. In this study we developed a robust SVM approach of classifying imbalanced and noisy data. We formulate the classification as a semi-definite programming problem and develop its robust counterparts under bounded data uncertainties, including multiple kernels for handling the data and investigate the robust formulations.

5 - Partially Linear Modeling for Conditional Quantiles

Chaojiang Wu, PhD Candidate, University of Cincinnati, 2925 Campus Green Drive, Cincinnati, OH, 45220, United States of America, wuca@mail.uc.edu, Yan Yu

To overcome the "curse of dimensionality" yet retain model flexibility, we propose two partially linear models for conditional quantiles with high dimensional covariates. An approximate iteratively reweighted least square algorithm and effective model degrees of freedom are developed for model comparisons. Two smoothing parameter selection criteria are investigated. Some asymptotic and finite sample properties are studied. A real data application demonstrates the success of proposed approach.

■ WD51

H - Caldwell Room - 3rd Floor

Alternative Dispatching Methods for Freight Transportation

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Sarah Root, Assistant Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, seroot@uark.edu

1 - Algorithms and Optimization Models for Truckload Relay Network Design

Hector Vergara, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hvergara@uark.edu, Sarah Root

Driver retention is a significant problem for full truckload carriers operating on a Point-to-Point dispatching method. Alternatively, dispatching under a network configuration of relay points can be used to improve driver retention due to a reduction in driver tour lengths. We propose a new mathematical formulation for strategic relay network design that minimizes total costs while considering operational constraints such as load circuity and driver tour length within the variable definition.

2 - A Lagrangean Decomposition Approach for Capacitated Relay Network Design

Halit Uster, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77840, United States of America, uster@tamu.edu, Panitan Kewcharoenwong

Motivated by its applications in Less-than-Truckload (LTL) and Truckload (TL) transportation, we consider a relay network design problem with generalized capacity and load imbalance requirements. We develop an efficient solution approach based on Lagrangean decomposition and present computational results illustrating the performance of the algorithm.

3 - Creative Dispatching in Truckload Trucking

Don Taylor, Gordon Professor and Department Head, Virginia Tech, Grado Department of ISE, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States of America, don.taylor@vt.edu

In this presentation, the author presents several alternatives to traditional dispatching in truckload trucking. The goal of these various alternatives is to improve the quality of life for professional drivers while keeping the trucking company profitable and the customer happy. With improved dispatching systems in place, current research is focused on the achievement of higher profitability without degradation of the improved dispatch function.

4 - Load Plan Improvement through IP Based Local Search

Kathleen Lindsey, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332-0205, United States of America, kate.abercrombie@gatech.edu, Alan Erera, Martin Savelsbergh

We develop an integer programming based local search improvement method for a service network design problem faced by less-than-truckload (LTL) freight transportation carriers. The technique uses a time-space network to realistically model consolidation opportunities, while simultaneously evaluating loaded freight and empty trailers. This approach finds significant cost savings for large-scale LTL networks seen in practice.

■ WD52

H - North Carolina - 3rd Floor

Models and Algorithms for Facility Location

Contributed Session

Chair: Ayse Durukan Sonmez, PhD Candidate, University of Houston, Department of Industrial Engineering, E224 Engineering Building 2, Houston, TX, 77204, United States of America, adurukan@uh.edu

1 - A Reliable Facility Location Model with Economies of Scale

Yu An, University of South Florida, 4202 Fowler Avenue, Tampa, FL, United States of America, yan2@mail.usf.edu, Bo Zeng, Yu Zhang

We consider a reliable facility location model with economies of scale, i.e. the unit service cost is a function of the service volume. A mixed integer nonlinear model is proposed and numerical study will be presented.

2 - Facility Location Model: A Robust Optimization Approach

Bo Zeng, Assistant Professor, University of South Florida, Tampa, FL, 33647, United States of America, bzeng@usf.edu, Long Zhao, Yu An

We consider a facility location problem with disruptions. A robust optimization model is constructed and solved using an algorithm with primal information. Numerical results will be presented and discussed.

3 - Competitive Hub Location and Pricing Problem

Armin Lüer, Graduate Student, Pontificia Universidad Catolica de Chile, Department of Electrical Engineering, Chile, arminluer@gmail.com, Vladimir Marianov

We formulate and solve the hub location and pricing problem using a metaheuristic. A new company tries to maximize its net benefit, capturing flows from an incumbent that operates a hub and spoke network. We use a Logit model to explain the clients' behavior.

4 - Gamma-robust Facility Relocation Problem (Gamma-RFRP)

Ayse Durukan Sonmez, PhD Candidate, University of Houston, Department of Industrial Engineering, E224 Engineering Building 2, Houston, TX, 77204, United States of America, adurukan@uh.edu, Gino J. Lim

Gamma-RFRP considers facility relocation by closing existing facilities and opening new ones, where demand changes are represented by different scenarios with known probabilities. We develop a mixed integer programming model that minimizes the expected weighted distance while the regret for each scenario is forced to be less than gamma. We develop a Lagrangean Decomposition Algorithm that produces fast and good quality solutions. Numerical experiments compare the performance of both methods.

■ WD54

H - Charlotte Hall - 3rd Floor

Joint Session Analytics/CPMS: Financial Risk Management in Practice

Sponsor: Analytics/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Wei Chen, Analytical Solutions Manager, SAS, SAS Campus Dr., Cary, NC, United States of America, wei.chen@sas.com

1 - Using Efficient Monte Carlo Simulation in Counterparty Credit Risk Estimation of OTC Derivatives

Samim Ghamami, Quantitative Analyst, Barclays Capital, 745 7th Avenue, New York, NY, United States of America, ghamami@usc.edu, Bo Zhang

OTC derivative products are subject to counterparty credit risk. A typical counterparty risk engine in a financial institution measures counterparty credit exposure based on Monte Carlo simulation. We present efficient Monte Carlo procedures for estimating potential future exposure (PFE) and expected exposure (EE); these are two of the most commonly used counterparty risk measures in the financial industry.

2 - A New Risk Assessment Framework for Asset-backed Securities (ABS)

Sunny Zhang, Senior Risk Consultant, SAS, 100 Campus Drive, Cary, NC, 27513, United States of America, Sunny.Zhang@sas.com

This paper introduces a new analytical framework that has implications for loan securitization. This framework better serves loan originators and investors by providing more accurate risk assessment and greater consistency and transparency. It promotes standardization of the asset pooling process and definitions, and affords to easily compare, rank, monitor and report loan pool performance across securities. As a result, cash flows and their associated uncertainties can be better quantified.

3 - Copula and Risk Aggregation

Jack Yang, Financial Solution Specialist, SAS Institution Inc., Cary, NC, 27513, United States of America, jack.yang@sas.com, Wei Chen

Risk aggregation is getting popula in financial risk management espcially in enterprise risk management. This presenation reviews types of copula and the advantages of using copula over other tools in risk aggregation and how it is related to the popula tail risk measures.

■ WD55

H - Mecklenburg Hall - 3rd Floor

Joint Session Analytics/CPMS: Forecast Value Added Analysis

Sponsor: Analytics/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Michael Gilliland, Product Marketing Manager, SAS Institute, SAS Campus Drive - C5234, Cary, NC, 27513, United States of America, Mike.Gilliland@sas.com

1 - Forecast Value Added Analysis: Case Studies

Michael Gilliland, Product Marketing Manager, SAS Institute, SAS Campus Drive - C5234, Cary, NC, 27513, United States of America, Mike.Gilliland@sas.com

FVA is defined as the change in a forecasting performance metric that can be attributed to a particular step or participant in the forecasting process. Organizations are using FVA analysis to identify waste in the forecasting process (activities that are failing to improve the forecast, or are making it worse). This session includes an overview of the FVA methodology, along with case studies from organizations that have applied this method.

2 - Applying Forecast Value Added at Newell Rubbermaid

Ryan Rickard, Sr. Supply Chain Manager, Newell Rubbermaid, 3 Glenlake Parkway, Atlanta, GA, 30328, United States of America, ryan.rickard@newellco.com

A key area of focus is improving Forecasting, and Forecast Value-added Analysis (FVA) serves as a key tool to increase Forecast Accuracy while optimizing forecasting resources. This session will focus on how FVA is used to improve Demand Planning and overall Supply Chain performance.

■ WD56

H - Biltmore Boardroom - 2nd Floor

Therapy and Treatment Issues in Health Care

Contributed Session

Chair: Yasaman Khodadadegan, PhD Student, Arizona State University, 1249 E., Spence Avenue, Apt 336, Tempe, AZ, 85281, United States of America, ykhodada@asu.edu

1 - Evolution-Based IMRT Planning

Arkajyoti Roy, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47906, United States of America, roya@purdue.edu, Omid Nohadani

Typical IMRT plans are optimized for static tumors. However, temporal changes in shape can degrade the outcome. We propose a model that incorporates the tumor evolution during the course of the treatment. This allows dose escalations leading to potentially higher survival rates. We show the advancement based on a clinical case.

2 - Managing Uncertainties in Radiosensitivity in Cancer Therapy

Omid Nohadani, Assistant Professor, Purdue University, 315 N. Grant Street, Grissom Hall, West Lafayette, IN, 47907, United States of America, nohadani@purdue.edu

The response of the tissue to external ionizing radiation changes during the course of the treatment, particularly when radiotherapy is combined with chemotherapy. We present a method that exploits these changes to the benefit of the patient by optimizing the plan respective to predictive changes. Quantitative advantages are demonstrated on a clinical IMRT case.

3 - Predicting Response to Citalopram Based on a New Boosted CART Algorithm

Manaf Zargoush, ESSEC, 3445, Apt 301, Hutchison Street, Montreal, QC, H2X 2G2, Canada, zargoush@gmail.com, Farrokh Alemi

We develop a variant of Boosted Classification And Regression Tree algorithm, called Binary Boosted CART, to predict patients' response to Citalopram, a common antidepressant. We do so using genetic data as the input to our algorithm.

4 - Radiation Dose Reduction for Critical Organs in Interventional Radiology Procedures

Yasaman Khodadadegan, PhD Student, Arizona State University, 1249 E., Spence Avenue, Apt 336, Tempe, AZ, 85281, United States of America, ykhodada@asu.edu, Muhong Zhang, Teresa Wu, William Pavlicek

Long interventional radiology procedures may result in high exposures leading to cancer induction for critical organs of the body. Variation of geometry parameters and x-ray energy setup changes the amount of absorbed radiation in the organs as well as image quality. A mixed-integer programming model is proposed to provide initial setup for each exam to minimize dose and satisfy image quality. Branch and cut method is discussed.

■ WD57

W - Providence I- Lobby Level

Optimization Models for Airline Crew Rostering and Crew Pairing

Sponsor: Aviation Applications

Sponsored Session

Chair: Wenwei Cao, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, United States of America, cww@gatech.edu

1 - Post Optimize Techniques for Airline Crew Rostering Problem

Yu Yu, Operations Research Analyst, Sabre Airline Solutions, No.555 Loushanguan Road, Metro Plaza, Suite 1608, Shanghai, 200051, China, yu.yu@sabre.com

Solution time and quality are crucial aspects for big sized Crew Rostering problem. Classic solution approach for the problem is to get initial assignments by heuristics and then improve the solution quality by Post Optimize (PO) techniques. We propose here two PO methods, a generalized Local Search and a subproblem optimize method. Test results show that both of the methods can support each other well and improve the solution quality efficiently.

2 - Integrating Assignment Requirements Into Airline Crew Pairing Optimization

Michael Römer, Martin Luther University of Halle-Wittenberg, Universitätsring 3, Halle, 06108, Germany, michael.roemer@wiwi.uni-halle.de, Taïeb Mellouli

In order to enhance the airline crew scheduling process, we integrate requirements from crew assignment into crew pairing optimization. Our flow-based model uses a state expanded network to represent pairing chains at multiple domiciles. Consistency with rest requirements and preassignments is enforced by employing the novel concept of availability blocks. Results from experiments with real world data from a medium-sized European airline show that the approach is advantageous and tractable.

3 - Long-term Crew Rostering and Integration in Fractional Airlines

Wenwei Cao, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, United States of America, cww@gatech.edu

Due to the dynamic nature of fractional jet operations, most crew planning efforts are limited by a time frame of one to three days. However, higher charter, reposition, and training costs may result from crew pair and crew-aircraft mismatches on an annual roster. We build several integer programming models to support roster generation through sequential planning stages. Beyond that we investigate the effect of integrating the sequential stages by developing a model that incorporates seniority rules and a solution approach based on branch-and-price. Practical usefulness of the framework is demonstrated in numerical results and a posteriori analysis of the scenarios that are most interesting to the management.

■ WD58

W - Providence II - Lobby Level

Topics in Homeland Security

Sponsor: Military Applications Society

Sponsored Session

Chair: Hiram Moya, PhD, Texas A&M University, 2807 Henry Ct., College Station, TX, 77845, United States of America, hiram@tamu.edu

1 - Border Crossing Modeling & Analysis – A Variance Reduction Policy Within Dynamic Reallocation

Hiram Moya, PhD, Texas A&M University, 2807 Henry Ct., College Station, TX, 77845, United States of America, hiram@tamu.edu

The U.S. international land boundary is a volatile, security intense area. In 2009, NAFTA trade was $735 billion, with 80% transported by commercial trucks. The specific problem is finding a balance between a reduction wait time and its variance. In conjunction with a Dynamic Reallocation Methodology of primary inspection, applying a variance reduction policy based on the use of secondary inspections will eliminate time outliers and reduce wait time without affecting security procedures.

2 - Selection of Effective Protection Systems for Electric Power Systems Against Terrorist Attacks

Vanlapha Santithammarak, PhD Candidate, Texas Tech University, Department of Industrial Engineering, Lubbock, TX, 79409, United States of America, vanlapha.santithammarak@ttu.edu, Milton Smith

Nowadays, terrorist attacks are a top concern to weaken the economy since 9/11. Electric power systems should be regarded as likely targets of terrorists because of the reliance upon electric power in all economic activities. The objective of this study is to evaluate and select effective methods to protect against physical attacks on power systems.

■ WD59

W - Providence III - Lobby Level

Service Science and Network Science

Sponsor: Service Science

Sponsored Session

Chair: Cheng Hsu, Professor, Rensselaer Polytechnic Institute, 5123 CII, RPI, 110 8th Street, Troy, NY, 12180-3590, United States of America, hsuc@rpi.edu

1 - A Semi-Markov Decision Problem for Proactive and Reactive Transshipments between Multiple Warehouses

Arkadi Seidscher, University of Vienna, Brünner Strafle 72, Vienna, 1210, Austria, arkadi.seidscher@univie.ac.at, Stefan Minner

We investigate the benefits of proactive over different reactive transshipment rules depending on the design of the distribution network, cost parameters, and demand and supply parameters in a multi-location inventory system. The problem is formulated as a Semi-Markov decision process. We find that the benefits of proactive transshipments are the largest for networks with intermediate opportunities of demand pooling and that the difference between reactive transshipment rules is negligible.

2 - Sourcing Strategies and Network Structure: A Network Theory Analysis of Global Sourcing

Steven Carnovale, Rutgers University-Rutgers Business School, 1 Washington Park, Room 1057B, Newark, NJ, 07102, United States of America, scarnova@pegasus.rutgers.edu, Sengun Yeniyurt

The paper focuses on the development of a framework of global sourcing using network theory. We review the literature and formulate theoretic hypotheses regarding the effects said framework for a firm's global sourcing strategy. Network theory constructs (centrality, transitivity, structural holes, and structural embededness) are explored. Specific network-theoretic hypotheses are developed regarding the effect of network structure on the likelihood of a new sourcing relationship being created.

3 - Network Reliability under Targeted and Random Failures

Seth Guikema, Assistant Professor, Johns Hopkins University, 3400 N. Charles St., Ames Hall, Baltimore, MD, 21218, United States of America, sguikema@jhu.edu, Sarah LaRocca

In this paper, we generate a large set of random networks encompassing a wide range of sizes and topological characteristics representative of real-world networks, such as the internet. We then evaluate the reliability of each network under both targeted and random element failures. These scenarios represent both natural (random) and man-made (targeted) hazards to infrastructure systems. This paper provides an understanding of the effect of network characteristics on systems reliability.

4 - Impact of Organizations' Networking Structure on Innovative Performance

Fethullah Caliskan, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, fcaliska@mail.usf.edu, Kingsley A. Reeves, Ozan Ozcan

Our aim is to assess the impact of supply chain and alliance networking structures on innovation performance. We focused on Florida's high tech industries taking the number of patents as our dependent variable. It is hypothesized that clustering, reach and their combination, clusteringXreach have positive impact on and region's innovativeness. A parallel simulation model is supposed to help policy makers decide where to invest in the development of ties within networks to spur innovation.

5 - Hyper-networking Drives New Service Business Designs

Cheng Hsu, Professor, Rensselaer Polytechnic Institute, 5123 CII, RPI, 110 8th Street, Troy, NY, 12180-3590, United States of America, hsuc@rpi.edu

One thing describes the technical nature of e-commerce, social networking, and the convergence of products and services as represented by the iPad: the hyper-networking of customers, providers, and resources in value co-creation. This hyper-networking model also applies to many human activities on physical habitats as well as in cyberspace. A formal analysis provides new insights into service value networks and leads to a model of micro-economic production functions.

■ WD60

W - College Room - 2nd Floor

Linear Optimization: Algorithms and Applications

Contributed Session

Chair: Roland Wunderling, CPLEX Architect, IBM, Annenstrasse 9, Graz, 8020, Austria, roland.wunderling@at.ibm.com

1 - A Modified Perceptron Algorithm for Linear Programming

Negar Soheili, Tepper School of business, CMU, 5000 Forbes Avenue, Pittsburgh, United States of America, nsoheili@andrew.cmu.edu, Javier PeÒa

The perceptron algorithm for solving the linear programming feasibility problem has attracted research attention due to its simplicity and popularity in the machine learning community. A main limitation of this algorithm is its slow convergence rate. We develop a modified version of the perceptron algorithm that retains the original simplicity but with substantially improved convergence rate.

2 - Linear Programming - A Forgotten Art?

Roland Wunderling, CPLEX Architect, IBM, Annenstrasse 9, Graz, 8020, Austria, roland.wunderling@at.ibm.com

Solving LP has long be taken for granted as MIP has taken center stage. However, in the past few years the demands on Linear Programming solver have caught up and we encounter more and more problem instances of huge dimensions. We will discuss these new types of issues and how CPLEX approaches then.

3 - Analysis and Modeling of Attributes Affecting Retention and Satisfaction Rates in an Online Learning

Javad Seyed, Adjunct Professor, American Public University, 1933 Amity Hill Court, Raleigh NC 27612, United States of America, javad.seyed@mycampus.apus.edu, SIchong Guan, Michael Miner, William Owen

In this study, the research team will address two key challenges in the delivery of online programs: Retention and satisfaction rate. In order to address these challenges, a quantitative linear mathematical model for optimization will be introduced that provides a holistic analysis of the attributes affecting retention and satisfaction rates.

■ WD61

W - Sharon Room - 2nd Floor

Design Issues

Contributed Session

Chair: Lars Backáker, Ph.D. Student, Linköping University, Bredgatan 33, Norrköping, 602 21, Sweden, lars.backaker@liu.se

1 - Managing Capacity for Mixed Fast Passenger and Heavy Freight Services

Bo-Lennart Nelldal, Adj. Professor, KTH Railway Group, Div. of Transport and Logistics, Stockholm, SE-100 44, Sweden, bo-lennart.nelldal@abe.kth.se, Oskar Froidh

Differences in train speed consume capacity. For strategic development of rail systems, analyses have been carried out by simulation for some Swedish main lines. Short distances between crossing stations on single-track lines is essential. For double-track lines, there are a number of different measures to overcome the main problem of catching up slower trains, which includes overtaking, increased speeds for slow trains, heavier freight, or timetable measures.

2 - Research on High-Speed Rail Cost Recovery Based on Multinomial Logit and Linear Optimization Models

Shoupeng Tang, The University of Texas at Austin, 1 University Station, C1761, Austin, United States of America, stang@mail.utexas.edu

Two multinomial logit models (MNL) will be built which depict mode choice behaviors before and after HSR operation respectively. Searching the minimum time that the cost of constructing and operating a High-Speed Rail (HSR) can be recovered based on various HSR operation speeds and frequencies is modeled as a linear optimization problem in which all available HSR service frequencies and ticket prices must be consistent with the constraints in the previous MNL logit models.

3 - An Approximate Dynamic Programming Framework for Solving the Train Design Optimization Problem

Maite Pena-Alcaraz, MIT, 77 Massachusetts Avenue, E40-244E, Cambridge, MA, 02139, United States of America, maitepa@mit.edu, Mort Webster

We present a train design optimization model to plan the tactical operation of a freight railroad industry. An Approximate Dynamic Programming paradigm will be used to decide what trains will be operated to transport the freights as well as which blocks will be assigned to each train. Different algorithms are tested within a study case presented in the 2011 RAS Problem Solving Competition.

4 - Dynamic Demand Assignment Within the Swedish Rail Freight Carload Service Segment

Lars Backáker, Ph.D. Student, Linköping University, Bredgatan 33, Norrköping, 602 21, Sweden, lars.backaker@liu.se, Johanna Törnquist Krasemann

Due to daily fluctuations in rail freight transport demand, demand assignment principles become critical for capacity utilization. In the Swedish car load service segment, the First-Booked-First-Served (FBFS) principle is adopted. The principle is transparent towards customers and straight forward. Though, it does not account for the flexibility of demand postponement. In co-operation with Green Cargo we benchmark the FBFS-principle with a dynamic, optimization-based demand assignment regime.

■ WD62

W - Independence Room - 2nd Floor

Energy Storage

Contributed Session

Chair: Doug Carmichael, Graduate Student, University of Colorado, 4882 Hopkins Place, Boulder, CO, 80301, United States of America, Robert.Carmichael@colorado.edu

1 - A Generalized Framework for Evaluating Pumping-up Power Plants

Kei Takahashi, Research Assistant, Waseda University, 3-4-1 Okubo, Shinjuku-ku, Tokyo, 169-8555, Japan, k-takahashi@aoni.waseda.jp, Takahiro Ohno, Ryohei Watanabe

This paper proposes a generalized framework for evaluating a pumping-up power plant (PPP). PPPs are efficient facilities for preserving energy of electricity which cannot be stored as it is, as gravitational energy. We formulate PPP control problems which can evaluate and compare various kinds of PPP as real option problems. This formulation has high flexibility and can evaluate various kinds of PPP including normal hydrogen power plant and multiple-use PPP.

2 - An Optimal Energy Management System for Microgrid Considering the Load Control

SooJeong Choi, student, Yonsei University, Room 610, DaeWoo Hall, 50 Yonsei-ro, Seodaemun-gu, seoul, 120-749, Korea, Republic of, crystal0208@yonsei.ac.kr, Sunju Park

This paper presents an optimal operation model for Microgrid which consists of small generators, storage devices, and manageable loads. The Mixed Integer Programming is used. The model incorporates diverse electricity load types to efficiently induce demand response as ensuring the stability for Microgrid. The evaluation shows that the proposed model works well compared to the unscheduled operation plan as increasing demand elasticity and decreasing total operation cost.

3 - Mitigating Supply and Demand Variability Within the Electrical Grid Using Energy Storage

Doug Carmichael, Graduate Student, University of Colorado, 4882 Hopkins Place, Boulder, CO, 80301, United States of America, Robert.Carmichael@colorado.edu, Stephen Lawrence

It is very difficult to design and operate an efficient and robust electrical grid that meets peak demands. This is due to high variability of energy demand, as well as the variability inherent in certain energy production sources. In order to mitigate this variability, energy storage technologies are increasingly being used. In this presentation, various grid configurations are analyzed in order to define the best strategies for deployment of energy storage under different circumstances.

■ WD63

W - Tryon North - 2nd Floor

Multiobjective Optimization for Engineering Design

Sponsor: Multiple Criteria Decision Making

Sponsored Session

Chair: Margaret Wiecek, Clemson University, Department of Mathematical Sciences, Clemson, SC, United States of America, wmalgor@clemson.edu

1 - Robust Multicriteria Routing Optimization to Enhance the Performance of the Internet

Erin Doolittle, Clemson University, Department of Mathematical Sciences, Clemson, SC, 29634, United States of America, edoolit@clemson.edu, Hervé Kerivin, Sandrine Vaton

We consider an intradomain routing problem on a telecommunication system with multiple objective functions and traffic uncertainty, the former corresponding to link utilizations and the latter being represented by a polyhedral model. Using a multicommodity-flow formulation, we study the efficient routings and present computational results for the ABILENE network.

2 - Equitable Multiobjective Optimization for the Hybrid Electric Vehicle Battery Design

Brian Dandurand, Graduate Research Assistant, Clemson University, Department of Mathematical Sciences, O-110 Martin Hall Box 340975, Clemson, SC, 29634-0975, United States of America, bdandur@clemson.edu, Margaret Wiecek

The applicability of equitable Pareto solutions to the vehicle battery packaging design is examined. The overall design is modeled as a bilevel multiobjective optimization problem. Equitable Pareto designs are computed for the decomposed problem, rather than for the overall problem, to provide designers with insight into tradeoff design decisions.

3 - Multi-objective Design of Vehicles in a Multi-scenario Framework: k-Optimality Selection of the Pareto

Paolo Guarneri, Clemson University, 205 Fluor Daniel Bldg, Clemson, United States of America, pguarne@clemson.edu, Massimiliano Gobbi, Gianpiero Mastinu

The vehicle design is a multiobjectiveproblem since the performance is described by many conflicting objectives modeled in terms of different maneuvers. In such a design framework, the Pareto optimality criterion is ineffective and the k-optimality criterion is applied to reduce the number of optimal solutions the designer can select.

4 - Biobjective Optimization for Analytical Target Cascading: Optimality vs. Achievability

Margaret Wiecek, Clemson University, Department of Mathematical Sciences, Clemson, SC, United States of America, wmalgor@clemson.edu, Melissa Gardenghi

Analytical target cascading, a hierarchical multidisciplinary methodology for decomposition and coordination of design problems, incorporates compromise between the system performance and the demands of the subproblems. Biobjective optimization is used to reconcile system optimality and subproblem achievability of targets while solving the decomposed problem and generating an overall optimal solution.

■ WD64

W - Queens Room - 2nd Floor

Strategy and Policy in Health Care

Contributed Session

Chair: Ali Vahit Esensoy, PhD Candidate, University of Toronto, CRHE, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, ali.esensoy@utoronto.ca

1 - A Panel-based Analysis Strategy for Accountable Care Organizations (ACOs)

Wei Liu, Graduate Student, Purdue University, 2334 South Beck Lane, Apt#209, lafayette, IN, 47909, United States of America, liu317@purdue.edu, Ping Huang

ACOs is a healthcare reform milestone. Primary care physicians face the challenges of controlling the cost while improving healthcare quality. Lack of a systematic understanding of the patient panel situation is one of the largest barriers in the construction of successful ACOs. A panel-based utilization analysis strategy will be introduced in this talk. This strategy will help physicians to better identify the target, improve the care coordination, and utilize the resources in an optimal way.

2 - A System Dynamics Modeling Approach to Identification Standards Adoption

Angelica Burbano, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, aburbano@uark.edu, Edward Pohl, Ronald Rardin

This research reports on the development of a modeling approach for identification standards adoption which is initially based on the classical Bass technology diffusion model and incorporates the challenges related to identification standards definition. The goal of the model is to simulate the behavior of the hospital population over time and observe the impact of diffusion coefficients in the adoption rate. The model allows for the analysis of policies to move the adoption process forward.

3 - Investment Response Model

Ali Vahit Esensoy, PhD Candidate, University of Toronto, CRHE, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, ali.esensoy@utoronto.ca, Michael Carter

This work involves the development of a system dynamics simulation model of a Local Health Integration Network to assess the effects of major investments into seniors' home and community care services on patient flows between health system sectors. Primary focus of the model is to determine the extent to which hospital discharge rates to home and long-term care, and emergency department use were influenced by the $1.1bn Aging At Home Strategy in Ontario, Canada.

4 - The Donor-Dependent Scoring Schemes for Cadaver Kidney Allocation

Yichuan Ding, Stanford University, 14 Comstock Circle, Apt 106, Stanford, CA, 94305, United States of America, y7ding@stanford.edu, Stefanos Zenios

In the U.S., the ranking of candidates on the cadaver kidney transplantation waitlist is determined by a scoring scheme, which can be classified into two categories: donor-dependent and donor-independent. By modeling the waitlist, we give a rigorous proof that a donor-dependent scoring scheme will enlarge the range of kidneys that will be accepted by rational candidates. Our simulation test shows that a donor-dependent scoring policy decreases the number of discarded kidneys by 7%.

■ WD65

W - Kings Room - 2nd Floor

Operations Management I

Contributed Session

Dahai Xing, Oklahoma State University, 89 S University PL APT1, Stillwater OK 74075, United States of America, dahai.xing@okstate.edu

1 - Lead Time-oriented Order Release Models: A Theoretical Analysis of Essential Shortcomings

Hubert Missbauer, Univ.-Professor, University of Innsbruck, Universitätsstrasse 15, Innsbruck, 6020, Austria, hubert.missbauer@uibk.ac.at

We deal with multi-period order release models where time-varying lead times are calculated explicitly, either by assuming a functional relationship between release quantities and lead times or by iterating between a fixed lead time release model and a simulation. Both approaches suffer from shortcomings, most important the convergence problems of the iterative approaches. The presentation analyzes these shortcomings using a single-stage order release model in discrete and continuous time.

2 - When do Emissions Reductions Improve Profits?

Brian Jacobs, Assistant Professor, Michigan State University, Eli Broad College of Business, N370 North Business Complex, East Lansing, MI, 48824-1122, United States of America, jacobsb@bus.msu.edu, David Closs, Sriram Narayanan, Sachin Modi

Empirical evidence of the relationship between firm-level emissions reductions and financial performance is often conflicting and inconclusive. Using data collected from TRI and Compustat, we demonstrate that this heterogeneity is driven by both the industry's dirtiness and the firm's operational capabilities. Further, we show that the impact of emissions reductions on financial performance is moderated by the firm's capabilities in environmental performance and employee relationships.

3 - Sales Effort Free Riding and Coordination with Price Match and Selective Target Rebate

Dahai Xing, Oklahoma State University, 89 S University PL APT1, Stillwater, OK, 74075, United States of America, dahai.xing@okstate.edu, Tieming Liu

This paper studies sales effort coordination for a supply chain with one manufacturer and two retail channels, where an online retailer offers a lower price and free-rides a traditional retailer's sales efforts. We designed a contract with price match and selective compensation rebate. The numerical analysis shows that such a contract can achieve a supply chain efficiency approximating that of an integrated supply chain.

■ WD66

W - Park Room - 2nd Floor

Manufacturing Topics

Contributed Session

Chair: Francisco Quiroz-Aguilar, Deputy Director, TESCo, Sierra Dorada Lote 62 Casa D, Cuautitlan, Mexico, fqasdp@hotmail.com

1 - Cost of Quality Tradeoffs in Manufacturing Process and Inspection Strategy Selection

Hadi Zaklouta, M.Sc. Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, zaklouta@mit.edu, Richard Roth

This work discusses the prevention, appraisal, internal- and external failure cost tradeoffs between different manufacturing process and inspection strategy options. It does so both from the conventional expected value perspective and from an approach that considers decision makers' risk aversion. Key decision driving factors include risk intolerance and product, manufacturing process and inspection strategy characteristics.

2 - Modeling Production Systems with Heterogeneous and Lead Time Sensitive Demand

Tanja Mlinar, PhD Student, Université catholique de Louvain, Voie du Roman Pays 34, Louvain La Neuve, 1348, Belgium, tanja.mlinar@uclouvain.be, Philippe Chevalier

We consider production queueing systems serving multiple heterogeneous demand streams sensitive to quoted delivery time. The company's objective is to select an optimal delivery lead time taking into account service level requirements. We study how to find the best combination of lead times for the different products in order to maximize the global profit.

3 - Simulation Optimization-based Decision Support Tool for Steel Manufacturing

Sharif Melouk, University of Alabama, Alston 300, Box 870226, Tuscaloosa, AL, United States of America, smelouk@cba.ua.edu, Nick Freeman, David Miller

Steel manufacturers continuously strive to improve operations and lower operating costs to buffer against raw material price variability and increasing global competition. In this work, we develop a simulation optimization-based support tool to investigate the impact of inventory practices, process dynamics, and resource capacities in a steelmaking facility. Overall, we demonstrate the utility of the solution approach and show that experimental results suggest cost reductions are possible.

4 - The Antecedents and Consequences of Plant Closing Announcement

Feng Mai, University of Cincinnati, 523 Carl H. Lindner Hall, Cincinnati, OH, 45221-0130, United States of America, maifg@mail.uc.edu, Amitabh Raturi

Plant closings are critical components of operations strategy and facilities planning. We use Dow Jones, Reuters, and similar news wires to collect announcements of plant closings over a five-year period. Then we use functional data analysis and other approaches to test hypotheses related to key financial and operating antecedent conditions and consequences of these announcements.

5 - Foundry Metalic Pieces Problems in the Automotive Industry
Francisco Quiroz-Aguilar, Deputy Director, TESCo, Sierra Dorada Lote 62 Casa D, Cuautitlan, Mexico, fqasdp@hotmail.com

In 2010 the automotive industry in Mexico sold about 820,000 vehicles, whose are made basically by foundry pieces, where it can be found several fails that produce economic loss, the present study shows the optimization of the foundry process of an automotive plant, using time study, simulation and decision tools to determine the best options. At the end the company reduced the 30% in rejected products, almost saved 30% in production costs.

■ WD67

W - Grand A - 2nd Floor

Business Applications I

Contributed Session

Chair: Laura Cardona, Analyst, Bancolombia S.A., Cra 48 #26-85., Torre Sur. Piso 5E, Medellìn, Colombia, lccardon@bancolombia.com.co

1 - Analytics and Forecasting of the Business Loads Based on Season Index Forecasting Method
Ming Xie, Manager, Industry Solutions (E&U, Logistics and BAO), IBM Research, Diamond Building A, ZGC Software Park, Beijing, 100193, China, xieming@cn.ibm.com, Wenjun Yin, Jin Dong

The future business loads is a key issue challenging the labor scheduling among different service outlets. Here we focus on the business loads forecasting for a bank branch. Through statistical analysis on the sample data, we found usable characteristics. Then we developed a forecasting method based on the season index forecasting method. Tests show that our method works well. In fact, the idea of the method can also be used to develop forecasting methods for other similar scenarios.

2 - Evaluating the Effectiveness of Large-Scale Managerial Decisions
Audrey Griffin, The Pennsylvania State University, DuBois Campus, College Place, DuBois, PA, 15801, United States of America, asb10@psu.edu

Evaluating the effectiveness of managerial decisions can be difficult. A software tool has been developed to detect en masse, major stock performance changes in virtually any industry. Periods of abrupt gains or losses can then be correlated with events of interest (e.g., large-scale IS implementations), leading to otherwise unmineable conclusions.

3 - Monitoring, Learning and Reputation: An Experimental Investigation on Alliance Partners' Opportunism
Yanhui Gao, Xi'an Jiaotong University, School of Management, No. 28 Xianning West Road, Xi'an, 710049, China, yhgaoxjtu@yahoo.com.cn, Difang Wan

How to control partners' opportunism is a very important issue in alliances. This paper reorganized the mechanisms advanced by complementary streams of literature, and juxtaposes three main measures that deter partners' opportunism: monitoring, learning and reputation. To better understand how they influence the partners' opportunistic behaviors and what the relationship among them is, we use an experimental design, that combines game theory with the mechanisms, to examine the interplay of them.

4 - Automation of the Boxplot for Outlier Detection in the Variable Expenses of a Transportation Company
Laura Cardona, Analyst, Bancolombia S.A., Cra 48 #26-85., Torre Sur. Piso 5E, Medellìn, Colombia, lccardon@bancolombia.com.co, Alejandro Kepes

We present an anomaly detection method to audit variable expenses in the routes of a road transportation company. With the use of data mining the boxplot method was adapted to be applied to large volumes of data, generating large numbers of boxplots. This allowed selecting just 0.2% of the trips for detailed auditing, allowing to focus only in those cases that showed abnormal behavior in their variable expenses. This turned out to be a very simple but useful and efficient solution.

■ WD68

W - Grand B - 2nd Floor

Green Supply Chain Management

Contributed Session

Chair: Xu Yang, Postdoctoral Associate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Room E40-211, Cambridge, MA, 02139, United States of America, xu_yang@mit.edu

1 - Joint Production and Carbon Emissions Permits Trading Strategies
Quan Yuan, Department of Systems Engineering & Engineering Management, Chinese University of Hong Kong, Hong Kong, Hong Kong - PRC, qyuan@se.cuhk.edu.hk, Yun Zhou, Frank Chen

We study both production and carbon emissions trading strategies for a firm that emits CO2 in production and purchases CO2 emissions permits from a spot market. The purchased number of permits should meet its annual CO2 emissions amount. The firm faces uncertain demand and fluctuating spot prices for CO2 permits. Purchasing permits incurs both variable and fixed costs. With Markov prices, we obtain the optimal joint policy structure.

2 - Multi Mode Lot Sizing Models with Carbon Emissions
Gokce Palak, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, gp192@msstate.edu, Sandra Eksioglu

We extend the economic lot sizing model with multi-mode replenishments to consider carbon emissions. We determine the optimality conditions under carbon caps, carbon tax, carbon cap and trade, and carbon offset policies. Our objective is to show how these policies impact the optimal order quantity and transportation mode selection. We use a large set of numerical experiments to identify the impact of different policies on the total (inventory, transportation and order setup) costs.

3 - The Implications of Carbon Management on Supply Chain Design Issues
Yi-Fen Chen, UC Berkeley, 4141 Etcheverry Hall, UC Berkeley, Berkeley, United States of America, yifenchen@berkeley.edu, Z. Max Shen, David Dornfeld

Many firms try to reduce their carbon emissions by focusing on transportation tactics rather than supply chain design strategies. This may lead to suboptimal decisions due to the lack of considerations of other supply chain activities, such as warehouse operations. An integrated supply chain design model was constructed to investigate the trade-offs between warehouse and transportation carbon emissions. We also investigate an multi-objective problem that minimizes both cost and carbon emissions.

4 - A Green Multi-period Production Scheduling Optimization Method
Xiaoqing Wang, IBM Research - China, Diamond Building A, ZGC Software Park, Beijing, China, xqwangxq@cn.ibm.com, Hongwei Ding, Minmin Qiu, Jin Dong

Manufacturing processes produce large amounts of carbon emissions, which push them to apply renewable energy to mitigate emissions from the production and operations. A green multi-period production scheduling optimization method for the single machine scheduling problem is addressed and proposed, and applications of renewable energy and fossil energy in the method is balanced and optimized.

5 - Environmental Impact Analysis of Shipping Food and Supplies to Galapagos Islands
Xu Yang, Postdoctoral Associate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Room E40-211, Cambridge, MA, 02139, United States of America, xu_yang@mit.edu, Edgar Blanco, Ximena Cordova-Vallejo

We conduct an analysis of the environmental impact of shipping food and supplies from Ecuador mainland to Galapagos Islands. All three modes of transportation (road, air and sea) are used in the shipping legs of different shipping routes. We focus on carbon emissions from the transportation in this study. We apply the NTM Methodology to calculate the carbon emissions from road, air and sea transportation. We also discuss how to reduce the environmental impact and manage the waste on the islands.

Wednesday, 4:30pm - 6:00pm

■ WE01

C - Room 201A

Stochastic Processes

Contributed Session

Chair: Oleksii Mostovyi, Carnegie Mellon University, Department of Mathematical Sciences, Pittsburgh, PA, United States of America, omostovy@andrew.cmu.edu

1 - A Modified Hourglass Model for Neural Activity

Cristina Lopez, Universidad de los Andes, Cra 1 Este # 19A-40, Bogota, Colombia, c.lopez35@uniandes.edu.co, Raha Akhavan-Tabatabaei, Viswanathan Arunachalam

We propose a stochastic model for the biological neural network activity in which the spike intervals are based on the frequency of excitation. The proposed model is used to construct a modified hourglass network model in which the interconnected neurons are inhibitory.

2 - A Simple Approximation for the Renewal Function and it's Integral

Hossein Parsa, Mississippi State University, 321B McCain building, Msstate, MS, 39762, United States of America, hp83@msstate.edu, Mingzhou Jin

A new simple approximation is proposed to compute the renewal function and its integral. The asymptotic approximation of the renewal function and its integral may not perform well when t is not large enough. To overcome the inaccuracy of the asymptotic approximation, we propose a modified approximation that computes the renewal function and its integral for the entire range of t while the challenge is to get an explicit expression rather than just to compute the renewal function numerically.

3 - Stochastic Truck Assignment

Subhro Mitra, Assistant Professor, University of North Texas at Dallas, 7400 University Hill, Dallas, TX, 75241, United States of America, subhro.mitra@unt.edu, Joseph Szmerekovsky

There are not many stochastic traffic assignment methodologies which have been applied in freight flow models. The behavioral assumption governing route choice differs considerably in the case of truck traffic from the case of passenger vehicle traffic. We developed a stochastic truck traffic assignment methodology. In our stochastic assignment model for truck traffic we use Monte Carlo simulation to generate the random component of the perceived time and the variable cost.

4 - Nonparametric Multivariate Distribution Estimation and Factor Selection for Mixed-type Datasets

Bryan Pearce, Clemson University, 103 Freeman Hall, Clemson, SC, 29634, United States of America, bpearce@clemson.edu, Kevin Taaffe

Application of stochastic tools to systems with interacting input factors requires specification of multivariate probability distributions. Mixed continuous, nominal, and/or ordinal factor sets prohibit usage of most classic distribution fitting strategies. Methods are presented for selecting relevant factors from the dataset and applying modified kernel density estimation techniques, with motivating examples from the healthcare and aerospace industries.

5 - Necessary and Sufficient Conditions in the Problem of Optimal Investment with Intermediate Consumption

Oleksii Mostovyi, Carnegie Mellon University, Department of Mathematical Sciences, Pittsburgh, PA, United States of America, omostovy@andrew.cmu.edu

We consider the problem of maximizing the expected utility of consumption and terminal wealth in the framework of a general incomplete semimartingale model of a financial market. We show that the necessary and sufficient conditions on the utility stochastic field and the model of a financial market, are that the value functions of the primal and dual problems are finite.

■ WE02

C - Room 201B

Structural Topics in Marketing

Contributed Session

Chair: Yin Zhou, Xi'an Jiaotong University, 28# Xianning West Road, Xi'an, China, celina528@gmail.com

1 - New Product Introduction in Supply Chains: Upward Extension, Fighter Brand, or Substitution?

Chia-Wei Kuo, National Taiwan University, 1 Sec 4 Roosevelt Road, Taipei, Taiwan - ROC, cwkuo@ntu.edu.tw, Ying-Ju Chen

We investigate how the manufacturer or the retailer introduces new products in this national-store-brand context. We find in the absence of cost efficiency discrepancy, the retailer typically introduces a new product with a quality closer to the national brand, whereas the manufacturer meticulously positions the new product to facilitate finer market segmentation. We also demonstrate the possibility that the control right can be inconsequential in the product line design.

2 - Store Within a Store Selection Based on the Demand Forecast

Wenbo Teng, Xi'an Jiaotong University, 28# Xianning West Road, Xi'an, China, Tengwenbo@sogou.com, Yin Zhou, Qian Peng, Danping Wang

This paper studies the impact of product substitutability, market uncertainty and demand forecast on the profit of the channel members under SWS (Store within a store) and traditional mode. The conclusion implies that the manufactory prefers SWS mode with low product substitutability, high market uncertainty and more demand forecast improvement. And when some conditions are satisfied, SWS mode is a Pareto strategy for both of the channel members.

3 - The Moderating Influence of Perceived Choice Freedom and its Antecedents in Chinese Gray Marketing

Qian Peng, Xiían Jiaotong University, 28# Xianning West Road, Xiían, China, rickiqian@stu.xjtu.edu.cn, Danping Wang, Wenbo Teng, Gui-jun Zhuang, Yin Zhou

This paper extends the TPB under the marketing ethics context, that is, in a gray marketing setting. Findings from a survey of 592 professional salespersons in China indicate that, un-ethicalness judgment (A), organization's connivance(SN), perceived choice freedom(PBC) have significant influence on the gray-marketing intention, the antecedents (referent groups both inside and outside organizations) have negative effect on PBC which also moderates the gray-marketing ethical decision-making.

4 - When Does Relational Governance Inhibit Opportunism in China: A Contingency Framework

Yin Zhou, Xi'an Jiaotong University, 28# Xianning West Road, Xi'an, China, celina528@gmail.com, Danping Wang, Wenbo Teng, Gui-jun Zhuang, Qian Peng

This research develops a contingency framework from a process-based view suggesting that the relationship between relational governance(RG) and opportunism(OP) is dependent on interorganizational relationship quality(IRQ). A survey of 152 respondents in China shows that when IRQ is low, RG in terms of joint planning will inhibit OP while joint problem solving will exacerbate OP; Conversely, when IRQ is high, joint planning will exacerbate OP while joint problem solving will inhibit OP.

■ WE03

C - Room 202A

Procurement and Costing

Contributed Session

Chair: Ozden Cakici, PhD Candidate, University of Rochester, Carol G. Simon Hall 4th Floor, Rochester, NY, 14620, United States of America, engin.cakici@simon.rochester.edu

1 - A Two-stage Procurement Problem under a Budgetary Constraint

Dogan Serel, Bilkent University, Faculty of Business Administration, 06800 Bilkent, Ankara, Turkey, serel@bilkent.edu.tr

We consider a single-period inventory problem in which two different orders are placed for the products. The first order is based on an initial demand forecast. After collecting market data, the demand forecast is revised, and a second order is placed. Because the purchase cost is higher for the second order, the retailer faces a tradeoff between the demand forecast accuracy and supply cost. We determine the retailer's optimal procurement policy using a computational procedure.

2 - The Effect of Contracts Within the Last Buy Problem
Nicholas Leifker, Assistant Professor, St. John Fisher College, 348 Wintergreen Way, Rochester, NY, 14618, United States of America, nleifker@sjfc.edu, Timothy Lowe, Philip Jones

The last buy problem is an inventory optimization problem in which the goal is to find the optimal "final" order amount for spare parts for end-of-life products. We will look at multiple models based on the actions taken once the last buy has run out - specifically, whether or not replenishment at a premium cost is possible. Based on these models, we will then examine the effect of contractual issues within the last buy, such as the use of contract extensions and contract pooling.

3 - Introduction of (Q,R,S) Inventory Policy under Continuous Time Costing
Ozden Cakici, PhD Candidate, University of Rochester, Carol G. Simon Hall 4th Floor, Rochester, NY, 14620, United States of America, engin.cakici@simon.rochester.edu, Harry Groenevelt

We investigate a (Q,R,S) inventory policy that orders in multiples of Q units, reviews every R time units, and inventory position never exceeds S. The model combines periodic and continuous review, and assumes a convex inventory cost rate function and stationary demand with independent increments. Continuous time costing allows comparison between policies with different review periods. We also show how the model can be extended to incorporate random lead times under certain conditions.

■ WE07

C - Room 204

Advances in Queueing Theory

Contributed Session

Chair: Muhammad El-Taha, Professor, University of Southern Maine, Department of Mathematics & Statistics, 96 Falmouth St., Portland, ME, 04104, United States of America, eltaha@usm.maine.edu

1 - Asymptotic Analysis of Blocking Probability under GI/M/s/s Systems with Heavy Traffic
Chia-Hung Wang, Department of Mathematical Sciences, National Chengchi University, No.115, Fuxing Rd., Yongkang Dist., Tainan, 71051, Taiwan - ROC, jhwang728@hotmail.com, Hsing Luh

This paper presents a heavy-traffic queueing model, where the traffic intensity increases to one as the number of servers approaches to infinity. An approximation and the asymptotic behavior are studied for the blocking probability with a sequence of queues indexed by the number of servers. In conclusive results, blocking probabilities are estimated analytically with heavy traffic under assumptions of exponential, deterministic and Erlang-r inter-arrival time distributions, individually.

2 - Error Estimation of Decomposition Methods for Analysis of Queuing System with Finite Buffer
Shanshan Qiu, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, dy5145@wayne.edu, Alper Murat, Ratna Chinnam

Decomposition methods are popular approximation approaches to the throughput analysis of production systems with unreliable machines and finite buffer capacities. In this research we try to determine precisely the performance of these methods. An analytic, rather than only numerical, upper bound on the error of Gershwin decomposition method (1983) is developed.

3 - A Gaussian-based Approximation of Congestion and Queue Time under Conditions of Stochastic and Non-stationary Arrival Rates
Michael Haughton, School of Business and Economics, Wilfrid Laurier University, 75 University Avenue West, Waterloo, ON, Canada, mhaughton@wlu.ca, KP Sapna

We propose a computationally efficient and reliably accurate method for estimating queue length (congestion) and queue time in systens characterised by stochastic and non-stationary arrival rates. The proposed Gaussian-based approach uses properties of the truncated normal distribution and provides time-dependent estimates for both metrics of queueing system performance. The quality of the proposed approximation is examined for a wide range of sinusoidal arrival rate functions and for empirical arrival rate data in the extant literature. Given its accuracy, the approximation is an effective alternative to extensve simulations.

4 - Sample-path Analysis of Queues with Batch Arrivals
Muhammad El-Taha, Professor, University of Southern Maine, Department of Mathematics & Statistics, 96 Falmouth St., Portland, ME, 04104, United States of America, eltaha@usm.maine.edu

In this talk we give a deterministic proof of a result that extends the Pollaczek-Khintchine formula for a batch arrival queueing model. We also give a conservation law for the same system with multiple classes. Our results are completely rigorous and holds under weaker assumption than those given in the literature. We do not make stochastic assumptions, so the results hold almost surely on every sample path of the stochastic process that describes the system evolution.

■ WE08

C - Room 205

Topics in Dynamic Programming

Contributed Session

Chair: Mohammad Mousavi, Stanford University, Stanford, CA, 94305, United States of America, mousavi@stanford.edu

1 - Improved Dynamic Programming Algorithm for the Resource Constrained Elementary Shortest Path Problem
Hyunchul Tae, Doctoral Candidate, POSTECH, 207-o, 4th Enginner Building, POSTECH, Hyoja-Dong, Nam-gu, Pohang, Korea, Republic of, scipio@postech.ac.kr, Byung-In Kim

The resource constrained elementary shortest path problem (RCESPP) is a sub-problem of column generation approach for vehicle routing problems. Column generation approach generally invokes many execution of the sub-problem so an efficient RCESPP algorithm is required for the approach. In this talk, we propose a new RCESPP dynamic programming algorithm. Computational results show that our algorithm can find near optimal solutions faster than other algorithms.

2 - Stochastic Dynamic Dispatch Policies for Consolidation Systems with Cargo Capacity
Liqing Zhang, Texas A&M University, Industrial & Systems Engineering, TAMU, College Station, TX, 77843, United States of America, liqing@tamu.edu, Sila Cetinkaya

We study a periodic review, stochastic dynamic distribution system where the transportation is conducted by a fleet of trucks with cargo capacity constraints. We first consider the case of single-truck and then examine the multi-truck case. For the multi-truck case, the transportation cost includes a multiple set-up cost term representing the cargo costs and capacities. We examine the optimal dispatch policies for both cases.

3 - An Approach for Dynamic Optimization in Evidence-based Prevention Program
Yuncheol Kang, Pennsylvania State University, 236 Leonhard Bldg., University Park, PA, United States of America, yckang@psu.edu, Vittal Prabhu

In this study, we present an idea for optimizing evidence-based prevention program (EBP) implementations in stochastic and dynamic environments. Our methodology is primarily focused on the Markov Decision Process (MDP) approach for dynamically optimizing implementations in EBP. We review MDP approach, illustrate its application, and discuss potential challenges in applying such approaches in practice.

■ WE09

C - Room 206A

Model Selection and Mis-specification Issues in Revenue Management

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Omar Besbes, Assistant Professor, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, ob2105@columbia.edu

1 - Dynamic Valuation of Delinquent Credit-Card Accounts
Naveed Chehrazi, PhD Candidate, Stanford University, Huang Engineering Center, Stanford, CA, 94305, United States of America, chehrazi@stanford.edu, Thomas Weber

We develop a dynamic method to estimate the repayment probability of a delinquent credit-card account given a bank's collection strategy as well as account-specific and macroeconomic information. Unlike the FICO score, the dynamic collectability score (DCS) constructed from our model represents the actual chance of collecting a given percentage of an outstanding debt over a specified time horizon. The DCS method is then used to price delinquent credit-card accounts based on repayment data.

2 - Model Specification and Buy Up in Revenue Management
William Cooper, University of Minnesota, Industrial and Systems Engineering, Minneapolis, MN, 55455, United States of America, billcoop@me.umn.edu, Le Li

We consider a revenue manager who controls bookings over a series of flights with a buy-up model, and updates estimates of the model parameters. We study the evolution of the estimates and the chosen booking limits when the buy-up model is misspecified, i.e., when there is no setting of its parameters such that its objective function gives an accurate representation of expected revenue as a function of the booking limit. We focus on settings where customers arrive according to Poisson processes.

3 - Directed Principal Component Analysis
Yi-hao Kao, Stanford University, Packard 274, Stanford, CA, United States of America, yihaokao@stanford.edu, Benjamin Van Roy

We consider a problem that involves estimating a covariance matrix and making a decision based on that estimate. Such problems arise in portfolio management among other areas, and a common approach is to apply principal component analysis to estimate a parsimonious factor model. This approach treats estimation and optimization separately. We propose directed PCA, an estimation algorithm that takes the decision objective into account, and demonstrate that it offers significant benefits.

4 - On the (surprising) Sufficiency of Linear Demand Models for Learning and Earning
Omar Besbes, Assistant Professor, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, ob2105@columbia.edu, Assaf Zeevi

We study a pricing problem in which the decision-maker (DM) does not have access to the true underlying demand model. Inspired by practice, we consider the case in which the DM postulates a parametric class of models and frequently recalibrates the parameters to re-optimize decisions. We analyze the impact of a key element almost always present in practice but often ignored in the literature: model mis-specification. We show that the price of mis-specification may be surprisingly small.

■ WE11

C - Room 207A

The Skorokhod Problem and Stochastic Networks

Sponsor: Applied Probability

Sponsored Session

Chair: Kavita Ramanan, Brown University, Providence, RI, United States of America, kavita_ramanan@brown.edu

1 - Optimal Control for Parallel Server Model at Equilibrium of the Fluid Limit, Using Measure Valued Processes
Haya Kaspi, Technion, Technion City, Haifa, 32000, Israel, iehaya@tx.technion.ac.il, Rami Atar, Nahum Shimkin

We study the multi-class parallel service model with reneging in the many servers fluid limit. The various classes have independent arrival processes, service times and patience. We assume that the service times and patience of the various classes have densities. Our main tool for the study is previous work by Kaspi-Ramanan and Kang-Ramanan on fluid limits of many servers queuing systems. We study a fixed, non preemptive priority assignments and identify the behavior of the queue as the unique solution of the corresponding measure valued fluid equations. We show that in the limit, at equilibrium, the preemptive and the corresponding non preemptive assignments policies give rise to the same solution. When reneging is exponential (with different parameters for different classes of customers) we show that, for a natural cost function, an analogue of the cu_9 priority assignment rule is asymptotically optimal at equilibrium. The proof of uniqueness for the solutions of the fluid equations relies on the uniqueness of a solution of a Skorokhod problem which is quite different from those appearing in conventional heavy traffic analysis.

2 - Stability of the Skorokhod Problem is Undecidable
David Gamarnik, Massachusetts Institute of Technology, 100 Main Street E62-563, Sloan School of Management, Cambridge, MA, 02139, United States of America, gamarnik@mit.edu, Dmitriy Katz-Rogozhnikov

The Skorokhod problem arises in studying Reflected Brownian Motion (RBM) and the associated fluid model on an non-negative orthant. One of the key problems is identifying conditions for stability of a Skorokhod problem arising in this context, defined as the property that trajectories are attracted to the origin. The stability conditions are known in dimension up to three, but not for general dimensions. In this paper we explain the fundamental difficulties encountered in trying to establish stability conditions for general dimensions. We prove that stability of the Skorokhod problem associated with a fluid model of an RBM is an undecidable property, when the starting state is a part of the input. Namely, there does not exist an algorithm (a constructive procedure) for identifying stable Skorokhod problem in general dimensions.

3 - Large Deviations Analysis for Symmetric RBM in 3-d
John Hasenbein, Associate Professor, University of Texas at Austin, ETC 5.128B, Department of Mechanical Engineering, Austin, TX, 78712-1063, United States of America, jhas@mail.utexas.edu, Ziyu Liang

We analyze the variational problem which arises from the large deviations principle for RBM in the positive 3-d orthant. In particular, we investigate the cases of rotationally and mirror symmetric RBM data. The goal is to determine general characteristics of optimal paths, which allow more efficient computational procedures for obtaining the exponent in the rate function.

■ WE14

C - Room 208A

Simulations in Energy Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy

Sponsored Session

Chair: Augusto Rupérez Micola, Universitat Pompeu Fabra, Ramon Trias Fargas 25, Barcelona, Spain, augusto.ruperezmicola@gmail.com

1 - Heterogeneous Agents in Electricity Forward Markets
Ronald Huisman, Associate Professor, Erasmus School of Economics / Erasmus University, P.O. Box 1738, Rotterdam, 3000DR, Netherlands, rhuisman@ese.eur.nl

We examine the presence of heterogeneous agents in electricity forward markets. We set up an agent based price model and make a distinction between fundamental and chartist agents. Agents are allowed to switch between groups conditional on recent performance. We find evidence that both fundamental and chartists are present in electricity futures markets, that fundamental agents base their expectations at least partly on fuel prices and that the agents switch between strategies over time.

2 - Pricing Mechanism for Real-time Balancing in Regional Electricity Markets
Wolf Ketter, Assistant Professor, Rotterdam School of Management, Burgemeester Oudlaan 50, T9-07, Rotterdam, 3062PA, Netherlands, WKetter@rsm.nl, Mathijs de Weerdt, John Collins

We consider the problem of designing a pricing mechanism for precisely controlling the real-time balance in electricity markets, where retail brokers aggregate the supply and demand of a number of individual customers, and must purchase or sell power at the wholesale level such that the total supply matches total demand. In real time, balancing must be done through purchase of regulating services, and by remotely controlling portions of their retail customer loads and sources.

3 - Wind Power Trading by Firms with Mixed Generation Portfolios
Abhishek Somani, PhD Economics Candidate, Iowa State University, Economics Department, Heady Hall 477, Ames, IA, 50011, United States of America, asomani@iastate.edu, Huan Zhao, Leigh Tesfatsion, Nivad Navid

The market rules governing wind power are still evolving and could lead to profit opportunities for some firms while disadvantaging others, depending on the nature of the rules and the generation portfolio mix of each firm. We use analytical and agent-based models to examine the effects of market rules on the trading strategies of profit-seeking firms that supply energy in wholesale power markets using portfolios of generation assets combining both conventional and wind resources.

■ WE19

C - Room 210B

Financial Engineering

Contributed Session

Chair: Nalan Gulpinar, The University of Warwick, Warwick Business School, Coventry, United Kingdom, ngulpinar@hotmail.com

1 - A General Two-factor Lattice Method for Stochastic Volatility Models

Chung-Li Tseng, Associate Professor, University of New South Wales, Australian School of Business, Sydney, Australia, c.tseng@unsw.edu.au, Wei-Chung Maio, San-Lin Chung, Pai-Ta Shih

We propose a general two-factor trinomial lattice method, extended from Hull and White (1994), to approximate diffusion processes with state-dependent volatilities. Lattice parameters are optimized to guarantee that branching probabilities are legitimate at all nodes and all stages, even if both state variables are highly correlated. Numerical tests against analytical benchmarks indicate the proposed lattice model can accurately value financial assets with two state variables.

2 - Dynamics of Reference Point and its Impact on Investor's Behavior

Yun Shi, The Chinese University of Hong Kong, Department of Systems Engineering, Rm 910A, ERB Shatin, Hong Kong, Hong Kong - ROC, yshi@se.cuhk.edu.hk, Jing Yao, Duan Li, Xiangyu Cui

Suitable modeling of dynamics of reference point plays a significant role in describing investor's behavior in dynamic situations. In the framework of prospect-theory preference, we formulate the dynamics of the reference point based on the investor's aspiration level for her/his investment performance and derive semi-analytical solution for the model. We further demonstrate our result to shed light on the disposition effect.

3 - Robust Regime-switching Portfolio Management under Supply Disruption

Nalan Gulpinar, The University of Warwick, Warwick Business School, Coventry, United Kingdom, ngulpinar@hotmail.com, Ethem Canakoglu

This paper is concerned with robust investment strategies for portfolio management under supply disruption within petroleum markets. We develop a regime-switching model where different regimes reflect the exogenous effects of supply disruption. We introduce a tractable robust approach to reduce parameter estimation errors arising within price dynamics. Numerical experiments are designed to investigate modelling implications of different price dynamics and market regimes.

■ WE20

C - Room 211A

Combinatorial Optimization

Contributed Session

Chair: Ping Ji, Associate Professor, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, Hong Kong - PRC, mfpji@inet.polyu.edu.hk

1 - Fleet Size and Mix Workover Rigs Scheduling Problem on Onshore Oil Fields

Werner Soares, Universidade Federal de Pernambuco, Av. Acadĺmico Hélio Ramos, s/n - Cidade, Recide, Brazil, werner.soares@gmail.com, Dario José Aloise, Ana Paula Costa

Important services on oil wells in onshore oil fields are performed by expensive workover rigs. Therefore, a good choice of fleet size and mix and scheduling of such equipment is necessary. However, in literature, the quantities are considered fixed, a priori, and the rigs generally homogeneous. In this work, heuristics are developed for the more complete version, presenting promising computational results on benchmarks instances.

2 - Application of Tabu Search Metaheuristics to Police Precincts Location

André Gurgel, Universidade Federal de Pernambuco, Av. Acadĺmico Hélio Ramos, s/n - Cidade, Recife, Brazil, andmgurgel@gmail.com, Rodrigo Ferreira, Dario José Aloise, Caroline Mota, Werner Soares

Location of police precincts is a strategic decision that can affect operations efficiency in terms of service time and costs. Based on p-median modeling, it was proposed a strategy of tabu search with path relinking and applied to the public security improvement of Natal city, Brazil. Results show a reduction of 44% in the total traveled distance, improving the routing of police patrols and service levels, increasing the number of solved cases.

3 - Optimization Models for Center Based Multicasting Routing

Carlos Oliveira, Bloomberg LP, 731 Lexington Ave, New York, NY, United States of America, coliveira@gmail.com

In multicast routing, data is transferred from one or more sources to a set of destinations. A popular strategy for maintaining multicast routing trees is to use a center node that serves as a hub for the network. In this talk, we present optimization models for this problem. We describe algorithms and discuss computational results from the the proposed approaches.

4 - A New Objective to Reconstruct Flux Distributions from Elementary Modes in Metabolic Networks

Ping Ji, Associate Professor, The Hong Kong Polytechnic University, Hung Hom, Kowloon, Hong Kong, Hong Kong - PRC, mfpji@inet.polyu.edu.hk, Siu Hung Joshua Chan

Metabolic network has been successful in studying cellular metabolism. Flux distribution in the network can be reconstructed from elementary modes to gain insights but the reconstruction is not unique, depending on the objective chosen. Based on a previous experiment suggesting the linearity in the co-regulation of metabolic pathways, we propose a new objective for the reconstruction by minimizing branchpoints to interpret flux distributions from a pathway perspective accurately.

5 - Disaggregation of Linear Diophantine Equation over Bounded Set

Bojun Lu, The Chinese University of Hong Kong, Department of Systems Engineering, 910A, ERB, Shatin, NT, Hong Kong - PRC, bjlu@se.cuhk.edu.hk, Duan Li

While linear Diophantine equation (LDE) over bounded set finds numerous applications, including cryptosystem and reachability study of Petri Nets, this classical challenge is known to be NP-hard. We consider in this research disaggregation schemes for LDE, i.e., to transform LDE into two equivalent integer linear equations using modular arithmetic in number theory. When disaggregation is attained in an iterative fashion, we can achieve dimension reduction successively.

■ WE21

C - Room 211B

Applied Stochastic Programming in Finance and Energy

Sponsor: Optimization/Stochastic Programming

Sponsored Session

Chair: Giorgio Consigli, Universit‡ degli studi di Bergamo, Italy, giorgio.consigli@unibg.it

1 - Stochastic Models for the Capacity Expansion Problem of a Power Producer

Maria Teresa Vespucci, Associate Professor, University of Bergamo, via Marconi 5, Dalmine, BG, 24044, Italy, maria-teresa.vespucci@unibg.it, Marida Bertocchi, Rosella Giacometti, Mario Innorta, Stefano Zigrino

We present a stochastic model for the optimal investment decisions in capacity expansion of a power producer, choosing among different technologies (thermal and renewable energy plants) and taking into account the uncertainty in fuel prices. A linear combination of the expected profit and of a risk measure must be maximized, with constraints on CO2 emissions and on sites availability for new plants. The expected profit includes revenues and costs for green certificates and CO2 emission permits.

2 - Generation Capacity Expansion with Long and Short Tern Uncertainties

Yves Smeers, Université Cathoique de Louvain, CORE, Voie du Roman Pays 34, Louvain-la-Neuve, 1348, Belgium, yves.smeers@uclouvain.be, Gauthier de Mae dí Aertrycke, Andreas Ehrenmann, Alexander Shapiro

We consider the problem of generation capacity expansion where the evaluation of the marginal value of plants is complicated by the penetration of intermittent sources. We apply sampling methods both in static and multistage environments in order to assess the distribution of the cash flow of generation units.

3 - Optimal Capital Growth with Convex Loss Penalties

Len MacLean, Herbert Lamb Chair, Dalhousie University, 6100 University Avenue, Halifax, NS, B3H 3J5, Canada, L.C.MacLean@DAL.CA, Yonggan Zhao, William T. Ziemba

In this paper the traditional capital growth model and modifications to control risk are developed. A mixture model based on Markov transitions between normally distributed market regimes is used for the dynamics of asset prices. Decisions on investment in assets are determined from a constrained growth model, where the trajectory of wealth is required to exceed a specified path over time with high probability, and the path violations are penalized using a convex loss function.

4 - Property and Casualty Dynamic Portfolio Optimization
Giorgio Consigli, Universit‡ degli studi di Bergamo, Italy, giorgio.consigli@unibg.it, Davide Musitelli, Massimo di Tria, Gaetano Iaquinta, Angelo Uristani, Vittorio Moriggia

Recent trends in the insurance sector have highlighted expansion of large insurance firms into asset management. The phenomenon has far reaching implications for the definition of optimal asset-liability management (ALM) strategies at the aggregate level and for capital required by insurance companies. In this article we present an ALM model tested in a real-world case study, combining in a dynamic framework an optimal strategic asset allocation problem formulation subject to property and casualty (P&C) business constraints for a large insurer. The benefits of a dynamic formulation and the opportunities arising from of an integrated approach to investment and P&C insurance management are highlighted in this chapter.

■ WE22

C - Room 212A

Continuous Optimization

Contributed Session

Chair: John Liu, Professor, City University of Hong Kong, CTFS, College of Business, Tat Chee Avenue, Kowloon, Hong Kong - PRC, liujjp@gmail.com

1 - Applications of Optimization Techniques in Quantum Chemistry
Mituhiro Fukuda, Tokyo Institute of Technology, 2-12-1-W8-41, Ookayama, Meguro-ku, Tokyo, Japan, mituhiro@is.titech.ac.jp, Maho Nakata, Katsuki Fujisawa

Certain problems in quantum chemistry can be cast as a continuous optimization problem. In particular, approximations using semidefinite programming (SDP) have been demonstrated to be very accurate for small atoms and molecules. We will discuss the formulations, and give numerical results on large-scale SDPs for these chemical compounds. These problems can be also seen as a generalization of the max-cut problem in graph theory in a higher dimension.

2 - Branch-and-Sandwich: An Algorithm for Optimistic Bi-level Programming Problems
Polyxeni Kleniati, Imperial College London, Centre for Process Systems Engineering, Department of Chemical Engineering, London, SW7 2AZ, United Kingdom, polyxeni.kleniati03@imperial.ac.uk, Claire S Adjiman

We tackle the optimistic bi-level programming problem with a nonconvex inner program. We explore two solution spaces, corresponding to the inner and outer problems, using a single branch-and-bound tree. The proposed subdivision process is shown exhaustive if all variables are selected for branching. The inner best (upper) bound is shown consistent and improving for the inner problem. It is used to tighten the best (lower) bound for the outer problem which is also shown consistent and improving.

3 - Conditional Gradient Algorithms for Rank-one Matrix Approximations with a Sparsity Constraint
Ronny Luss, Tel Aviv University, School of Mathematical Sciences, Ramat Aviv, Tel Aviv, 69978, Israel, ronnyluss@gmail.com, Marc Teboulle

The sparsity constrained rank-one matrix approximation problem is a difficult mathematical optimization problem arising in a wide array of useful applications. We introduce an algorithmic framework that unifies a variety of seemingly different algorithms that have been derived from disparate approaches. Building on the old and well-known conditional gradient algorithm, we provide a simplified version which either is given by an analytic formula or requires a very low computational complexity.

4 - Error Analysis of Meshfree Approximation Methods Based on Convex Optimization
Agustin Bompadre, Postdoctoral Fellow, California Institute of Technology, 1200 E. California Boulevard, Pasadena, CA, 91125, United States of America, abompadr@gmail.com, Michael Ortiz

Approximation methods are used to solve numerically PDEs in Material Science. In this talk, we discuss meshfree approximation methods, which are methods that avoid meshing the domain. We give a set of sufficient conditions to guarantee the convergence of approximates based on meshfree methods. We review the Local Maximum-Entropy approximation scheme, which is a meshfree approximation method based on an optimization principle, and we show that the general error bounds apply to this method.

5 - Solution Characteristics of a Nonsmooth Convex Program with Nonpolyhedron Frontier Constraints
John Liu, Professor, City University of Hong Kong, CTFS, College of Business, Tat Chee Avenue, Kowloon, Hong Kong - PRC, liujjp@gmail.com, Xuesong Li, Jiguang Yuan

We are concerned about a convex program with a nonsmooth objective function and nonpolyhedron goal constraints (termed frontier constraints), that is embraced with a range of optimization applications, such as multi-dimension frontier analysis, multi-objective programming, and data envelopment analysis. We obtain solution characteristics of a nonpolyhedron nonsmooth convex program. Then, we formulate solution programs to determine nondominated points of a nonpolyhedron solution set.

■ WE23

C - Room 212B

Evacuations

Contributed Session

Chair: Chrysafis Vogiatzis, PhD Student, University of Florida, Department of Industrial and Systems Eng., Gainesville, FL, 32608, United States of America, chvogiat@ufl.edu

1 - Dynamically Locating Control Sensors During Emergency Evacuations
Jiaming Qiu, Rensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States of America, qiuj@rpi.edu, Jeff Ban, Thomas Sharkey

We propose dynamic location models for the deployment of control sensors in traffic systems during an emergency evacuation with the objective of minimizing the total system evacuation time. We provide a rolling destination procedure that first focuses on evacuating a critical area of the network (for example, the coastline in the case of hurricanes) and then gradually expands this area over time. Computational results for realistic traffic systems will be presented.

2 - Research Projekt REPKA - Regional Evacuation: Planning, Control, and Adaptation
Katharina Gerhardt, TU Kaiserslautern, Paul-Ehrlich-Str. 14, Kaiserslautern, 67663, Germany, gerhardt@mathematik.uni-kl.de

A basic rescue measure in case of attacks and natural disasters is the evacuation of affected buildings and regions. We focus on the situation that occurs when a large crowd has already left a building and must then be brought further away to places that are rated safe. Mathematical optimization and simulation is used to develop practical evacuation plans for an entire region. Relief units are then able to run through multiple situations before a disaster actually occurs.

3 - Evacuation Management under Extreme Tropical Events
Chrysafis Vogiatzis, PhD Student, University of Florida, Department of Industrial and Systems Eng., Gainesville, FL, 32608, United States of America, chvogiat@ufl.edu, Panos Pardalos

In this talk, an original multimodal transportation education virtual appliance (MTEVA) is presented. In the appliance, a storm surge and inundation model is coupled with a transportation model and an optimization engine, which form this evacuation planning software. Evacuation planning is performed online (using cloud computing) and is dynamic, depending on the storm characteristics at every time. Computational results for large scale network optimization are also given.

■ WE24

C - Room 213A

Topics in Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Alejandro Toriello, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER 240, Los Angeles, CA, 90089, United States of America, toriello@usc.edu

1 - Convex Optimization over the Integers
Daniel Dadush, PhD Student, Georgia Tech, Atlanta, GA, United States of America, dndadush@gatech.edu

We extend and improve upon the classic works of Lenstra '79 and Kannan '83 on Integer Programming in fixed dimension. We provide an algorithm to exactly minimize a convex function over the integer points in any compact convex set (suitably presented) of essential complexity O(n)^n, where n is the number of integer variables. Comparing to previous works, we provide the fastest algorithm for Integer Linear Programming and show how to extend generic convex optimization to the integer setting.

2 - Sell or Hold: A Simple Two-stage Stochastic Combinatorial Optimization Problem
Qie He, Georgia Tech ISyE, 765 Ferst Dr NW, Atlanta, United States of America, qie.he@gatech.edu, Shabbir Ahmed, George Nemhauser

There are k out of n individual assets to be sold over two stages with known first-stage prices and distribution of second-stage prices. The sell or hold problem (SHP) is to determine which assets are to be sold at each stage to maximize the total expected revenue. We show that SHP is NP-hard when second-stage prices are realized as a finite set of scenarios. We identify a polynomially solvable case of SHP. A max{1/2,k/n}-approximation algorithm is presented for the scenario-based SHP.

3 - Facets for Single-node Capacitated Flow Set Using n-step MIR
Kiavash Kianfar, Assistant Professor, Texas A&M University, TAMU 3131, College Station, TX, 77843-3131, United States of America, kianfar@tamu.edu

Pochet and Wolsey (1995) introduced partition inequalities for three substructures, namely the integer knapsack set with divisible coefficients and two forms of single-node capacitated flow set with divisible coefficients. We show that the n-step MIR inequalities of Kianfar and Fathi (2009) not only generate/dominate these partition inequalities but also give new facets for the generalization of the three sets above to the case where coefficients are not necessarily divisible.

4 - Optimal Toll Design: A Lower Bound Framework for the Traveling Salesman Problem
Alejandro Toriello, Assistant Professor, University of Southern California, 3715 McClintock Avenue, GER 240, Los Angeles, CA, 90089, United States of America, toriello@usc.edu

We propose a framework of lower bounds for the asymmetric traveling salesman problem based on approximating the dynamic programming formulation, and give an economic interpretation wherein the salesman must pay tolls as he travels between cities. We then introduce an exact reformulation that generates a family of successively tighter lower bounds, all solvable in polynomial time. We discuss computational results on benchmark instances.

■ WE25

C - Room 213BC

Supply Chain Management

Sponsor: Manufacturing & Service Oper Mgmt

Sponsored Session

Chair: Gurhan Kok, Duke University, The Fuqua School of Business, Durham, NC, United States of America, gurhan.kok@duke.edu

1 - Centralized and Decentralized Dynamic Price and Lead Time Quotation
Baykal Hafizoglu, Graduate Research Assistant, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, baykal@asu.edu, Pinar Keskinocak, Esma Gel

We discuss dynamic price and lead time quotation problem in a make-to-order system under two decision making settings: (1) centralized setting considers a central agent determining price and lead times jointly, and (2) decentralized setting assumes that price and lead time decisions are taken respectively by marketing and manufacturing departments. We analyze the optimal price and lead time decisions under both settings and discuss the inefficiencies of decentralized decision making.

2 - Strategic Communication for Capacity Alignment with Pricing in a Supply Chain
Hyoduk Shin, Assistant Professor, Northwestern University, Kellogg School of Management, Evanston, IL, 60201, United States of America, hyoduk-shin@kellogg.northwestern.edu, Noam Shamir, Leon Chu

We study demand information sharing in a supply chain. A retailer with demand information decides whether to strategically communicate his private information with the manufacturer, after which the manufacturer determines the capacity and the wholesale price. We show that if the value of information is large, the information can be voluntarily shared fully in a discrete demand distribution. Otherwise, in general, information will be shared partially depending on the value of information.

3 - Rationing Policies in Two-Echelon Distribution Systems
Frank W. Ciarallo, Wright State University, Dayton, OH, United States of America, frank.ciarallo@wright.edu, Zumbul Atan

We study two-retailer, one-warehouse systems with base-stock ordering and critical value rationing at the warehouse. Rationing policies reserve a portion of warehouse stock for replenishment orders from one retailer. Our study allows for an alternate path for orders from the lower priority retailer directly to the supplier when rationing is active. We develop a heuristic based on a cost approximation and evaluate its performance, as well as gain insight into the use of critical value rationing.

■ WE26

C - Room 213D

Choice and Assortment Planning

Contributed Session

Chair: Mrinmay Deb, Doctoral Student, Pennsylvania State University, 479 Business Building, University Park, State College, PA, 16802, United States of America, mud166@psu.edu

1 - An Objective Operational Learning Approach to Dynamic Assortment Planning
Vivek Ramamurthy, University of California-Berkeley, 450/42 Sutardja Dai Hall, Berkeley, CA, United States of America, vivek_ramamurthy@berkeley.edu, Z. Max Shen

We consider the problem of determining the optimal assortment of products to offer to maximize the expected revenue, while making minimal assumptions about the customer demand model. We consider a model that constructs an objective estimate of the revenue, as a function of the assortment offered, and the demand estimated from sales data. The performance of the approach is studied using data from an online retailer.

2 - Integrated Assortment, Shelf Space and Price Planning in Retailing
Heinrich Kuhn, Professor, Catholic University of Eichstaett-Ingolstadt, Production and Operations Management, Auf der Schanz 49, Ingolstadt, 85049, Germany, heinrich.kuhn@ku-eichstaett.de, Alexander H. Huebner

Category managers in retailing have to decide about the listings, facings, prices, and replenishment amounts. We propose a model that jointly optimizes all these decisions viewing category profit as a composite function of price- and space-dependent demand, consumer-driven substitution and price-dependent profit. The planning problem is modeled as a specialized knapsack problem and solved via CPLEX. The integrated solution increases profit significantly compared to the current retail practice.

3 - Managing Retail Product Lines under Cross-selling Effects
Ameera Ibrahim, University of Massachusetts-Amherst, 121 Presidents Dr., Amherst, MA, 01003, United States of America, ameera@som.umass.edu, Ahmed Ghoniem, Bacel Maddah

We investigate joint assortment planning, dynamic pricing, and inventory management decisions for retail product lines under cross-selling effects. We propose a mixed-integer nonlinear programming model that is reformulated into a linearized equivalent. Managerial insights are discussed and computational results are reported for both exact and heuristic solution methods.

4 - Discrete Choice Models in Two Destinations
Joo Hwan Seo, PhD Candidate, George Washington University, Funger Hall, Suite 301, 2201 G Street, NW, Washington DC, 20052, United States of America, joohwans@gwmail.gwu.edu, Jane Park

Discrete choice models imply choices between two or more discrete alternatives. In our paper, models investigate a spatial survey for Las Vegas and Atlantic City, preferences of visitors' alternative choice and create a Geographic Information System based decision support. This research studies the important of factors relating to the consumers' choice decision such as distance, consumer demographic, and perception.

5 - Joint Inventory Pricing and Assortment Decisions for Vertically Differentiated Products
Mrinmay Deb, Doctoral Student, Pennsylvania State University, 479 Business Building, University Park, State College, PA, 16802, United States of America, mud166@psu.edu, Susan Xu

We determine the pricing, inventory, and assortment decisions of a retailer stocking quality differentiated products under consumer driven substitution (static). We consider two cases: demand is heterogeneous but deterministic (riskless case) and demand is heterogeneous but uncertain (risky case). We find that the optimal prices are higher in the risky case and the optimal risky assortment is a unique subset of the optimal riskless assortment.

■ WE28

C - Room 215

Environmental Operations

Contributed Session

Chair: Marshal Wang, Environment Canada, 10 Wellington Street, Gatineau, K1A 0H3, Canada, cheng-marshal.wang@ec.gc.ca

1 - Coupling Optimization and Simulation Techniques for the Optimal Design of Water Distribution Networks

Birhanu Mengistu, Graduate Research Assistant, North Carolina A&T State University, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, bmmengis@ncat.edu, Shoou-Yuh Chang

A cost minimization model of water distribution networks is constructed using a binary integer programming optimization technique linked with the hydraulic simulation solver, EPANET, for the optimal design. The model is then applied to three benchmark water distribution networks and the results are compared with those of earlier studies. While the resulting design is similar, the proposed model is user friendly and more efficient with respect to computational effort.

2 - Mindful Greening: Creating Change in a Corporate Wasteland

Kimberly Howell, Pacifica Graduate Institute, 21200 Kittridge Street, #4128, Woodland Hills, CA, 91303, United States of America, howell.kim@gmail.com

The organizational hero is a past perception replaced in recent decades by a capitalistic protagonist who wins at any cost regardless of environmental fallout. Organizational greening, the notion of becoming more ecologically mindful, begins with understanding the effects of materialism and deindividuation. Mindful greening practices such as storytelling, ritual, and myth, can create environments upon which more ecologically-sound practices can be built and sense of community harvested.

3 - Did the Provincial Regional Features Influence the Corporate Philanthropic Disaster Response?

Zhao Xiaoqin, Xi'an Jiaotong University, The School of Management, Xi'an, China, zxq_play@yahoo.cn, Wan Difang

By using the data of corporate philanthropic donation after 5ï12 Wenchuan Earthquake of China, the research conducted the empirical research on how the features of 31 provinces of China mainland influenced the corporate philanthropic behavior. The result showed the amount and the number of enterprises donation were directly proportion to the province's economic development level. And the local government did not directly intervened but had some government-oriented potence in firms donation.

4 - The Hybrid Economy-energy-Environment Model and Animated Data Visualization

Marshal Wang, Environment Canada, 10 Wellington Street, Gatineau, K1A 0H3, Canada, cheng-marshal.wang@ec.gc.ca

In this talk, first I will review the developments of the hybrid model: EC-IAM(Environment Canada-Integrated Assessment Model) from the prospective of Canadian Federal Government. It is an intertemporal multi-region multi-sector general equilibrium model for analyzing the regional and global effects of climate policies. Then I will demonstrate our results of EC-IAM model and E2020 model using animated bubble chart, motion bar chart and map visualization.

■ WE30

C - Room 216B

Information in the Supply Chain II

Contributed Session

Chair: Long Gao, Assistant Professor, University of California-Riverside, Riverside, CA, 92521, United States of America, longg@ucr.edu

1 - A Simulation Study of Outsourced Transportation Configurations in a Retail Supply Chain

Stephane Collignon, PhD Student, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24060, United States of America, stephane@vt.edu, Deborah Cook, Tabitha James

The influence of information sharing on SC transportation outcomes has received less attention than its equivalent on inventory levels, backorders, etc. This study compares, through simulation, the effects of two information sharing scenarios on the performance of the transportation component of a retail SC. We examine implementations of partnerships by organizations that influence operational behaviors, which in turn impact transportation outcomes.

2 - Using Game Theory to Exploit the Impact of Information Sharing in Multi-level Supply-chain Network

Brandon Ha, OR Graduate Student, Southern Methodist Univeristy, 317 Basswood Trl, Garland, TX, 75040, United States of America, dha@smu.edu, Andrew Yu

The objective of this research is to quantify the savings from demand information sharing at the different tier in a multi-level supply chain structure through reducing the "bullwhip effect", explore the different information-sharing coalition scheme in the supply-chain, and identify the necessary conditions required to encourage and sustain each information-sharing coalition scheme. A game-theoretic approach is proposed to derive the optimal condition.

3 - Setting the Right Incentives for Global Planning and Operations

Ulas Ozen, Alcatel-Lucent Bell Labs, Blanchardstown Industrial Park, Dublin, Ireland, ulas.ozen@alcatel-lucent.com, Henk Norde, Marco Slikker

We consider a firm selling a group of products that require the same production technology and share resources through multiple regional business units. The demand in each region is stochastic and best observed by the regional units. The firm is engaged in global planning and manufacturing activities and relies on the regional units' forecasts. In this research, we are studying incentive mechanisms that induce the business units to reveal their private information truthfully and work hard.

4 - Inventory Management with Advance Demand Information and Two Demand Classes

Sourish Sarkar, PhD Candidate, Virginia Polytechnic Institute and State University, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, sourish@vt.edu, John Shewchuk

We consider an inventory system serving two demand classes that differ in their backorder costs. Additionally, only one class provides advance demand information and allows early fulfillment. We show the benefit of early fulfillment and investigate suitable replenishment and allocation policies to minimize the holding and backorder costs.

5 - Information Acquisition and Voluntary Disclosure in an Export-processing System

Long Gao, Assistant Professor, University of California-Riverside, Riverside, CA, 92521, United States of America, longg@ucr.edu, Zhalin Li

We study voluntary information sharing in the export-processing trade mode, where the buyer provides the raw materials to the supplier, who faces random yield and receives a fee for processing and exporting the final products. We show that the supplier with low and high yields may withhold the information while the supplier with medium yields may disclose. Our analysis underscores that voluntary information sharing should be viewed as an integral part of corporate optimal strategies.

■ WE31

C - Room 217A

Operational Technology for Patient Flow Improvement

Sponsor: Health Applications

Sponsored Session

Chair: Gilles Reinhardt, Associate Professor, DePaul University, 1, E., Jackson Blvd., Chicago, IL, 60604, United States of America, greinhar@condor.depaul.edu

1 - Admission Policies in a Neurological Hospital Ward

Saied Samiedaluie, McGill University, Montreal, QC, Canada, saied.samiedaluie@mail.mcgill.ca, Vedat Verter, Beste Kucukyazici, Dan Zhang

In this paper, we study patient admission policies in a neurological hospital ward, where there are multiple patient types with different medical characteristics. The patients need to wait in ED or ICU until a hospital bed is assigned to them. Each type of patient has different arrival rate, average length of stay and waiting cost. The problem is formulated as an average cost dynamic program over infinite horizon. An approximate dynamic programming to solve the problem is also presented.

2 - A Systems Approach to Emergency Department Congestion

Hannah Wong, PhD, Harvard Medical School, 101 Merrimac Street, 10th Floor, Boston, MA, 02114, United States of America, Wong.Hannah@mgh.harvard.edu, Howard Abrams, Dante Morra, Robert Wu, Michael Caesar

This project uses system dynamics principles to assemble the ideas and simulate the problem of patients boarding in the Emergency Department (ED). The modeling process provided clinicians and managers with a new awareness of the interdependencies of their strategic and operational-level decisions. It also empowered them to move forward with redesign of sustainable strategies that significantly improved their ED performance.

3 - Emergency Department Patient Flow Simulations Using Spreadsheets

Michael Klein, PhD Student, McGill University, 1001 Sherbrooke Street West, Montreal, QC, Canada, michael.klein2@mail.mcgill.ca, Gilles Reinhardt

We propose a discrete-event simulation platform that runs in spreadsheets. The popularity of spreadsheet programs makes such simulation more accessible to stakeholders who may rely on it to test the value of potential interventions, to develop utilization and performance expectations, or as a medium to long range budgeting and planning tool.

4 - Mobile Technology for Patient-Flow Management: An Application for the NEDOCS Score

Gilles Reinhardt, Associate Professor, DePaul University, 1, E., Jackson Blvd., Chicago, IL, 60604, United States of America, greinhar@condor.depaul.edu

The NEDOCS score is a measure of crowding that uses common values. The complexity of the formula and the specificity of its model hinder its effective implementation and usage. We developed a mobile application allowing users to compute and disseminate the score on demand. It is also customizable (coefficients & thresholds, and aggregation across regions EDs). It also provides push notifications, trend charts, and the ability to download historical input and results for longer term analysis.

■ WE33

C - Room 217D

Panel Discussion: Integrated Nanomanufacturing and Nanoinformatics Research

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Lijuan Xu, PhD Student, University of Southern California, Los Angeles, CA, United States of America, lijuanxu@usc.edu

1 - Integrated Nanomanufacturing and Nanoinformatics Research

Moderator: Lijuan Xu, PhD Student, University of Southern California, Los Angeles, CA, United States of America, lijuanxu@usc.edu, Panelist: Qiang Huang

Nanomanufacturing poses significant challenges for process modeling and control. A panel of discussants will share their experiences and perspectives regarding the tremendous research opportunities for QSR community.

■ WE34

C - Room 218A

Multi-agent Models on Public Health, Energy and Policy

Sponsor: Health Applications

Sponsored Session

Chair: Emine Yaylali, North Carolina State University, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, eyaylal@ncsu.edu

1 - A Distributed Newton Method for Network Utility Maximization

Ermin Wei, Department of Electrical Engineering and Computer Science, Massaachusetts Institute of Technology, 32 Vassar St., 32-D640, Cambridge, MA, 02139, United States of America, erminwei@mit.edu, Ali Jadbabaie, Asuman Ozdaglar

This work develops a distributed Newton-type fast converging algorithm for Network Utility Maximization problems, which can be implemented using the same distributed information exchange mechanism as existing first order methods. We show that even with inexact computation at each step, the objective function value still converges superlinearly to an explicitly characterized error neighborhood. Simulation results demonstrate significant convergence rate improvement over first-order methods.

2 - Teamwork in Applications for Energy Conservation: Distributed Coordination under Uncertainty

Jun-young Kwak, PhD Student, University of Southern California, 3737 Watt Way, PHE 514, Los Angeles, CA, 90089, United States of America, junyounk@usc.edu, Farrokh Jazizadeh, Geoffrey Kavulya, Burcin Gerber, Milind Tambe, Pradeep Varakantham, Laura Klein

Recent developments in multiagent systems are opening up the possibility of exciting applications for energy conversation. As humans begin to interact with complex building systems, it becomes crucial that the resulting team reasons about coordination and negotiation among team members under uncertainty inherent in the real-world. This work presents a novel planning method for distributed coordination and agent negotiation for such domains and aims to optimize multiple competitive objectives.

3 - A Multi-agent Model for Optimizing Alerting Decisions in the Case of a Disease Outbreak

Emine Yaylali, North Carolina State University, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, eyaylal@ncsu.edu, Julie Ivy

We develop a two-agent decentralized POMDP model of the public health system where local and state health departments are decision makers. The model seeks to identify an infectious disease outbreak such as, H1N1 and pertussis, issue a timely alert and initiate mitigation actions. An iterative heuristic based on finite-grid approximation method is developed to identify alerting policies that consider the trade-offs between early and late alerting and structural properties are explored.

4 - A Survey of Applications of Agent-Based Modeling and Simulation to Healthcare Operations Management

Stuart Price, University of Maryland, College Park, MD, United States of America, sprice@rhsmith.umd.edu, Sean Barnes, Bruce Golden

Agent-based modeling (ABM) is gaining momentum in many fields and it has added to the insights previously contributed by other methods such as system dynamics and discrete event simulation. Healthcare operations management is one field that is particularly well-suited for ABM. In this paper, we summarize these applications.

■ WE42

H - Gwynn Room - 4th Floor

Topics in Information Systems Research

Sponsor: Information Systems Society

Sponsored Session

Chair: Monica Johar, Assistant Professor, University of North Carolina, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, msjohar@uncc.edu

1 - Exploraration and Exploitation in Open Source Software Development

Ram Kumar, Professor, University of North Carolina at Charlotte, Charlotte, NC, 28223, United States of America, rlkumar@uncc.edu, Orcun Temizkhan

Open Source Software (OSS) is developed through voluntary contributions of software developers. Software developers perform exploitation and exploration activities during the OSS development process. Exploitation activities focus on incremental improvements in software. In contrast, exploration activities focus on somewhat more radical changes in software. We compare and contrast exploration and exploitation networks in the context of OSS development.

2 - Rethinking the Role of Public Beta Testing

Xun Li, The University of North Carolina at Charlotte, Charlotte, NC, United States of America, xli26@uncc.edu, Sree Nilakanta, Kevin Scheibe, Zhengrui Jiang

Many firms are relying on public beta testing to improve software quality. While the benefit of quality assurance is well recognized, two market-related benefits, resulting from word-of-mouth and network externality, have not been analyzed. We consider both the reliability-side and the market-side of benefits, and develop models to determine the optimal number of public testers and the optimal duration of testing. We find that market-related benefits can substantially increase the total profit.

3 - Optimizing Software Reuse Policies: A Control Theoretic Approach

Monica Johar, Assistant Professor, University of North Carolina, 9201 University City Blvd, Charlotte, NC, 28223, United States of America, msjohar@uncc.edu, Suresh P. Sethi, Vijay Mookerjee

We study optimal policies for local and global reuse in a software project using a control theoretic approach. We first consider a local reuse policy where the benefits of reuse activities are restricted within the project. Next we consider two sequentially linked projects where local reuse in the first project has global effects: some or all of the reuse capital accumulated in the first project benefits the downstream project. We also propose a coordination scheme.

■ WE44

H - Suite 406 - 4th Floor

Energy Systems

Contributed Session

Chair: Shaya Sheikh, Case Western Reserve University, Olin 613-10900-Euclid Avenue, Cleveland, OH, 44120, United States of America, shaya.sheikh@case.edu

1 - Power Distribution Network Design Model with New Supply and Demand Nodes

Feng Jin, IBM Research - China, ZhongGuanCun Park,Building 19, BeiJing, China, jinfsh@cn.ibm.com, Oktay Gunluk, Wenjun Yin, Jin Dong, Xinjie Lv

Power distribution network design is a very important task to satisfy the ever-increasing requirements from economic and social development. But we need to choose some projects to be carried out because of total budget or many other constraints. With power distribution network design model, we can automatically give suggestions on the optimized location of new substation and power supply path.

2 - Efficiency Analysis of Turkish Electricity Distribution Firms Using Stochastic Frontier Analysis

Aydin Celen, Chief Expert on Competition, Turkish Competition Authority, Bilkent Plaza, B3 Blok, Ankara, 06800, Turkey, acelen@Rekabet.gov.tr, Cem Iyigun

We measured the technical efficiency levels of the electricity distribution firms in Turkey during 2002-2009 periods. For this aim, we utilized the stochastic frontier models of Battese and Coelli (1992 & 1995) with multi-output translog input distance function. Using different input and output variables we produced six different alternative model specifications. The results showed that the first order coefficients of the variables in all models are statistically significant.

3 - Application of Local Weather Forecasting in New Energy Field

Yuhui Fu, IBM China, Diamond Building, ZhongguancunSoftwarePark, Beijing, China, fuyuhui@cn.ibm.com, Haifeng Wang, Jin Dong, Wenjun Yin, Ming Xie

The ratio of new energy in total energy consumption of China is ascending continuously and quickly. But not all of the power produced by new energy system could be used, because these kind of energy are usually unstable and could do damage to the grid. To make better use of it, power prediction and weather forecasting is needed. The weather forecasting is also used in Microgrid field. The paper explained the structure of this kind of application and some related issues.

4 - Rule-based Data Verification and Improvement in Power Distribution Network Evaluation

Jinyan Shao, IBM Research, Building 19A, Zhongguancun Software Park, Haidian District, Bejing, China, shaojiny@cn.ibm.com, Wenjun Yin, Feng Gao, Xinjie Lv, Tianzhi Zhao, Ming Xie

The quality of data is one of the most critical factors that impact the effectiveness and result of power system evaluation. Unfortunately, it is a very common problem in power distribution systems that some abnormal data disturb and debase the evaluation process and results. Here, we present a rule-based approach to detect these data and then make proper verification and improvement. The effectiveness of this approach is verified in the evaluation of a district-level power distribution network.

5 - Design and Operation of Hybrid and Integrated Energy Systems

Shaya Sheikh, Case Western Reserve University, Olin 613-10900-Euclid Avenue, Cleveland, OH, 44120, United States of America, shaya.sheikh@case.edu, Behnam Malakooti, Camelia Al-Najjar, Matthew Lehman

This paper presents Integrated Energy Systems that deal with energy supply and energy demand variations in different periods. We consider two scenarios for this system. Fixed demand scenario is solved using integer linear programming solvers such as LINGO. Stochastic demand scenario is solved using Frank-Wolfe method. We also develop a multi-objective optimization considering total cost and environmental impacts and discuss a numerical example for multi-objective integrated energy model.

■ WE45

H - Suite 407 - 4th Floor

Statistics and Quality Control II

Contributed Session

Chair: Chang-Ho Chin, Kyung Hee University, 1 Seocheon-dong, Giheung-gu, Yongin-si, Korea, Republic of, chin@khu.ac.kr

1 - Multi-Criteria Number Partitioning: An Application in Analysis of Covariance

Robert Howley, Lehigh University, Harold S. Mohler Laboratory, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, roh210@lehigh.edu, Robert Storer

An extension of the number partitioning problem, multi-criteria number partitioning (MCNP), is examined and a generalization of the Karmarkar-Karp algorithm is presented as an approximate solution. Using MCNP to partition covariates into subgroups of equivalent distributions is shown to be an effective tool in enhancing the power of Analysis of Covariance based simulation experiments.

2 - Feature Extraction and Classification in Pattern Recognition and Their Application in Economy

Pawel Blaszczyk, University of Silesia, Institute of Mathematics, Poland, pblaszcz@math.us.edu.pl

Feature extraction and classification are the basic methods used to analyze and interpret economic data. The number of samples is often much smaller than the number of features. In this situation it makes impossible to estimate the classifier parameters properly and the classification results may be inadequate. In this case it is important to decrease the dimension of the feature space. This can be done by feature extraction. In this paper we present new feature extraction method. Our method is an extension of the classical PLS algorithm. A new weighted separation criterion are applied.

3 - Decompounding Poisson Random Sums Based on Properties of Integer Numbers

Masoud Kamgarpour, Postdoctoral Fellow, University of British Columbia, Mathematics Department, 2603-668 Citadel Parade, Vancouver, BC, Canada, masoudkomi@gmail.com, Hamed Hasheminia, David Gillen

Poisson counting process with bulk arrivals are seen in various applications such as queuing theory. Usually estimating the parameters of compound Poisson processes are mathematically and computationally cumbersome. We develop various easy to compute estimators based on the properties of integer numbers and prove consistency of the estimators. We also test our models with different numerical examples.

■ WE47

H - Dunn Room - 3rd Floor

Policy Analyses for Freight Transportation and Logistics

Sponsor: Transportation Science and Logistics

Sponsored Session

Chair: Ahmad Jarrah, Associate Professor, The George Washington University, Department of Decision Sciences, Washington, DC, United States of America, jarrah@gwu.edu

1 - Operational Changes versus External Policies for Cost and Emissions Reductions

Anne Goodchild, Assistant Professor, University of Washington, Civil and Environmental Engineering, Seattle, WA, United States of America, annegood@u.washington.edu, Felipe Sandoval

Two pick-up and delivery companies are used as case studies to examine the relative impact of operational changes versus external policies on cost, emissions, and service quality. It is found that both cost and emissions can be reduced through internal changes, whereas external policies do not simultaneously improve cost and emissions.

2 - A Statistical Process Control System for Infrastructure Performance Monitoring

Pablo Durango-Cohen, Associate Professor, Northwestern University, 2145 Sheridan Road, A332, Evanston, IL, 60208, United States of America, pdc@northwestern.edu, Yikai Chen, David Corr

Statistical process control has been widely used to monitor the performance of manufacturing and financial systems. Such systems alert decision makers of systematic, temporary or permanent changes. In this presentation we discuss the development of a framework to monitor transportation infrastructure, and present results from an implementation on The Hurley Bridge (Wisconsin Structure B-26-7).

3 - Shipment Consolidation Policy Analysis with Stepwise Freight Costs

Dincer Konur, Industrial and Systems Engineering, University of Florida, Gainesville, FL, United States of America, dincer@ufl.edu, Joseph Geunes

We analyze shipment consolidation policies that explicitly account for transportation costs, including per-truck capacity and variable costs. We use a set partitioning formulation, where each element of the partition corresponds to the subset of consolidated items. We apply a branch-and-price approach and propose heuristic methods for solving the resulting nonlinear set partitioning problem.

4 - Reconfiguring the P&D Networks of a Major Carrier

Ahmad Jarrah, Associate Professor, The George Washington University, Department of Decision Sciences, Washington, DC, United States of America, jarrah@gwu.edu, Jonathan Bard

We use large-scale geographic contiguous clustering to analyze the P&D commercial and residential networks for a major carrier. We present scenarios for complete or partial merging of the two networks, and assess the potential savings. We present the basic clustering model used with the required modifications for the various scenarios.

■ WE48

H - Graham Room - 3rd Floor

Multi-modal Issues in Freight Transportation

Contributed Session

Chair: Kok-Choon Tan, Associate Professor, NUS Business School, Department of Decision Sciences, 15 Kent Ridge Drive, Singapore, 119245, Singapore, biztkc@nus.edu.sg

1 - Manhattan Associates Domestic Common Carrier Shipment Planning Engine

Aykagan Ak, Senior Science Analyst, Manhattan Associates, 2300 Windy Ridge Pkwy, Atlanta, GA, 30339, United States of America, aak@manh.com, Kim Ross, Srinivas Nandiraju

In domestic shipment planning, a shipper needs to seamlessly perform shipment planning across multiple modes like TL, LTL, and Rail etc. Shipment planning needs to handle the complex rate structures across the modes and also meet carrier capacities negotiated during transportation procurement. In this talk we will present an overview of Manhattan Associates Shipment planning engine and discuss how some of the major US retailers plan their day-to-day transportation shipments with this engine.

2 - Optimizing the Expected NPV in a Multimodal Transportation Network

Alejandro Garcia del Valle, Full Professor, University of A Coruna, Polytechnic School, Mendizabal s/n, Ferrol, 15403, Spain, agvalle@udc.es, Rosa Rios Prado, David del Rio Vilas, Juan Manuel Bastida SardiÒa, Javier Faulin, Diego Crespo Pereira

Multimodal transportation is generally accepted as an efficient alternative to road transportation in terms of costs, fuel consumption, environmental externalities and road congestion. This work presents a novel optimization approach to the multimodal network design for internal Spanish freight transportation. Optimization is conducted in order to maximize the expected NPV. Service utilization rates are evaluated by means of a parameterized model implemented in TRANSCAD.

3 - Freight Cost Minimization at a Global Mining Company

Kok-Choon Tan, Associate Professor, NUS Business School, Department of Decision Sciences, 15 Kent Ridge Drive, Singapore, 119245, Singapore, biztkc@nus.edu.sg, Jie Sun, Run-Yan Tan

This paper presents an application of linear programming to a global mining company's freight cost minimization problem. We describe a simple spreadsheet implementation of the linear programming solution which resulted in annualised savings estimated to be about two million Singapore dollars.

■ WE52

H - North Carolina - 3rd Floor

Applications of Facility Planning

Contributed Session

Chair: Vladimir Marianov, Pontificia Universidad Catolica de Chile, Avda. Libertador Bernardo OHiggins 340, Santiago, Chile, marianov@ing.puc.cl

1 - Sequential Clustering for Police Districting

Christopher Rump, Associate Professor, Bowling Green State University, College of Business Administration, Applied Statistics & Operations Research, Bowling Green, OH, 43403-0267, United States of America, cmrump@bgsu.edu

We consider the problem of designing police command districts and, at a more granular level, police patrol beats. In doing so, we consider a hierarchy of clustering objectives to measure the overall distance within each formed district. The districting design optimization problem is modeled heuristically as a sequential clustering problem that for most choices of clustering objective can be solved efficiently via its linear programming relaxation.

2 - Electric Vehicle Charging Facility Network Planning

Lili Zhao, IBM Research China, Diamond Building A, Zhongguancun Software Park #19, Beijing, 100193, China, zhaolil@cn.ibm.com, Ming Xie, Qiming Tian, Bin Zhang, Wenjun Yin, Jin Dong

With the rapid development of Electirc Vehicle(EV) in marketplace, as the energy source of EV, charging facilities' deployment has become more and more urgent. A scientific charging network planning methodology can help lower the network's unfavorable impact on grid and promote the network's service capability for customers. In our paper, we make comparison analysis of different charging facility formats, and present an approach to plan and optimize charging facility network.

3 - Fortification of Cell Phone Towers for Disaster Survival

Vladimir Marianov, Pontificia Universidad Catolica de Chile, Avda. Libertador Bernardo O'Higgins 340, Santiago, Chile, marianov@ing.puc.cl, H. A. Eiselt

We fortify cell phone towers so to maximize coverage and minimize expected or worst-case loss of communications after natural disasters. The model is applied to a region in the south of Chile that was stricken by a magnitude 8.8 earthquake. Computational results are provided for a variety of scenarios.

■ WE54

H - Charlotte Hall - 3rd Floor

Joint Panel Discussion Analytics/CPMS: Consulting Firms Share Their Lessons Learned on how to Create Significant Impact with Optimization and Advanced Analytics at Their Client Organizations

Sponsor: Analytics/CPMS, The Practice Section of INFORMS

Sponsored Session

Chair: Steve Sashihara, CEO, Princeton Consultants, 2 Research Way, Princeton, NJ, 08540, United States of America, ssashihara@princeton.com

1 - Consulting Firms Share Their Lessons Learned on how to Create Significant Impact with Optimization and Advanced Analytics at Their Client Organizations

Moderator: Michael Menche, Princeton Consultants, Inc., 2 Research Way, Princeton, NJ, 08540, United States of America, mmenche@princeton.com, Bill Thoet, Senior Vice President, Booz Allen Hamilton, McLean VA, United States of America, Thoet_William@bah.com

In this panel, leaders of consulting practices specializing in Optimization and Advanced Analytics discuss their experiences in how to structure and deliver successful engagements that range from operational improvement, to marketing, to strategy. Questions discussed will include: in what ways are successful optimization projects different classic IT projects? To what extent does optimization change the consulting firm's deliverables to clients? To what extent does optimization change the consulting firm's deliverables to clients? What is the role of optimization in strategy engagements? When and to what extent should the deliverable to the client include a live model rather than a static report based on a model? What are the pros and cons? Does optimization software change the consultant's traditional status as "trusted advisor?" What are the best ways to leverage and work with a client's in-house OR department? After examining these issues, this panel will discuss their best practices for staffing, implementing, and scaling up optimization projects, as well as road bumps and roadblocks along the way.

■ WE57

W - Providence I- Lobby Level

Alternate Strategies for Aviation Systems Planning

Sponsor: Aviation Applications

Sponsored Session

Chair: Regina Clewlow, PhD Candidate, Engineering Systems, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rclewlow@mit.edu

1 - The Impact of High-speed Rail on Air Traffic: Implications for Aviation System Planning

Regina Clewlow, PhD Candidate, Engineering Systems, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rclewlow@mit.edu

The development of high-speed rail in Europe and Asia has had a substantial impact on aviation market share, particularly for short-haul travel. We examine the impact of high-speed rail on air travel demand through an econometric analysis, exploring variations in how rail improvements influence the evolution of air traffic. The results have significant implications for aviation system planning, including potential strategies to reduce carbon emissions.

2 - Reorganization of the Airline Industry – A Holistic Approach

John Kettelle, Arlington, VA, United States of America, kettelle1@earthlink.net

This paper explores the remarkable efficiencies obtainable by combining all the surviving U.S. airlines into "OBA" (One Big Airline) - cutting the total cost of providing current passenger travel by about 80%! This cooperative (instead of competitive) approach is clearly contrary to a basic principle of our capitalist system, and presents an exciting challenge to the airline industry and to capitalism itself.

3 - Demand Substitution in the Airline Industry

Valery Pavlov, University of Auckland, 12 Grafton Road, Auckland, New Zealand, v.pavlov@auckland.ac.nz, Tava Olsen

The value of demand substitution has been long recognized by both practitioners and academics. However, while in some industries it has become an everyday practice, it barely exists in some other. The focus of our study is on the airline industry in which the form of demand substitution we propose is not yet applied widely. We give a simple mechanism for demand substitution that can be beneficial for an airline.

■ WE58

W - Providence II - Lobby Level

Disaster Relief Planning and Operations II

Sponsor: Military Applications Society

Sponsored Session

Chair: Brian Piper, North Carolina State University, 7801-102 Mayfaire Crest Lane, Raleigh, NC, 27615, United States of America, bepiper@ncsu.edu

1 - Integrated Management of Emergency Vehicle Fleet

Elham Sharifi, Research Assistant, University of Maryland, Department of civil and Environmental Eng., 1173 Glenn L. Martin Hall, UMD, college park, MD, 20742, United States of America, esharifi@umd.edu, Ali Haghani, Hadi Sadrsadat

In an Emergency Response System the response time plays a crucial role in minimizing the adverse impacts such as fatalities and loss of property. Response time not only is related to a dispatching system but also has a close relationship with area-coverage of emergency vehicles. The objective of this research is providing a model that can help reduce the response time and improve service level by accounting for the Coverage Problem, Deployment Problem and Routing Problem of emergency vehicles.

2 - Models for Logistics and Transportation Procurement in Humanitarian Settings

Zhenyu (Edwin) Shi, Ph.D Candidate, Northwestern University, 2145 Sheridan Road, Room 210, Evanston, IL, 60208, United States of America, edwinshi@u.northwestern.edu, Karen Smilowitz, Irina Dolinskaya

In light of recent humanitarian needs, web-based platforms have emerged to facilitate logistics and transportation procurement. However, many rely on manual vetting and matching of parties. Beginning with a simple setting, we present models to systematically screen and match parties for large scale operation in humanitarian relief.

3 - Optimizing Engineering Improvements for Civil Infrastructure Systems Vulnerable to Natural Hazards

Brian Piper, North Carolina State University, 7801-102 Mayfaire Crest Lane, Raleigh, NC, 27615, United States of America, bepiper@ncsu.edu, Ranji Ranjithan, John Baugh, Downey Brill

We present a mathematical programming framework for optimizing civil infrastructure system (CIS) improvement decisions to protect against natural hazards. Several performance criteria are defined, including some to consider the resilience of the CIS to support critical lifeline services after a disruption. Using an illustrative example, we present a comparison of these resilience measures for several decision scenarios.

■ WE59

W - Providence III - Lobby Level

Knowledge Management in Service

Sponsor: Service Science

Sponsored Session

Chair: Robert Burgess, Georgia Tech, College of Managemenet, Atlanta, GA, 30308, United States of America, Robert.burgess@mgt.gatech.edu

1 - Dynamic Knowledge Management with Rotating Personnel Resources in a Service Setting

Robert Burgess, Georgia Tech, College of Management, Atlanta, GA, 30308, United States of America, Robert.burgess@mgt.gatech.edu, Craig Hill

Many service environments struggle with knowledge management and its continuity going forward. Some organizations are further constrained by gaining and losing their operating personnel based on a finite planning horizon. This presentation reports on the investigation of this problem as it specifically impacts several organizations on college campuses.

2 - Adaptive Replication: The Reutilization of Knowledge Assets in Fast Changing Environments

Stefano Miraglia, Imperial College Business School, Tanaka Building, South Kensington Campus, London, SW7 2AZ, United Kingdom, stefano.miraglia@imperial.ac.uk, Andrea Prencipe, Andrew Davies

Reusing knowledge entails dealing with two opposing forces: while the advantages of replication push for reproducing knowledge exactly, exogenous changes impose some adaptation. This qualitative study analyzes two large firms that have been dealing with replication and adaptation for decades. Findings show that replication and adaptation are treated as interplaying rather than opposed. The new concept of 'adaptive replication' is introduced to explain such interplay.

■ WE61

W - Sharon Room - 2nd Floor

Public Transportation

Contributed Session

Chair: Virot Chiraphadhanakul, Massachusetts Institute of Technology, 77 Massachusetts Avenue E40-130, Cambridge, MA, United States of America, virot@mit.edu

1 - Solving Dynamic Multi-depot Dial-a-ride Problem Using a Heuristic Based on Clustering First-routing

Taehyeong Kim, University of Maryland-College Park, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, tommykim@umd.edu, Ali Haghani

In this paper, a heuristic based on clustering first-routing second has been developed for the static DARP model. The static heuristic has been extended to on-line heuristic for the dynamic DARP. In dynamic DARP, no-shows, accidents, cancellations, and new requests are considered for scheduling and routing. This on-line heuristic is tested on the framework of simulation that is made based on real world problem.

2 - Demand Driven Transport under Large Demands

Chandrasekhar Prabala, Infosys Technologies Ltd., Emp. No. 94067, Electronics City, Hosur Road, Bangalore, India, 560100, India, venkata_p@infosys.com, G N Srinivasa Prasanna

We present results from simulations of dynamic dial-a-ride problem under large user demands, typical to developing nations. We present an analysis of heuristics developed to address the problem and consider the case of a fleet of small buses/ vans finely distributed throughout a city, under large demands. Our simulations indicate that high vehicle fills can be obtained with low delay; we compare the quality of solutions with ILP bounds.

3 - Incremental Bus Schedule Design: Combining Limited-stop and Local Bus Services
Virot Chiraphadhanakul, Massachusetts Institute of Technology, 77 Massachusetts Avenue E40-130, Cambridge, MA, United States of America, virot@mit.edu, Cynthia Barnhart

Limited-stop or express bus services have been operated in many cities around the world to shorten travel times thereby making public transit a more attractive choice for commuters. We propose in this work an optimization model that, given a current bus route and its frequency over a certain period, determines (1) bus stops along the route to be served by the express service and (2) the frequency allocation between the express and local services such that the user surplus is maximized.

■ WE62

W - Independence Room - 2nd Floor

Closed Loop and Reverse Supply Chain

Contributed Session

Chair: Wenbo Shi, Iowa State University, 3004 IMSE, Ames, IA, United States of America, wenboshi@iastate.edu

1 - Closed Loop Supply Chains for U.S., Japan and EU Auto Industries - A System Dynamics Study
Sameer Kumar, Professor of Operations and Supply Chain Management, Opus College of Business, University of St. Thomas, Mail # TMH343, 1000 LaSalle Avenue, Minneapolis, MN, 55403, United States of America, skumar@stthomas.edu

System Dynamics analysis of the U.S., Japan and EU auto industries' reverse value chains was conducted to explore the impact of government regulations, financial incentives and market pricing for remanufactured and recycle materials on cash flows and use of such raw materials for car manufacturers in these three market segments.

2 - E-Scrap Reverse Supply Chain Model with Mass Customization and Channel Flexibility
I-Hsuan Hong, Assistant Professor, National Taiwan University, Industrial Engineering, 1, Sec. 4, Roosevelt Road, Taipei, 106, Taiwan - ROC, ihong@ntu.edu.tw, Jr-Fong Dang, Chon-Hou Lo

Many enterprises cooperate with third-party service providers to bear responsibilities for part (or all) of recycling operations of waste electronics. We propose a two-stage game model where the manufacturer (leader) designs the optimal contract rent for the third-party service provider (follower) and the follower determines the optimal reward money for customers. We further discuss how mass customization and flexibility of recycling channel have impacts on both parties' decisions.

3 - Reverse Supply Chains with Landfill Considerations
Wenbo Shi, Iowa State University, 3004 IMSE, Ames, IA, United States of America, wenboshi@iastate.edu, Jo Min, Karla Valenzuela

We formulate and analyze reverse supply chains consisting of remanufacturers and landfill operators under a Stackelberg game framework. The resulting equilibrium analyses show that an increase in the disposal fee encourages remanufacturing activities when the fee is relatively low while discourages these activities when the fee is relatively high. We also examine the role of the government's environmental policy via economic incentives.

■ WE63

W - Tryon North - 2nd Floor

Multicriteria Decision Making

Contributed Session

Chair: Orrin Cooper, University of Pittsburgh, Mervis Hall, Pittsburgh, PA, United States of America, orc1@pitt.edu

1 - A Multiobjective Model for Warranty Policies Integrating Product Quality, Market Share, and R&D Cost
Jayprakash Patankar, Professor of Management, The University of Akron, CBA, Akron, OH, 44325-4801, United States of America, jgp@uakron.edu, Amitava Mitra

This paper considers warranty policies involving two attributes. Product failure rate is influenced by usage rate, product age and research and development expenditures. Market share is influenced by warranty time, usage limit, price and quality. An integrated model addresses goals such as attainment of market share and net profit per unit.

2 - An Exact Algorithm for Solving Multiobjective Integer Programs
Angela Ward, Graduate Student, Clemson University, Department of Mathematical Sciences, Martin Hall, Box 340975, Clemson, SC, 29634-0975, United States of America, arhowar@clemson.edu, Matthew Saltzman, Margaret Wiecek

An algorithm based on the weighted-Chebyshev scalarization for identifying all Pareto points of multiobjective integer programs is proposed. The number of iterations is linear in the number of points and the weights used in any iteration are completely determined by the current set of points. Computational results are included.

3 - Comparing Scalarization Methods for Bicreteria Discrete Optimization Problems
Metin Turkay, Professor, Koc University, Rumelifeneri Yolu, Sariyer, Istanbul 344, Istanbul, 3440, Turkey, mturkay@ku.edu.tr, Gokhan Kirlik

Generating entire efficient set for bicriteria discrete optimization problem is one of challenging problems of operations research literature. In this study, well-known scalarization methods are compared with respect to computational efficiency. Additional to well-known methods, augmented form of epsilon-constraint method is modified. All methods are coded in C++ by using CPLEX concert technology. The algorithms are tested on bicriteria knapsack problem instances in various types and sizes.

4 - Solutions for Weakly Connected ANP Decisions Models
Orrin Cooper, University of Pittsburgh, Mervis Hall, Pittsburgh, PA, United States of America, orc1@pitt.edu

Strongly Connected Decisions – decisions where each alternative possesses every attribute considered – are rare in decision making. An AHP/ANP theorem requires alternatives and criteria to be strongly connected. The required information for a strongly connected network exists; but not in the Supermatrix. With additional comparisons the network can be strongly connected. This methodology can simplify ANP cluster comparisons. This approach is applied to Third Party Logistics Provider Selection.

■ WE65

W - Kings Room - 2nd Floor

Operations Management II

Contributed Session

Chair: Mark Van Oyen, Associate Professor, University of Michigan, 3249 Rockcress CT, Ann Arbor, MI, 48103, United States of America, vanoyen@umich.edu

1 - Dynamic Policies in Knowledge-based Service System
Qifeng Shao, PhD Candidate, Northwestern University, 2145 Sheridan C210, Evanston, IL, 60208, United States of America, qshao@northwestern.edu, Seyed Iravani

We propose a modeling framework of a knowledge based service system. With help from a feed back system, the agent adjusts processing strategies to deal with different types of customers. Since the optimal strategy has a complex structure and hard to implement, we examined several heuristics and found effective policies with simple threshold design.

2 - A Biased Random-key Genetic Algorithm for the Order Batching Problem in Distribution Warehouses
Soeren Koch, Otto-von-Guericke-University Magdeburg, Universitaetsplatz 2, Magdeburg, 39106, Germany, soeren.koch@ovgu.de

Order picking is a warehouse function that deals with the retrieval of articles from the warehouse in order to satisfy customer demands. The problem considered here, deals with the question of how different orders should be grouped (batched) into more substantial ones, with respect to a minimization of the total tour length. For the solution of this problem, a highly competitive hybrid algorithm based on a biased random-key genetic algorithm and a local search procedure is presented.

3 - Dynamic Scheduling of a Flexible "N" Queuing Network under CONWIP
Mark Van Oyen, Associate Professor, University of Michigan, 3249 Rockcress CT, Ann Arbor, MI, 48103, United States of America, vanoyen@umich.edu, David Singer, Fang Dong

We investigate the control of dynamic execution level control of an "N" queueing network with a CONWIP release policy. Using MDP's and simulation, we identify effective scheduling control policies to extract operational flexibility. We provide evidence of significant improvement of production delays, ship completion times, and facility utilization toward the goal of helping the U.S. shipbuilding industry to achieve on-time production at budgeted cost.

■ WE67

W - Grand A - 2nd Floor

Business Applications II

Contributed Session

Chair: Valerie C.Y. Zhu, Associate Professor, Xi'an University of Science & Technology, 28, West of Xian Ning Road, Xi'an, Shaanxi, 710049, China, valeriezhu@mail.xjtu.edu.cn

1 - The Impact of Industrial Concentration on the Company's Debt Maturity-evidence Form China

Leiming Fu, Xiían Jiaotong University, School of Management, 28 Xianning West Road, X iían, 710049, China, xjtuflaming@hotmail.com, Difang Wan, Yahui Zhang

This paper analysis the impact of industrial concentration on debt maturity in China.We find that, industrial concentration and the firm's debt maturity has a U-shaped relationship, i.e., when the industry is less concentrated, the short-term debt ratio is negatively correlated with the industrial concentration, while they are positively correlated when the industry is highly concentrated, and the results are robust.

2 - Gaining Competitiveness through a Lean Enterprise Transformation: A Case Study for an Auto-parts Firm

Gustavo Perez, PhD Student, Oklahoma State University, 4599 N. Washington, Stillwater, OK, 74075, United States of America, gustavo.perez@okstate.edu

This paper examines how a medium-sized German company, supplier to the automotive sector in Mexico, accomplished a Lean Enterprise Transformation. A case study approach was used to analyze the tools and practices of this particular lean initiative. Results indicate the lean transformation made a radical change in the firm's performance indicators.

3 - Service-manufactruing is the Only Wayout!

Valerie C.Y. Zhu, Associate Professor, Xi'an University of Science & Technology, 28, West of Xian Ning Road, Xi'an, Shaanxi, 710049, China, valeriezhu@mail.xjtu.edu.cn

Chinese manufacturing has met its Waterloo and calls for an urgent business transformation if it wants to survive and sustain its development. Based on lots of fundamental research, authors of this paper have proposed a new business conceptual model—- SERVICE-MANUFACTURING, which focuses on the seamless marriage of service and manufacturing and how this new model can be implemented in real business practices.

■ WE68

W - Grand B - 2nd Floor

Remanufacturing and End-of-Life Issues

Contributed Session

Chair: Robert Riggs, PhD Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, Mi, 48109, United States of America, robriggs@umich.edu

1 - Inspection Schemes for Part Recovery under Demand Uncertainty

Gonca Yildirim, University of Florida, Department of Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, gonca@ufl.edu, Elif Akcali

We examine different inspection schemes for a salvaging facility that collects a particular end-of-life product, performs a series of disassembly and recovery operations to reclaim a reusable part and sells the recovered part in the used parts market. We include environmental fees that create a non-negligible tradeoff against the operational costs in acquisition and stocking decisions under different inspection schemes.

2 - Inventory-promotion Policy in Hybrid Manufacturing System with Expediting

S. Phil Kim, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, ksphil@purdue.edu, George Shanthikumar, Seokcheon Lee

The joint inventory-promotion decision problem in a closed-loop hybrid system is considered. The remanufactured product is 'as-good-as-new'. The stochastic returns are assumed to be positively correlated with the volume of circulation. The demands are also stochastic and influenced by the promotion decision. For a given decision on the promotion, we show that the optimal solution structure is defined by two points in the state space.

3 - Performance Evaluation of Disassembly Lines with Flexible Machines Performing Disassembly and Split

Robert Riggs, PhD Student, University of Michigan, 1205 Beal Avenue, Ann Arbor, Mi, 48109, United States of America, robriggs@umich.edu, Francesca Simone, S. Jack Hu

End-of-life processing for products is becoming increasingly desirable in order to minimize amount of waste sent to landfills. For the configuration phase, in which a large number of system configurations have to be evaluated, a tool that analyzes remanufacturing systems composed by flexible machines is desirable. We present an approximate analytical method based on decomposition techniques for modeling and evaluating systems where disassembly and split operations occur at the same work station.

■ WE69

W - Grand D - 2nd Floor

Green Innovation and Product Development

Sponsor: Manufacturing & Service Oper Mgmt/ Sustainable Operations

Sponsored Session

Chair: Vishal Agrawal, Assistant Professor, Georgetown University, 37th and O Streets, McDonough School of Business, Washington, DC, 20057, United States of America, va64@georgetown.edu

1 - Seven Cognitive Concepts for Successful Sustainable Design

Erin MacDonald, Assistant Professor of Mechanical Engineering, Iowa State University, 2020 Black Engineering Building, Ames, IA, 50011, United States of America, erinmacd@iastate.edu

For the past forty years, researchers have studied how to encourage proenvironmental behaviors such as the adoption of recycling programs and purchase of sustainable products. This work synthesizes findings from psychology, consumer studies, economics, decision sciences, and public policy into cognitive concepts that are crucial to the successful purchase and use of sustainable products. Product examples and relevant design methods are discussed.

2 - The NGOs Dilemma: How to Influence Firms to Replace a Potentially Hazardous Substance

Feryal Erhun, Stanford University, MS&E, Stanford, CA, United States of America, feryal.erhun@stanford.ed u, Yanchong Karen Zheng, Tim Kraft

Recently, the uncertain environmental impact of consumer products and the chemicals they contain has been a popular topic in the news. When a potentially hazardous substance is identified, an NGO interested in removing this substance from commercial use must develop an efficient strategy for where to direct its often limited resources. We analyze this decision and determine under what conditions should an NGO target the industry vs. the regulatory body to influence firms to replace a substance.

3 - Using Economic Input-Output Life Cycle Assessment (EIO-LCA) to Guide Sustainable Design

Jeremy Michalek, Associate Professor, Carnegie Mellon University, Scaife Hall 324, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, jmichalek@cmu.edu, Chris Hendrickson, Jon Cagan

We explore the use of EIO-LCA as a tool to support sustainable design by quickly determining which aspects of the product and its supply chain dominate life cycle emissions. Compared to traditional processed-based LCA, EIO-LCA estimates are aggregate, using data on economic transactions and emissions from each sector of the economy. However, full supply chain emissions associated with output from each sector are computed instantly, helping determine where to focus sustainable design efforts.

4 - The Role of Product Modularity in Green Product Design

Sezer Ulku, Georgetown University, McDonough School of Business, Washington DC, United States of America, su8@georgetown.edu, Vishal Agrawal

We investigate a firm's strategic choice between modular and integral product architectures by endogenizing the development decisions and investigate their effect on the introduction and replacement of products. We identify when modularity leads to higher profits and lower environmental impact. We also analyze the effect of consumers' environmental concerns and disposal fees on the firm's choice between modular and integral architectures, and the resulting environmental impact.

Session Chair Index

A

Abayomi, Kobi SA50
Abbas, Ali MB17, TA65
Abbasi, Ahmed TC67
Abbasi, Baback TD67
Abouee-Mehrizi, Hossein MC11, MD38
Acharya, Dharma MC32
Adan, Ivo MD07
Agarwal, Ashish SC42
Agarwal, Shweta MA15
Agnetis, Alessandro SD18
Agrahari, Homarjun SB16
Agrawal, Anirudh TD65
Agrawal, Anupam MD01
Agrawal, Vishal WE69
Aharoni, Merav SA03
AhmadBeygi, Shervin SB57
Ahmadi, Reza MA01
Ahmed, Shabbir TB06
Ahn, Hyun-Soo TC25
Ahuja, Ravindra MB32
Akcali, Elif TD69
Akcay, Alp WC49
Akhavan-Tabatabaei, Raha WC58
Aktekin, Tevfik WB53
Alagoz, Oguzhan TD05
Alamar, Ben MC52
Aleman, Dionne SC19, SD44, WB64
Alistar, Sabina TC36
Allahverdi, Ali WC06
Allon, Gad SA07, TD28, WB25
Altug, Mehmet Sekip WA26
Alzalg, Baha SC22
Anderson, Edward SC40
Anjos, Miguel TA60, TD60
Ankenman, Bruce SC49
Ano, Katsunori TA21
Apley, Dan SA33
Araz, Ozgur SB17
Argon, Nilay MD11
Armony, Mor SA01, SB01, TD27
Askin, Ronald MD47
Ata, Baris SB09, TD16, WB27
Atasu, Atalay MA69
August, Terrence WC39
Aydin, Burcu WD03
Aydin, Goker SA09
Ayer, Turgay TB34
Ayhan, Hayriye MA11
Ayvaci, Mehmet TB31

B

Babich, Volodymyr SD30, MD30
Backaker, Lars WD61
Badinelli, Ralph WB59
Baharnemati, MohammadReza MA23
Bajwa, Ahmad WB02
Baker, Erin MA17
Bakir, Onur TC03
Balakrishnan, Jaydeep WC68
Balaporia, Zahir MA55
Balasubramanian, Hari MD34
Baldick, Ross WA14, WD14
Ban, Jeff WB51
Banciu, Mihai TC46
Bander, Jim TC19
Bao, Xiaowei MA20
Bapna, Ravi TC45
Barker, Kash TA44, TC15
Barker, Theresa WA47, WB47
Barnett, Arnold SD64, TC23
Barroso, Luiz Augusto WA14, WD14
Bassamboo, Achal SC28, WC27
Bastin, Fabian WA12
Baucells, Manel TA15
Bayati, Mohsen TC11
Bayraksan, Guzin TC21, WA16
Beasley, J E SD02
Beier, Eric MA22
Beil, Damian MA25, MB45
Bell, Peter TA46
Belloni, Alexandre MB22
Belotti, Pietro MC24
Bengtson, Neal SA55
Benjaafar, Saif MC27
Berg, Bjorn TA36
Bergey, Paul WA43
Berman, Oded MC38
Berndt, Antje SA06
Besbes, Omar WE09
Best, Michael MC02
Bettinger, Brendan WC56
Bhulai, Sandjai TA11
Bian, Linkan MA35
Bichler, Martin SD45
Bienstock, Daniel WD43
Bier, Vicki MD15
Biller, Bahar WC49
Biller, Stephan SA54
Birge, John SA02, SB02, MB30
Bish, Douglas WA51
Bisi, Arnab SD56
Bjørndal, Endre SA66
Bjørndal, Mette TD62
Blanchet, Jose TB49, WD11
Blanco, Edgar MD69
Boginski, Vladimir TD20
Bolooriarabani, Alireza MA56
Bompadre, Agustin TB20
Borchert, Patricia MA52
Bordley, Robert SD17
Borgonovo, Emanuele WB15
Borror, Connie MD37
Boudia, Mourad WC57
Boyabatli, Onur SB30
Boylan, Greg WA35
Boyles, Steve SC51
Broschak, Joseph SB52
Brott, Evan MD13
Brown, David TC29
Bryant, Paul TD68
Buch, Nils WB03
Budde, Maximilian WA45
Bukkapatnam, Satish MC33, WA33
Burgess, Robert WB59, WE59
Burton, Richard SD52
Butenko, Sergiy SA60, SD20
Butler, Allen MB54, MC54, MD54
Buyuktahtakin, Esra SB19, WA54
Byon, Eunshin MD35, TA35

C

Cai, Ning TA29
Cakici, Ozden WE03
Camdereli, Almula TC02
Cao, Wenhua SC31
Cao, Wenwei WD57
Capponi, Agostino MD29
Cardona, Laura WD67
Carmichael, Doug WD62
Caro, Felipe SC25
Carrillo, Janice MD40
Carter, Michael TB36
Chan, Carri SB29
Chan, Timothy TC34
Chandra, Saurabh WA66
Chao, Raul SC41, MC40, MC41
Chari, Manoj WA55
Chatterjee, Samrat WC23
Chattopadhyay, Nilanjan TB65
Chaturvedi, Aadhaar MC30
Chelst, Ken MA46
Chen, Jenyi (Jay) WC65
Chen, Jianqing SB39, WB39
Chen, Jing TD13
Chen, Kay-Yut TC50
Chen, Li SB26
Chen, Nan SD35
Chen, Richard SC08
Chen, Si SC36
Chen, Victoria SB50
Chen, Wei WD54
Chen, Weiwei WB55
Chen, Yihsu TD43
Chen, Zhi-Long MA18
Chen, ZhiLong WC50
Cheng, Clark TA32
Chimka, Justin WC37
Chin, Chang-Ho WE45
Chinneck, John MC04
Chipman, Hugh SD33
Chiraphadhanakul, Virot WE61
Chiu, Yi-Chang MB48
Cho, Soo-Haeng SC01
Chod, Jiri MA30
Choi, Sangdo(Sam) TC56
Choo, Adrian SA59
Chu, Ch MC23
Cimren, Emrah MC43, TA18
Clewlow, Regina WE57
Cochran, James MC46
Cohen, Morris A. MB01
Cohn, Amy TD57
Coit, David SB37, MC37
Coles, John SA64
Conejo, Antonio J. MB43
Consigli, Giorgio WE21
Cooper, Orrin WE63
Cooper, William TC05
Corlu, Canan Gunes SB49
Craig, Anthony WA32
Cruz, Jose MC69
Curtis, Frank E. MD22. WB22
Czerwinski, David MA 44, MD44

D

Dadvand, Arash WA30
Dai, Jim SC05
Daim, Tugrul WC59
Dalkiran, Evrim SA20
Dao, T.H. Diep SB55
Dauzere-Peres, Stephane SA18
Davies, Jane MA40
Day, Bob SB45, SC45
Day, Jeff TC55
de Almeida, Adiel T WB63
Deb, Kalyanmoy TA63
Deb, Mrinmay WE26
Debo, Laurens MD28, WB69
Deckro, Dick MD58
Defourny, Boris MB12
DeHoratius, Nicole SD03, TD26
Demirkan, Haluk TB59
Deo, Sarang SA27, SD29, MB25
Deshpande, Ajay TA59
Deshpande, Vinayak SA25
Dewan, Pooja SC16, SD32
Dey, Santanu S. SC24, SD04, TC24
Diaz, Rafael TC49
Diwekar, Urmila WD21
Doan, Kien TC48
Dogru, Mustafa K. WA03
Dolinskaya, Irina MB64, MC64, MD64
Dong, Fang WD07
Donnelly, Tom WB58
Drezner, Tammy TC38
Drezner, Zvi SB38, TB38
Druehl, Cheryl MC40, WC40
Du, Lili WC48
Duan, Lian SC50
Duclos-Gosselin, Louis SB53
Dugardin, Frédéric TC06
Dulin, John TC59
Durango-Cohen, Elizabeth TC54
Durukan Sonmez, Ayse WD52
Dyson, Robert MD23

E

Eckstein, Jonathan MB04
Edirisinghe, Chanaka SD19
Ekici, Ali SA34
Eksioglu, Sandra TB16
El Ouardighi, Fouad WA68
El-Taha, Muhammad WE07
Engau, Alexander WA60
Enns, Eva WC31
Erat, Sanjiv SA41
Erdem, Asli Sencer WB44
Erenay, Fatih Safa TA31
Ergun, Ozlem TB12
Erhun, Feryal MB44, TA06
Erzurumlu, Sinan SA40, SB40
Esenduran, Gokce TA69
Esensoy, Ali Vahit WD64
Evans, Gerald MA65
Ezell, Barry SA23, SB23, SC23

F

Fan, Neng SA22, WA20
Farias, Vivek SC13, WC11
Faulin, Javier WC38
Feng, Liming WA29
Feng, Tianjun MC15
Fidan, Neslihan WB10
Figueira, Jose SA63
Fisher, Michele MA54
Fixson, Sebastian SB41
Flapper, Simme Douwe WB61
Fogliatto, Flavio TA23
Forrester, Richard MD46
Foster, Justin TB62
Fourer, Robert SB03
Fox, Bill MC58
Fransoo, Jan C. TA50, TC47
Frazier, Peter MD06, TA49
Froehle, Craig WA34
Fuchs, Erica MB41
Fukasawa, Ricardo MB24
Fuller, Douglas WA56
Fulton, Lawrence WB34

G

Gabriel, Steven MB14
Gallien, Jeremie SB64, SC64
Ganesan, Rajesh TD23
Gans, Noah MB28
Gao, Gordon SC39
Gao, Long WE30
Gapeev, Pavel MB02
Garg, Rajiv SD42
Garrow, Laurie SC57
Gartner, Nathan H. TA48
Gass, Saul SC06
Gaukler, Gary SD23, WA01
Gaur, Vishal SA30
Gebraeel, Nagi SC37, MA35
Gel, Esma MA03
Gendreau, Michel SB47
Geng, Qin WB65
Ghate, Archis TA05
Ghoniem, Ahmed TB57
Ghosh, Soumyadip MA49
Gibas, Cynthia SA12
Giesecke, Kay SB06
Giesen, Ricardo WC61
Gilliland, Michael WD55
Girotra, Karan SD41, TC26
Glasserman, Paul MA29
Goel, Ankur TA30
Goez, Julio C. TC60
Gokpinar, Bilal TA41
Golbeck, Steven WB29
Golden, Bruce SA04
Gomes, Carla TA12
Goossens, Dries SA45
Gorin, Tom WD09
Gorman, Michael TA55, WC55
Grabarnik, Genady SA65
Graves, Stephen C. SC55, SD55
Greenland, Arnold MC55
Groleau, Tom MC39
Groznik, Ana SD34
Grushka-Cockayne, Yael SB15, SD03, MA15
Guajardo, Jose A. MB01
Guan, Yihan SB34
Guan, Yongpei SD22
Guikema, Seth TB15
Guler, Kemal MD45
Gulpinar, Nalan WE19
Guo, Xin MC29
Gupta, Aparna MA19
Gurumurthi, Suri WB68
Gurvich, Itai SA11

H

Hafezi, Maryam WB41
Haghnevis, Moeed MD49
Hall, John WA64
Hall, Nicholas G. MA27, MB18
Hampshire, Robert SC11, SD51
Han, Lanshan WC22
Han, Sung Won WC36
Hansen, Mark MC57
Harsha, Pavithra SD28
Hartley, Dean MA58, MB58
Hasenbein, John SD07
Hawn, Olga WC41
He, Xuili WA65
Hedman, Kory SA14
Heese, H. Sebastian MC01
Heitz, Christoph TD59
Helm, Jonathan SD31
Henderson, Shane MB49, TD34
Henry, Andrew J. WC34
Hicks, Illya MC60, MD60
Hill, Ray WA49
Hilliard, Michael TA62
Hinrichs, Curt SD46
Hirsch, Michael SC58, MC20
Hobbs, Benjamin MA14
Hoberg, Kai TD03
Hoffman, David WC67
Honhon, Dorothee MD25, TD17
Hooker, John TA08, TB08
Hopp, Wallace MD17
Hsu, Cheng WD59
Hsuan, Juliana TA40
Hu, Bo TA28
Hu, Guiping TC16
Hu, Ming SB28, MB13, TD01
Huang, Changjian WA19, WC53
Huang, Ming-Hui SD65
Huang, Peng SA39, SD39
Huang, Qiang SB33, MB35, MD33
Huang, Shuai TA53, TC53
Huang, Wei WD46
Huh, Woonghee Tim SC26, TA25
Hunt, David TB32
Hutton, David TA34

I

Iancu, Dan TC29, WB01
Iravani, Foaad MA01
Iyoob, Ilyas MA08

J

Jacobson, Evin WA31
Jagabathula, Srikanth SD13
Janakiraman, Ganesh TA26
Janssen, Rene WA04
Jarrah, Ahmad WE47
Jasin, Stefanus SB09
Jayaraman, Raja MB56, WB35
Jeong, Myong K (MK) SB54
Jeong, Young Seon TB53
Ji, Ping WE20
Jiang, Ruiwei MB21
Jin, Judy TC33
Jin, Tongdan TD35
Johari, Ramesh SB13
Johar, Monica WE42
John, Richard SD15
Johnson, Alan SC44
Johnson, Andy SB66, SD66, MC66
Johnson, Michael SA38, SC54, TA64, TB64, TD64
Jones, Dylan SB63
Jose, Victor Richmond WC17
Joshi, Karuna SC65
Jung, Jongbin WB12

K

Kabirian, Alireza WC03
Kageyama, Masayuki TA21
Kamarthi, Sagar TA33, WB33
Kang, Pilsung TD53
Karaesmen, Itir MA13
Karamanis, Dimitrios SB21
Karray, Salma WD02
Kartal-Koç, Elçin WA05
Karwan, Mark SC63
Kashiha, Mona WD48
Katok, Elena MA05
Kattuman, Paul WC19
Kazaz, Burak SC02
KC, Diwas MC26
Ke, Wei TC09
Keeney, Ralph SB05
Keisler, Jeff SC15, MB15
Keller, L. Robin MC15
Kemahlioglu Ziya, Eda TB01, TC69
Kesavan, Saravanan TD25
Keskinocak, Pinar MA34
Ketter, Wolf TA45
Keysan, Gizem WA23
Khajavirad, Aida TC20
Khanjari, Neda WD30
Kharoufeh, Jeffrey SB36
Khodadadegan, Yasaman WD56
Khojandi, Anahita SA37
Khorrami, Babak MB57
Kianfar, Kiavash SA24
Kiassat, Corey WA41
Kim, Byung Cho TA39
Kim, Doyoon TD46
Kim, Norman TB53
Kim, Sang-Hyun SC27
Kim, Seong-Hee WB49
Kim, Seong-joon WC45
Kim, Seoung Bum TD53
Kim, Sujin SD49
Kim, Yong Hoon MC48
Kingsford, Carl SB12
Kirshner, Sam WB13
Klampfl, Erica MA54, TC07
Klastorin, Ted MC18
Ko, Jeonghan WA25, WC33
Kocadagli, Ozan WC07
Kok, Gurhan WE25
Koksalan, Murat MA63
Konak, Abdullah MB36
Kondo, Akira TA57
Kong, Zhenyu (James) TC35
Konrad, Renata MA42
Kortanek, Kenneth TA02
Kou, Steve TB29
Krass, Dmitry SD38
Kremer, Mirko TB26
Krishnamurthy, Ananth TB52, TC52, WA52
Kristjansson, Bjarni MA04, MC03, TA03
Kucukyavuz, Simge MA24, MD05, WB24
Kulturel-Konak, Sadan TA52
Kumar, Mahesh MA13
Kumar, Subodha MD39
Kuo, April TC32
Kurt, Murat SA31
Kuruzovich, Jason TC42
Kutanoglu, Erhan TA38
Kuzu, Kaan SC59
Kwon, Changhyun TC51
Kwon, Dharma TA17

L

LaGanga, Linda WD31
Lai, Guoming SC30
Laird, Susan TA58, TB58
Lambert, W. Brian WC16
Lan, Guanghui TC22, WB60
Lau, Nelson TD50
Lavieri, Mariel SD31
Lawphongpanich, Siriphong (Toi) SB48
Lee, Deishin TD16
Lee, Donald SC29
Lee, Eva WA36, WD34
Lee, Jaegul TD40
Lee, Jon SB24
Lee, Kashek WC28
Lee, Loo Hay TD49
Lee, Seonah MB09
Lee, Seungchul TB54, WC33
Lee, Young-Jin TD42
Lee, Yu-Ching WD22
Lee Ho, Linda TA23
Lehman, Toby WD26
Lei, Lei MD18
Lembke, Ron WA47
Lemieux, James TA13
Lengacher, David WD15
Leung, Joseph SB18
Leung, Ming-Ying SD12
Leung, Tim TA19
Levi, Retsef MA06, MB27, MC34
Lewis, Mark MA11
Leyton-Brown, Kevin MC45
Liao, Haitao MA33, TA37
Li, Chung-Lun SC18
Li, Cuihong WC01
Li, Gang MC65
Li, Haitao WA44
Li, Hongmin MD09
Li, Jing MC53
Li, Lingfei WB29

Li, Xinxin WC42
Lieberman, Warren TB55
Lightfoot, Howard MB65
Lim, Andrew SD11
Lim, Gino J. SC31, MA23, MB31
Lim, Michael TD38
Lim, Yun Fong TA66
Lin, Chunfang Devon SB35
Lin, Grace MD65
Lin, Mingfeng MC42
Linares, Pedro WC43
List, Barry MB39
Liu, Andrew SC14
Liu, Biao WC26
Liu, Henry MA48
Liu, Heping MD04
Liu, Jian TB37
Liu, John WE22
Liu, Nan SC34
Liu, Zhen MD19
Liu, Zhixin TB18
Llewellyn, Donna SD54
Lobel, Ilan SD09
Loch, Christoph MD50, TB41
Logendran, R. Logen WB28
Lovell, David SA57
Lownes, Nicholas MA51
Lu, Shu TD22
Lu, Yingda MB42
Lu, Yingdong SD59
Lubin, Benjamin MA45
Luedtke, Jim TA24, TD24
Luken, Brittany MA57
Lustig, Irv TD55
Lv, Hairong WC04

M

Ma, Shiqian TB60
Macal, Charles SA49
Magazine, Michael WA34
Maglaras, Costis SC07, TB13
Marais, Karen TB23
Mardan, Setareh SA13
Marianov, Vladimir WE52
Marla, Lavanya TC57
Marquis, Jon TD63
Martin, Kipp TB03
Martínez-de-Albéniz, Victor SD01, MC30
Martonosi, Susan SC03, MC44
Masini, Andrea WD41
Mason, Jennifer MD36
Massol, Olivier TA43
Mayorga, Maria WD28
McDill, Marc SD16, MA16, MB16, MC16, MD16
McGarvey, Ronald SA32
McLay, Laura MA64, TC64
Medal, Hugh TD44
Megahed, Aly WD47
Megahed, Fadel M. MB37, TD37
Mehrota, Sanjay TD66
Mehravaran, Yasaman WC18
Mehta, Sameep MA59
Meisel, Stephan MC47
Mendoza, Alvaro WB62
Mendoza-Arriaga, Rafael WA29
Merener, Nicolas WC10
Mersereau, Adam SB32
Mesa Arango, Rodrigo SA47
Meyer, Marlize MB55
Mirzaei, Shokoufeh TC61
Mishra, Anant TB40
Mishra, Nishant SB56
Mitchell, William SC52
Mitra, Gautam TB02
Mittelmann, Hans SA08
Moallemi, Ciamac SC07, MB29, WC11
Moazeni, Somayeh WD08
Mobasher, Arezou MB31
Mohr, Doug MA55
Mohr, Shirley TD54
Monroe, Richard WC66
Montibeller, Gilberto WA63
Montiel, Luis TB17
Moore, Bruce TD19
Morales, Juan SA16
Moritz, Brent WA50
Morrice, Douglas MC49
Morrow, W. Ross WB67
Morton, Alec SC15, MB15
Mostovyi, Oleksii WE01
Mousavi, Mohammad WE08
Moya, Hiram WD58
Mujahid, Syed WC20
Murali, Pavan TD51
Murat, Alper SC38
Muriel, Ana TD69
Murray, Chase SA58, SB58
Murray-Tuite, Pamela MC51
Mut, Murat MC22
Muthulingam, Suresh SD27, MD01, TB69
Myers, David SC32

N

Nagai, Daisuke MD56
Nagurney, Anna MA03
Nanduri, Vishnu SD43
Nason, Scott SD57
Natarajarathinam, Malini WB54
Nazerzadeh, Hamid TA09
Neal, Larry MC17
Nembhard, David TC66
Netessine, Serguei MC25, TB28
Nezamuddin, N. SC48
Ng, ManWo WC48
Niculescu, Marius Florin TD39
Nie, Xiaofeng WC58
Niederhoff, Julie TB50
Norback, Judith TB46
Ntaimo, Lewis MA22

O

Oberstone, Joel MB52, MD52
Oh, Sechan WA28
Olivares, Marcelo SB25, TB25
Olvera, Mariana SB11
Onal, Hayri WB16
Oren, Shmuel MD14
Osadchiy, Nikolay TB30
Osorio, Carolina SD48
O'Sullivan, Donal WD16
Ott, Ursula WB17
Ouyang, Yanfeng TB51
Ozer, Ozalp MB06, WC25
Ozkan, Gulru TC40
Ozlen, Melih WC63

P

Palocsay, Susan MB46
Pant, Gautam TA67
Papageorgiou, Dimitri TA47
Parija, Gyana MD66
Park, Chiwoo TB33
Park, Kun Soo MD02
Parlier, Greg TC58
Parnell, Gregory WA58
Parsons, Jay WD19
Pataki, Gabor TB24
Pathak, Praveen TB67
Paynabar, Kamran TC33
Peccati, Lorenzo MD23, WC15
Peeta, Srinivas TD47
Pekec, Sasa TB45, TD45
Peng, Jiming TB22
Peng, Xianhua TA29
Perakis, Georgia SA26, MC09
Perera, Sandun WC29
Perry, Ohad MA07
Petersen, Jon MD57
Phadnis, Shardul WA17
Phillips, Lawrence SC17
Phillips, Robert TD09
Piper, Brian MC63, WE58
Pokharel, Shaligram WB66
Pollack-Johnson, Bruce WD18
Popescu, Dana MA09
Portal, Benazir WB04
Posner, Marc TC18
Powell, Warren TC12
Prasanna, G N Srinivasa WA62
Precup, Doina MA12
Prekopa, Andras SD21
Prieto, Diana WB08, WD23
Primbs, James MC19
Psarros, Ioannis TD61
Puranam, Srinivasa WA08

Q

Qian, Peter SB35, SD53, MC35
Qiao, Wenxin WA61
Qin, Fei TD30
Quadrifoglio, Luca MB51, TB47
Quiroz-Aguilar, Francisco WD66

R

Racer, Mike SB46, SC46
Radchenko, Peter MA50
Rafique, Raza WD44
Rahman, Mohammad SA42, MA39
Rainwater, Chase SA44
Ralphs, Ted MB03
Ramanan, Kavita WE11
Rand, William WA59
Randhawa, Ramandeep SC28, WC27
Ranjithan, Ranji MB63
Rankin, Yolanda MD65
Ransbotham, Sam WA39
Rasekh, Lila TC13
Raskina, Olga MD55
Raviv, Tal SA51, SB51
Rebennack, Steffen SB20, WB14, WC14
Reed, Josh SB07
Reed, Patrick TB63
Rees, Jackie WD42
Regnier, Eva SC03
Reinhardt, Gilles WE31
Resende, Mauricio SC60, SD60
Richard, Jean-Philippe MD24, WC24
Riggs, Robert WE68
Roels, Guillaume MD26
Romeijn, Edwin MD31
Rong Li, Shirley WC47
Rönnqvist, Mikael WC51
Root, Sarah WD51
Rose, Marc WA57
Roth, Wendy TB19
Rouse, Paul SC66
Rousseau, Louis-Martin MD08, TC08
Royset, Johannes TB21, WA21, WB21
Ru, Jun TC39
Rudin, Cynthia MA53, MD53
Runger, George SC53
Rupérez Micola, Augusto WB43, WE14
Russell, Robert WC13
Rust, Roland T. MB59
Ryan, Jennifer TB66
Ryan, Sarah TB14
Ryoo, Hong Seo TA20
Ryzhov, Ilya SB22

S

Sa-ngasoongsong, Akkarapol WD01
Saat, Rapik MA32
Saghafian, Soroush MA36, MD17
Saha, Syamantak MC59
Sahin, Ozge WB09
Sahinidis, Nick TA04
Sahoo, Nachiketa WB42
Saldana, Carolina WC44
Salo, Ahti SC15, MB15
Saltzman, Matthew MD03
Samorani, Michele MC56, TD04
Samuelson, Doug SC55, SD55, TD07
Saniee, Iraj MB60
Sanli, Tugrul TB09
Sashihara, Steve WE54
Sauma, Enzo MC14
Sauré, Antoine MC12
Saure, Denis Roland WC09
Savaskan, Canan MB69, WA69
Sayyady, Fatemeh TB61
Schaller, Jeffrey WA06
Scheller-Wolf, Alan TD11
Schwartz, Russell SD12
Secomandi, Nicola SC30
Seifert, Matthias SA17
Sen, Suvrajeet SA21
Sen Gupta, Rajorshi WD39
Seref, Onur MD20
Seshadri, Sridhar TB30
Shah, Devavrat MB11
Shan, Xiaojun WA15
Shanbhag, Uday MA21, MD21, WA22

Shang, Jennifer TC28
Shang, Kevin SC26, MC05, MD30
Shao, Fang WC46
Sharkey, Thomas TC44
Sharma, Sushant TD48
Sheikh, Shaya WE44
Shen, Houcai SA05
Shen, Siqian SD08
Shen, Wenjing TD02
Shetty, Bala TA68, TB68
Shi, Jianjun TD33
Shi, Jim MC13
Shi, Yong SD63
Shin, Hyoduk TB39
Shinde, Shilpa WD45
Shittu, Ekundayo TC43, WC69
Shi, Wenbo WE62
Shoemaker, Christine TB04, TC04
Shrivastava, Abhishek SA35, MA37
Shwartz, Larisa SA65
Siddiqui, Afzal SA43
Siemsen, Enno WB50
Simaiakis, Ioannis WB57
Singh Rathore, Ajay Pal TC68
Singh, Harpreet TB42
Sioshansi, Ramteen MD43
Sisikoglu, Esra MC36
Slowinski, Roman MD23
Smalley, Hannah MA34
Smith, J. Cole SD36, MA60, WD24
Snyder, Larry MA38, MB38, TB44
Solorio, Carlos WB45
Song, Jeannette WD25
Song, Joe SC12
Sosic, Greys MB26, TA01
Souza, Gilvan "Gil" SB27
Soyer, Refik WD33
Spetzler, Carl SA15
Squillante, Mark S. WA11
Staats, Bradley SD40
Staum, Jeremy TD29
Stier-Moses, Nicolas E. SD24
Stolyar, Aleksandr MB07
Strinka, Zohar SC56
Su, Xuanming SD26
Subramanian, Ravi MB69
Subramanyam, Ramanath MD42
Su, Che-lin WB27
Sun, Bo WB07
Sun, Li TB56
Sundaramoorthi, Durai SA53
Susarla, Anjana TA42
Sweda, Timothy SC43
Swinney, Robert WD27
Szechtman, Roberto MB23
Szidarovszky, Ferenc TD67

T

Tan, Kok-Choon WE48
Taneri, Niyazi MD41
Tang, Wenjie TA17
Tao, Zhi WC32
Tas, Sinan WB23
Taylor, Terry SA27
Tezcan, Tolga WB11
Tian, Zhigang SD35, TD35
Tiwari, Vikram SD34
Toktay, Beril TA27
Tomasgard, Asgeir TD14
Topaloglu, Huseyin SC09
Toriello, Alejandro WE24
Trapp, Andrew SC20
Triantis, Kostas MB66
Trichakis, Nikolaos SA29
Tsetlin, Ilia TC17
Tsung, Fugee MC23
Turner, John SD25
Turner, Thomas TD58

U

Uhan, Nelson WA67
Ulu, Canan TD17
Unuvar, Merve SC21
Uryasev, Stan MA02

V

van Hoeve, Willem-Jan TD08
van Houtum, Geert-Jan TB27
Van Oyen, Mark MA36, WE65
Van Roy, Benjamin SD06
Van Vyve, Mathieu WA24
Van Woensel, Tom SC47, MB47
Vanhoucke, Mario TD18, WA18
Varghese, Vijith Malayil WB56
Varshney, Kush MD59
Vinokurova, Natalya SA52
Virine, Lev TC62
Vogiatzis, Chrysafis WE23
Vorobeychik, Yevgeniy SB04
Vulcano, Gustavo SC13

W

Wagner, Harvey SD05
Wan, Hong SC49
Wang, Hsueh Ming Stev WA40
Wang, Hui John WA25
Wang, Hui SA36
Wang, Kaibo MB37, TD37
Wang, Lizhi SB43
Wang, Marshal WE28
Wang, Sijian SD53
Ward, Amy MB05
Wattal, Sunil SB42
Weber, Charles MB40, WB40
Webster, Mort TD21
Weintraub, Gabriel SB25, MA25, MC07
Wen, Aihong MD32
Wernz, Christian WC34
Wiecek, Margaret WD63
Wilhelm, Wilbert TA16
Willoughby, Keith MB34
Wogrin, Sonja SD14
Wollega, Ebisa WC12
Woodruff, David SC04
Worley, Owen MA43
Wortman, Martin TC35
Wu, Chaojiang WD50
Wu, Chihwen TC65
Wu, Owen MC06
Wu, Tao WC08
Wu, Yaozhong MC50
Wu, Yijiang TC41
Wunderling, Roland WD60

X

Xanthopoulos, Petros MB50
Xia, Cathy MB08, TB11
Xie, Chi MA47, MD48
Xing, Dahai WD65
Xing, Tao TB48
Xu, Jie WA07
Xu, Jiefeng WA38
Xu, Jingyang WB06
Xu, Lijuan SB33, MB35, WE33
Xu, Lizhen WA42
Xu, Yanyi WA13
Xu, Yi MA41, WA27

Y

Yaesoubi, Reza SB31
Yakici, Ertan WB38
Yang, Hui SD50, WB37
Yang, Jian MC28
Yang, Muer WB31
Yang, Nan TC30
Yang, Qingyu WA37
Yang, Rui WC60
Yang, Xu WD68
Yao, David D. TA07
Yao, Tao TA51
Yarmand, Hamed TC31, TD31
Yavuz, Mesut TD06
Yayla-Kullu, Muge SA28, WB26
Yaylali, Emine WE34
Ye, Hengqing TA07
Yeung, Thomas WD12
Yin, Rui TC01
Yin, Yafeng SA48
Yu, Andrew WB18
Yu, Yugang TD52, WB52
Yunes, Tallys MC08

Z

Zabarankin, Michael WC21
Zakeri, Golbon TA14
Zavala, Victor M. SB14
Zechman, Emily MD63
Zeid, Abe SC35, TA33, WB33
Zeng, Bo SB08, TB43
Zeng, Li SD37
Zenios, Stefanos TB05
Zhang, Fuqiang MA28, MD27
Zhang, Guoqing SA56, WB47
Zhang, Hongchao TA22
Zhang, Jingyu TD36
Zhang, Juheng WA53
Zhang, Jun SB44
Zhang, Lei WB48
Zhang, Li WA19, WC53
Zhang, Muhong MC21
Zhang, Shengfan MC31
Zhang, Xiaowei TB07
Zhao, Xin TA56
Zhao, Yao MA26
Zhao, Yonggan MB19
Zhao, Yueqiong TA61
Zheng, Hong MD51
Zheng, Qipeng (Phil) TC14
Zheng, Yanchong Karen WC25
Zhong, Hongsheng SD47
Zhou, Enlu MD12, TD12, WD49
Zhou, Jing WA02
Zhou, Qiang TC37
Zhou, Ruoyi SB65
Zhou, Xuesong TD32, WA48, WB32
Zhou, Yin WE02
Zhou, Yong-Pin TC27
Zhou, Zhi WC62
Zhu, Kangyuan WB20
Zhu, Mengxiao WB46
Zhu, Valerie C.Y. WE67
Zhu, Zhen MB20
Zhuang, Jun TD15, WA15
Zionts, Stanley TC63

Author Index

A

Abada, Ibrahim TA43
Abayomi, Kobi SA50
Abbas, Ali MB17, MD15, TA65
Abbasi, Ahmed TC67
Abbasi, Sheraz WD21
Abbosh, Ayman MC36
Abbott, Jim IS-M
Abdollahian, Mehrnaz TD06
Abe, Naoki SC55
Abecassis, Michael MA56
Abedi, Vahideh SD38
Abell, Jeffrey WA25
Abginehchi, Soheil WA08
Abhishek, Kumar SC35
Aboolian, Robert TB38
Abouee-Mehrizi, Hossein MC11, MD38
Abrams, Howard SD54, WE31
Abuhmid, Hatem TA33
Abu-Nabaa, Hisham WA40
Acemoglu, Daron SD24
Acharya, Dharma MC32, TC32
Acharya, Shikhar MB36
Achterberg, Tobias SA08, SB24, WA24
Acimovic, Jason TC39
Acquisti, Alessandro WC19
Adam, Nabil WC49
Adamopoulos, Panagiotis WB42
Adamou, Nikolaos WC15
Adams, Warren MB20, WC24
Adan, Ivo MD07, TB52, TD11
Adasme, Pablo MB60
Adelman, Dan SB09, MC41, WC11
Adhav, Hemant SA53, IS-T
Adida, Elodie SA31, MB13, MB25, TD01
Adje, Assale MA20
Adjiman, Claire S WE22
Adlakha, Sachin MA25, MA49, MC07
Adomavicius, Gediminas TA67, WB42
Afeche, Philipp SC28, MD28, TC27, TD01
Aflaki, Sam TD28
Agarwal, Amit MB32
Agarwal, Ashish SC42, TD39
Agarwal, Ritu SC39, MC42
Agarwal, Shweta MA15
Agca, Esra WA51, WB44
Aggarwal, Vikas WC46
Aghdashi, Seyedbehzad TB61
Agnetis, Alessandro MB18
Agost, Rodrigo Acuna WC57
Agrahari, Homarjun SB16, SD36
Agrawal, Anirudh TD65
Agrawal, Anupam MD01, SD27, TA17
Agrawal, Narendra SC25
Agrawal, Vishal SC27, TA27, WA69, WE69
Aguado, José MC14
Aguirre, Oswaldo IS-M
Agusdinata, Datu TD47
Aguwa, Celestine WA31
Aharoni, Merav SA03, MD66
Ahiska, Semra Sebnem WA30, WD03
AhmadBeygi, Shervin TD57
Ahmadi, Reza MA01, TC68
Ahmed, Md. Tanveer TA39
Ahmed, Shabbir TD24, WA24, WB24, WB33, WE24
Ahn, Hyun-Soo SA09, MB45, MD11, TA30, TB01, TC25
Ahn, Hyun-Soo WB09
Ahrari, Amir IS-M, TD06
Ahuja, Ravindra MB32
Ai, Jing WA19
Aickelin, Galina WC23
Aickelin, Uwe WC23
Aidekon, Elie SC07
Airoldi, Mara SC15
Aitken, Victor MC04
Aivas, Inge TB31
Ak, Aykagan TD61, WE48
Akan, Mustafa SC26, MD28
Akartunali, Kerem WA31
Akbarinasaji, Shirin IS-M
Akbilek, Nevra WB07
Akcali, Elif WB69, WE68
Akcay, Alp WC49
Akcay, Yalcin WB26
Akella, Ram TD59
Akgun, Osman TB11
Akhavan-Tabatabaei, Raha TB54, WB35, WC58, WE01
Akhtar, Taimoor TC04
Akinsanmi, Eyiwunmi MB41
Akkaya, Kemal MC36
Aksin, Zeynep SA07, WB27
Aktekin, Tevfik WB53
Aktürk, M. Selim WC57
Akyol, Bahar IS-M
Alaeddini, Adel MC56, TB37, TB56, WD45
Alagoz, Oguzhan SD54, TA31, TB31, TC36, TD05
Alam, Mahabub TD44
Alamar, Ben MC52
Alan, Yasin SA30, MD27
Alaniazar, Saman TC41
Alarcon, Fernando SC55
Albey, Erinc SA05
Aleman, Dionne SC19, SC31, SD44, MA31, IS-M, MC31, TA31
Alemi, Farrokh WD56
Alexander, Suraj SA59
Alexander, Gordon MC02
Ali, Ahad WC07
Alirezazadeh, Pantea WB41
Alistar, Sabina SB34, SC54
Alizamir, Saed TD17
Al-Khalifa, Khalifa SB37, MC37 TB37
Alkire, Brien SA32
Allahverdi, Ali WC06
Allaire, Douglas WB15
Allen, Dave TD46
Allen, Theodore WB64
Allon, Gad SA07, SC28, SD28, MA28, MC26, MD28, TB26, TC01, TD28, WB25
Almeida, Paul SB52
Almeida-Dias, Juscelino SA63
Almeida-Filho, Adiel WB63
Al-Najjar, Camelia WE44
Aloise, Dario José WE20
Aloulou, Mohamed Ali SC18
Aloysius, John WA01
Alptekinoglu, Aydin SC25, MD25
Al-Salem, Ameer TB57
Altiparmak, Fulya WA38
Altug, Mehmet Sekip MA01, WA26
Alvarez, Pamela MD16
Alzalg, Baha SC22
Amaran, Satyajith TA04
Amaro, Carlos WD25
Amayri, Abeer TD35
Ambrosiano, John SD15
Amini, Mehdi WA44
Amodeo, Lionel SC63, MD63, TC06
Amornpetchkul, Thunyarat SA09
An, Heungjo TA16
An, Lianjun MA49
An, Qian MA47
An, Shi TB51
An, Tuyin TC46
An, Yu MB38, WD52
Anand, Krishnan MB69
Andersen, Erling SA08
Anderson, Chris TA13, TC02
Anderson, David TB56, WC42
Anderson, Edward SC40
Anderson, Eric WD43
Anderson, Gary SC55
Anderson, Laura SB65
Anderson, Lindsay MC43
Anderson, Steve SC32
Anderson, Timothy WC59
Anderson, Trisha MA69
Andersson, Emma WC61
Andra, Mitha IS-M
Andradóttir, Sigrun MA11, MC49
Andre, Jean MB14
Andritsos, Dimitrios MC26
Ang, James MC21, WB11
Ángel, Marín WC57
Angelis, John MA40
Angelus, Alexandar TA25
Angulo, Gustavo SC55, WA24
Animesh, Animesh MA39
Anitescu, Mihai SB14, MB12, WC60
Anjos, Miguel TA60, TC20
Ankenman, Bruce SC49
Ano, Katsunori TA21
Anshelevich, Elliot SD60
Anupindi, Ravi SC30
Aperjis, Christina SB28, TC50
Apley, Dan MD33, TD37
Apras, Server WB56
Apt, Jay SB43
Araghi, Mojtaba SC28
Aral, Karca Duru MA56
Araman, Victor SC13, WC09
Aravkin, Aleksandr WB22
Araz, Ozgur SB17
Archetti, Claudia MB47
Arellano, John MC60
Arendt, Susan WA16
Argon, Nilay SB29, MD11
Argote, Linda SD42, MD40
Argyris, Nikos SC15, WA63
Arifoglu, Kenan MB25, TA27
Arikan, Mazhar WB27
Ariyajunya, Bancha SB50
Ariyawansa, Ari SC22
Arlotto, Alessandro SB22, TA11
Armbruster, Benjamin SB34, TA34, TC36
Armbruster, Dieter TA66
Armony, Mor SA11, SD03, MA07, TD27
Arney, Chris MC58
Arney, Kristin MC58
Arntzen, Bruce TC47
Aron, Ravi TA42
Arora, Nikhil WA62
Arora, Ritesh MB36
Arratia, Andrea MA16
Artiles-Leon, Noel WB45
Arunachalam, Viswanathan WE01
Asaf, Sigal MD66
Asaoka, Masahiro WC26
Ashlagi, Itai SD09, MA53
Askin, Ronald MD47, MD49
Assad, Arjang SC06
Assumaning, Godwin TC62
Asudegi, Mona IS-M
Aswal, Abhilasha WD08
Ata, Baris SA26, SD07, TC69, TD16, WB27
Atamtürk, Alper WC57
Atan, Zumbul WE25
Atar, Rami WE11
Atasu, Atalay TA69, WA69, WB69
Atkinson, Michael MB23, TA31, TD15
Au, Siu-Tong MB65
Audy, Jean-Francois TC08
August, Terrence TB39, TD39, WC25, WC39
Avci, Buket TB28, WB26
Avetisyan, Hakob MB14
Avila Herrera, Juan Felix TB53
Aviv, Yossi WD27
Avraham, Edison SA51
Awaysheh, Amrou MA69
Aybat, Necdet Serhat TB60
Aydilek, Harun WC06
Aydin, Ayhan MC41
Aydin, Burcu TC03, WD03
Aydin, Gizem TD44
Aydin, Goker SB27, MD09, MD25, WB09
Aydin, Nezir MD38
Aydinliyim, Tolga SC18, TA69, TC18, WA26
Ayer, Turgay SD54, TC36
Ayhan, Hayriye MA11
Aytug, Haldun WA53
Ayvaci, Mehmet TA31
Ayvaz, Nur TD13
Azadian, Farshid WD48
Azadivar, Justin MB45

Azcárate, Cristina TB62
Aziz, Adbul TA48, TC48
Azizzadeh, Shahrzad MB63, WD47

B

Ba, Shan MA33
Babasov, Vusal MA31, IS-M, TB31
Babich, Volodymyr MD30, TB30
Baccelli, Francis MB07
Backåker, Lars WD61
Badesha, Santokh TA28
Badinelli, Ralph WB59
Bae, Suk Joo MB35, WC45
Baharian, Golshid IS-M
Baharnemati, Mohammad Reza MA23
Bai, Lihui TB61, WB07
Bai, Lijie TD60
Bai, Xinxin SC35, TC62
Bai, Xue SB55, TB67
Bai, Yun TB16, TD38
Bailey, Glenn MC46
Bailey, Jennifer SB40
Bailey, Matt TC46
Bajwa, Ahmad WB02
Baker, Erin MA17, MB15, TD21, WB43, WC69
Bakir, Onur TC03
Bakkehaug, Rikard TA61
Bakker, Vincent SD18
Bakshi, Nitin SC27, TD01
Bala, Ram SA28, WA41
Balakrishna, Poornima TA57
Balakrishnan, Anantaram SC48, TC32
Balakrishnan, Hamsa TB23, TC57, WB57
Balakrishnan, Jaydeep WC68
Balakrishnan, P.V.(Sundar) MA52
Balan, Tonya WA55
Balas, Egon TB24
Balasubramanian, Hari SA18, MD34, IS-T
Balasubramanian, Sridhar MD50
Balasundaram, Balabhaskar SA60, MC20, MD60
Balcioglu, Baris MC11
Baldick, Ross WA14, WC14
Balestrieri, Filippo SB28
Baliban, Richard C. SB20, TC16
Ball, Michael SB57, SD64, TC23
Ballard, Kandace MC64
Ballot, Eric TC52
Balseiro, Santiago TA09
Bam, Maya MC44
Bambos, Nick MA07
Ban, Jeff SB48, MA48, TA48, TD48, WB51, WE23
Banal-Estanol, Albert TA43
Banciu, Mihai TC46
Bancroft, John MC39
Bandara, Damitha WD28
Bandari, Roja WB33
Bandaru, Sunith TA63
Banerjee, Avijit SA56
Banker, Rajiv SD66
Bansal, Manish SB38
Bansal, Saurabh WA27
Bao, Xiaowei TC20
Bapna, Ravi TC45
Baptista, Alexandre MC02
Barajas, Joel TD59
Barber, Gerard MA65
Bard, Jonathan SC47, MC46, WE47
Bardhan, Indranil TD42
Bardossy, M. Gisela WD24
Baringo, Luis MB43
Barkan, Christopher MA32
Barker, Clayton MA31, IS-M, MD52
Barker, Kash SC44, TA44, TC15, TD44, WC15, WD50
Barlatt, Ada Y. MD54
Barlowe, Scott SA12
Barmish, B. Ross TC19
Barnard, James WB54
Barnes, Sean WE34
Barnes, Wesley SB58
Barnett Lawton, Jorge TC43
Barnett, Arnold SD64, TC23
Barnett, David SB58
Barnhart, Cynthia SB57, SD03, TC57, WE61
Baron, Opher SC28, MC11, MD28
Baroody, Jim TA28
Barquìn, Julián SD14
Barrett, Anthony SD15
Barron, Robert WB43
Barry, Shaun SCu55
Bartlett, Eric MD32, MD55
Barton, Paul I. SA20, MA20
Barton, Russell SB49, MA42, MC53
Baskaran, Latha TA62
Basole, Rahul SB02, SC41
Bassamboo, Achal SA07, SA11, SB07, SC28, SD28, MC11, MD28, TB26, TC01, WB25
Bassi, Andrea MC43, TB14
Bastani, Kaveh WB37
Basten, Rob TA58
Bastert, Oliver SA08, MC10 TD08
Bastian, Nathaniel D. WA36, WB34
Bastida Sardiña, Juan Manuel WE48
Bastin, Fabian WA12, WB13
Basu, Amitabh SA24
Batarseh, Ola SB49
Bates, Michael IS-T
Batey, John MD54
Batt, Robert MA36
Batta, Rajan SA35, SD38, MA23, MC38
Batur, Demet SD49
Batur, G. Didem WC61
Baucells, Manel SA17, SB15, TA15
Baugh, John WE58
Bautista Alderete, Guillermo SD14
Bavafa, Hessam SB29
Bayati, Mohsen SC29, MB11, TC11
Baydogan, Mustafa SC53
Bayraksan, Guzin TC21, WA16
Bayram, Armagan SA38, TA64
Bean, Michael MD10
Bearden, Neil MD50, WB50
Beasley, J E SD02, MC20
Beccacece, Francesca WB15
Beck, Chris TC08
Beck, Eduard SC54
Beck, Marissa SB45, MA45
Becker-Peth, Michael MC50
Beckmann, Lars SA03
Beeler, Michael TA31
Beer, Ruth TB01
Begen, Mehmet MA31, IS-M, MC39, TA46, TB31
Behdani, Behnam SD36
Behkami, Nima WC59
Behr, Joshua SB23, TC49
Behzad, Banafsheh IS-M
Behzadnia, Peyman TB43
Beier, Eric MA22
Beil, Damian MA25, MB45, TC45
Beiza, Alex SC55
Belavina, Elena MC25, TB28, WC01
Bell, Peter TA46
Bellamy, Marcus SB02
Belloni, Alexandre SD13, MB22
Bellos, Ioannis MA41, WA28
Bellotti, Tony WC53
Belmans, Ronnie TC14
Belobaba, Peter WD09
Belotti, Pietro MC24, TC60
Beltran, Jose Luis SB28
Bemley, Jessye IS-T
Ben-Alia, Eran WC48
Benanzer, Todd WB66
Benaroch, Michel WA28
Benbya, Hind SC40
Bendoly, Elliot MA09
Benekohal, Rahim MA47, TC48, WA61
Ben-Gal, Irad SD37, MA35
Bengtson, Neal SA55
Bengtsson, Jens WC51
Ben-Haim, Yael MD66
Benjaafar, Saif MC27, MD11, TD50
Bennett, Ashlea SA47, MA31, IS-M, WB38
Bennett, James SC55
Bennett, Kristin TD48
Benneyan, James SD44, IS-M, IS-T, TC56, WC56
Benson, Hande TA22
Bensoussan, Alain MD02, WC29
Bent, Russell MB64, MC64, TA08
Bentefouet, Frank TC66
Bentzen, Eric TA40
Berenguer, Gemma MA38
Berente, Nicholas TD40
Berg, Bjorn MA31, MB12, IS-M
Berg, Jordan TA45
Berger, Roger TA20
Bergey, Paul WA43
Berglund, Paul TC51, WD08
Bergman, David MC08, TB08
Berk, Emre MC27
Berling, Peter SD01
Berman, Oded SD38, MD38
Bermúdez, Jose D. TB02
Bernardes, Ednilson TC69
Berndt, Antje SA06
Berner, Cristian SC55
Bernstein, Fernando SC26
Berrichi, Ali MD63
Berry, Christie SA53, IS-T
Berry, Jillian WB56
Bertazzi, Luca SC22
Berthold, Timo SA08
Bertocchi, Marida WE21
Bertsimas, Dimitris SA02, SA29, MD17, TC43, TD23, WB01, WC36
Berumen, Lorena WD41
Besbes, Omar SC13, MB28, TD17, WE09
Besikci, Umut TD18
Besiou, Maria WA69, WB52
Bessa, Ricardo WB14
Best, Michael MC02
Best, Tom TD66
Besterfield Sacre, Mary TC41
Bettinger, Brendan WC56
Bettis, Rich WC41
Bevan, Gwyn SC15
Bevers, Michael MC16
Beyca, Omer TC35
Beyer, Dirk TB66
Bhamidi, Shankar MB11
Bhardwaj, Pradeep MD50
Bhargava, Hemant WC39
Bhaskar, Umang SD60
Bhaskaran, Sreekumar SA41, SB40, TB01, WA27
Bhat, Nikhil MB11
Bhat, Sanket WC68
Bhattacharjya, Debarun MB17, TA15, TB17
Bhatti, Shahzad MA38
Bhavna, Sharma TD16
Bhulai, Sandjai TA11
Bian, Linkan SC37, MA33
Bianchessi, Nicola MB47
Bibelnieks, Eric TC55
Bichescu, Bogdan MA34
Bichler, Martin SA45, SD45, MA45
Bickel, Eric MB15, TB17, WA16
Biehl, Sebastian MD34
Biehn, Neil SA13, TC55
Bielecki, Tomasz MD29
Bienstock, Daniel SD04, TB24, WB64, WD43
Bier, Vicki SA35, SD15, MA17, WB23
Bierlaire, Michel SD48, WB48
Bigras, Louis-Philippe WD09
Bijvank, Marco WB13, WD03
Bilge, Umit SA05, TD18
Biller, Bahar SB49, WC49
Biller, Stephan TD69
Bilyk, Andrew SA18
Bimpikis, Kostas SB13
Binato, Silvio WA14
Bingham, Derek SD33
Birbil, Ilker SB09
Birge, John SA02, SD30, MA29, TB29, TB30, WA31, WD21
Birgin, Ernesto IS-T

Bish, Douglas SC56, MD17, TA51, WA51
Bish, Ebru SC56, MD17
Bisi, Arnab SD56, WA13
Bisias, Dimitrios SA29
Bixby, Robert E. SA08
Bjarnadottir, Margret SB34
Björndal, Endre SA66
Björndal, Mette SA66
Black, Jason MA43, WB55
Black, Ryan WC37
Blacksten, Ric MC39, TB15
Blake, John MB34
Blanchet, Jose TB49, WD11
Blanco, Edgar MD69, TB51, WA32, WD68
Blanco, Rosa TB62
Blanco, Victor SB38, SC24
Blaszczyk, Pawel WE45
Bliek, Christian MD22
Blocher, James MB18
Block, Emily SB52
Blohm, Andrew MB14
Blok, Herman TA11
Blomberg, Jeanette SB65, TD59
Blomberg, Jodi MC55
Bloom, Jeremy SA14, SC14
Blum, David SC23
Blumenfeld, Sabin IS-T
Blumstein, Alfred SD64
Bobashev, Georgiy TD31
Bockstedt, Jesse TB40
Bodily, Samuel E. SB46, SC46
Boeckenstedt, Randy WA16
Boginski, Vladimir SA60, MD43, TD20
Bohannan, Tom TA10
Boile, Maria WB47
Boland, Nastashia L. MD24
Bolandifar, Ehsan SD30, TB50
Bollapragada, Ramesh TD30, WC03
Bollapragada, Srinivas MD12
Bolooriarabani, Alireza MA56
Bompadre, Agustin WE22
Boni, Odellia SA03
Bonshtain, Reut TC25
Bookbinder, James H. WB47, WD48
Boone, Ed MA64
Bopardikar, Shaunak TB21
Borchert, Patricia MA52
Bordley, Robert SB21, MD15, TC46
Bordoloi, Sanjeev WD31
Börgers, Tilman SA31
Borges, Jose G MB16
Borgonovo, Emanuele TA15, WB15
Borgs, Christian SB13, TC11
Borin, Seth MD43
Boros, Endre TA20
Borror, Connie MD37
Borshchev, Andrei WA10
Bortfeld, Thomas TC34
Bosch, Paul MA22
Bosman, Maurice SD18
Botterud, Audun SD43, WB14, WC62
Bouchery, Yann SD56
Boudia, Mourad WC57
Boudreau, Kevin SC40, SD39
Boulaksil, Youssef SB44
Bountourelis, Theologos WB31
Boxma, Onno MD07
Boyabatli, Onur SB30, MD30
Boyaci, Tamer MB26, MC30, WB69
Boyd, Stephen MB04
Boylan, Greg WA35, WC37
Boyles, Steve SC51, MD48, WB48
Boysen, Hans TC32
Bozorgirad, Mir Abbas WB28
Bradley, James TA25
Bradley, Randy MA34
Bradonjic, Milan SC08
Braga, Diogo TB62
Bragge, Johanna MA63
Braithwaite, Ronald Scott MD36
Brandeau, Margaret SC54, MB39, WC31
Brandi, Rafael WD14
Braun, Martin TA18
Braun, Robert MC24
Braverman, Mark SD09, MA53
Bray, Robert SB01, TC26
Bredehoeft, Michael TB23
Brennan, Patricia F. MB34
Brenneman, William SD33
Bretthauer, Kurt MB31, TB34
Briant, Olivier WA23
Briat, Vincent TA43
Brigantic, Robert WD34
Briggs, Justin SD23
Brill, Downey WE58
Briskorn, Dirk SB18
Broadie, Mark MB52
Brockett, Patrick WA19
Broekmeulen, Rob SD27
Brommer, Tracey WC32
Brooks, J. Paul IS-T
Brooks, Paul MA64, MD20
Brooms, Anthony TA11
Broschak, Joseph SB52
Brott, Evan MD13
Brown, David MB29, TC17
Brown, Robert TC16
Browning, Tyson SB41, SC41
Brunner, Jens MD66
Brunnermeier, Markus TD29
Bryant, Paul TD68
Bu, Lei TD61
Bubeck, Sebastien TA49
Buch, Nils WB03
Buchanan, Austin MB44, TB16
Budde, Maximilian WA45
Budhiraja, Amarjit TD22
Buede, Dennis SD15
Buell, Ryan MB01, TC26
Bui, Loc SD11
Bukkapatanam, Vibhav SA06
Bukkapatnam, Satish MC33, TC35, WD01
Bundy, Jonathan WC41
Burbano, Angelica MB56, WA47, WC56, WD64
Burbridge, John WB17
Burer, Sam SA20
Burger, Thomas TB59
Burgess, Robert WB59, WE59
Burke, James V. WB22
Burks, Robert MC58
Burnside, Elizabeth SD54, TA31, TC36
Burt, Christina WB04
Burtch, Gordon D. SB42
Burton, Benjamin A. WC63
Burton, Richard SC52
Buscaylet, Fabrice TD08
Busch, Theresa WC36
Bushuev, Maxim WC03
Büsing, Christina MC21
Bussieck, Michael MC04, WC44
Butenko, Sergiy SA60, SB36, SD20
Butler, John MC49
Buxi, Gurkaran SA57
Buyuktahtakin, Esra SB19, TC24, WC28
Buyurgan, Nebil MB56, WA47, WC56
Buzzard, Greg TA15
Byon, Eunshin MD35, TD35

C

Caballero, Karla TD59
Cabanda, Emilyn MC66
Cabral, Renato WD14
Cabrera-Rios, Mauricio MB33, IS-T
Cachon, Gerard MB28, TB25, WD25
Cadarso, Luis WC57
Cadenillas, Abel MD02
Cadoux, Florent TD08
Caesar, Michael SD54, WE31
Cagan, Jon WE69
Caglar, Toros WB53
Cai, Chengdong MB48
Cai, Di WC10
Cai, Huaning SD11
Cai, Ning MD19, TA29, WA29
Cai, Q.X. SA05
Cai, Selina SB28, TC01
Cai, Xiaoqiang SC18
Cai, Ximing MB63
Cakanyildirim, Metin SB44
Cakici, Ozden WE03
Caldentey, Rene SC13, SD30, MD09, WC09
Caliskan Demirag, Ozgun SA09, SB46
Caliskan, Fethullah WD59
Calkin, David SD16
Cambell, Arthur TB13
Camdereli, Almula TC02
Camelio, Jaime A. SA33, MB33, IS-T, TD37
Camm, Jeffrey MC46, MD03
Campbell, Ann SD47
Campbell, Chantel MC32
Campbell, Dennis MB01, TC26
Campodónico, Nora WA14
Campos-Nanez, Enrique WD19
Canakoglu, Ethem WE19
Candas, Mehmet MC55
Candogan, Ozan SB13, SD24
Cao, Dasong WC13
Cao, Fang SA50
Cao, James WC65
Cao, Qingning SA28
Cao, Wenhua SC31
Cao, Wenwei SB64, WD57
Capan, Muge MA31, IS-M
Capar, Ibrahim SA64
Capar, Ismail TC61
Caplice, Chris TC47, WA17
Capponi, Agostino SB06, MD29
Caramanis, Constantine MA37, MB22
Caramanis, Michael TB62
Carbone, Daniel IS-T
Carbone, Jared WA16
Cardell, Judith MC43
Cardona, Laura WD67
Cardoso, Fabio SC44
Carlson, Robert TC69
Carlsson, Dick MD16
Carlsson, John SC38, SD47, MD03, TB38
Carmichael, Doug WD62
Carnes, Tim SA54, MB27, MC34
Carnovale, Steven IS-M, WD59
Caro, Felipe SC25, MD69
Caromi, Raied MC36
Carpin, Stefano WA21
Carr, Daniel SA12
Carr, Sean TD36
Carrasco, Rodrigo MB18
Carrillo, Janice TC40
Carter, Michael TA31, TB36, WD64
Caruso, Katie TC07
Carvajal, Rodolfo TA24, WB16
Carvalho, Marco WA62
Casbeer, David SB58
Case, Rod MC32
Castanier, Bruno SA37, WD12
Castle, Brent S. MD12
Catalan, Jaime SC55
Cates, Jacob SC58
Caulkins, Jonathan SB46
Caunhye, Aakil WC58
Cavalcante, Victor TC65
Cavdar, Bahar WA07
Cavdaroglu, Burak WB20
Cavus, Ozlem TC29
Ceci, Federica SB41
Cefkin, Melissa SB65
Ceglarek, Darek SD50
Celebi, Emre SD14
Celen, Aydin WE44
Celik, Melih SB64, TB12
Celinski, Tom WA43
Celis, Elisa TA09
Centeno, Efraim SD14
Centeno, Grisselle SA22, SB08, TD36, WA04
Ceran, Yasin TB42, TC39
Cervellera, Cristiano SB50
Ceryan, Oben WB09
Cetinay, Hande SA40
Cetinkaya, Elcin MD02
Cetinkaya, Sila TB07, TD13, WA08, WB69, WE08
Ceyhan, Mehmet Erkan IS-M, IS-T
Cezarino, Wagner TA23

Chaabane, Amin TD69
Chadwick, Samantha MA32
Chae, Young MA49
Chai, Yueting WD39
Chaintreau, Augustin SC11
Chakraborty, Goutam SD46
Chalermkraivuth, Kete MD12
Chamberlayne, Edward TA51
Chan, Carri SB29, SD64, MA07, MC26, TD27
Chan, Eddie WB52
Chan, Ellen TB59
Chan, Hsin-Li WA35
Chan, Siu Hung Joshua WE20
Chan, Timothy MD31, TC34
Chan, Ya-Hui WA59
Chan, Yupo MC36
Chandnani, Vijay TA18
Chandra, Anca SB65
Chandra, Saurabh TA47, WA66
Chandrasekaran, Karthekeyan WC24
Chandrasekaran, Ramaswamy SD27
Chang, Allison WC36
Chang, Chia-Jung SB33, MB33, IS-T, TC33
Chang, Gan-Len WB48
Chang, Mou-Hsiung MC53
Chang, Shoou-Yuh TC62, WE28
Chang, Shou-Chuan MC23
Chang, Wei TC28
Chanta, Sunarin MA64
Chao, An-kuo SA33
Chao, Raul SD41, MC40, MD50
Chao, Xiuli MC28, WA03, WB65
Chaovalitwongse, Art MD20
Chapman, Randall G. MA10
Chari, Manoj TD55
Chase, Valerie MA31, IS-M
Chatfield, Dean TB58
Chatterjee, Samrat WC23
Chattopadhyay, Nilanjan TB65
Chattopadhyay, Sreya TB65
Chaturvedi, Aadhaar MA25, MC30
Chaudhuri, Saikat SD40
Chavez-Bedayo, Luis MA29
Chayes, Jennifer SB13, TC11
Cheesebrough, Tony SA23, SC23
Chehade, Hicham SC63
Chehrazi, Naveed WE09
Chellathurai, Thamayanthi SD02
Chelst, Ken MA46
Chemla, Daniel SB51
Chen, Anastasia SC64
Chen, Bo WD12
Chen, Chen SB01, SD11
Chen, Chien-Hung MD54, WA36
Chen, Chun-Hung IS-T, TD49, WB49
Chen, David MC27
Chen, E. Jack MC49
Chen, Frank SA09, WD68
Chen, He SD26
Chen, Heng TD57
Chen, Heping MA43
Chen, Hongyan WA08
Chen, Hongyu TC39
Chen, Jenyi (Jay) WC65
Chen, Jian SA05
Chen, Jianqing SB39, WA42, WB39
Chen, Jie WC60
Chen, Jieqiu SA20
Chen, Jing TD13
Chen, Jingnan MD19
Chen, Kai-Min IS-M
Chen, Kay-Yut MB28, TB66, TC50, WC49
Chen, Li SB26, TB25, WB50
Chen, Liang WA16
Chen, Lijian MB56, TC28, WB07
Chen, Liwen WB67
Chen, Lucy WB01
Chen, Michael TB43
Chen, Ming SD28
Chen, Nan SD35, MB02, MD19
Chen, Peihua IS-M
Chen, Qi WA48
Chen, Qin SA56
Chen, Rachel MB13, WA34
Chen, Richard SC08, WA20
Chen, Shea MC19
Chen, Victoria SB50, MD20, MD53, TD53, WA16
Chen, Wei TA15, TC28, WD54
Chen, Weiwei TD49, WB55, WC20
Chen, Wenkai MB59
Chen, Xi SC49, TC22
Chen, Xiaojun WD22
Chen, Xin MC28, TB51, IS-T
Chen, Xinyun TB49, WD11
Chen, Yi-Fen WD68
Chen, Yihsu MA14, MD14, TC43, TD43
Chen, Yikai WE47
Chen, Yin TD67
Chen, Ying-Ju SB26, SB28, SD09, TA09, TB25, TC01, WE02
Chen, Yiwei SB13
Chen, Yong WA07, WA37
Chen, Yuche SA22
Chen, Yun WB37
Chen, Yupeng SC26
Chen, Zhi-Long SD28, MA18
Chen, ZhiLong WC50
Chen, Zongze SC50
Cheng, Changqing MC33
Cheng, Chun-Hung SC63, TD20, WC68
Cheng, Feng IS-M
Cheng, Jialin MC37
Cheng, Junzilan TD63
Cheng, Peng TD23
Cheng, Yang TD48
Chen-ritzo, Ching-Hua SC44
Cherchye, Laurens IS-T
Cheridito, Patrick TD29
Chernov, Mikhail MD45
Chernozhukov, Victor MB22
Chertkov, Michael WD43
Chester, Mikhail SB43
Cheung, Kwok IS-M
Cheung, Maurice IS-M
Chevalier, Philippe MA25, WD08, WD66
Chew, Ek Peng TD49, WA66, WB06
Chhajed, Dilip WB44
Chiang, I. Robert WD18
Chick, Stephen SB22, MA56, WB49
Childers, Ashley WA51
Chilingerian, Jon SC66
Chimka, Justin WC37
Chin, Ryan SD51
Chinnam, Ratna SC38, MA56, MD41, TC02, TC41, WB61, WD48, WE07
Chinneck, John MC04, MD08
Chiou, Suh-Wen SB65, WB67
Chipman, Hugh MD33
Chiraphadhanakul, Virot WE61
Chirkova, Rada WB12
Chiu, Yi-Chang MB48, MD51, TB48, TB51
Chmielewski, Hana MB63
Cho, Byung Rae WA33, WA35, WC37
Cho, David MB31
Cho, Joseph WC59
Cho, Soo-Haeng SC01, MC01, TC25, WC36
Cho, Sugon SA50
Cho, Sungzoon TB53, TD53
Cho, Tae-Yeon MD37
Chod, Jiri TB30
Choi, Daeheon TD42
Choi, Dong Gu TB14
Choi, Hwayong TB19
Choi, Jihye WA07
Choi, Jin Young WC18
Choi, Min WA26
Choi, Sangdo(Sam) TC56
Choi, SooJeong WD62
Choi, Sungyong TC03
Choi, Youngsoo MA23
Choo, Adrian SA59
Choobineh, Fred SD49
Chopade, Pravin WD23
Chou, Mabel SA51, WB11
Choudhary, Vidyanand TD39
ChoWehary, Pawan MA49
Christelle, Gueret TC08
Christensen, Benjamin MC34
Christophel, Philipp SB08
Chu, Leon MB26, WC01, WE25
Chuang, Hao-Chun MD39
Chun, So Yeon MA02, TB12
Chung, Byung Do SA48, MB21, TA51
Chung, Gunhui WA16
Chung, Kwanghun MA24
Chung, San-Lin WE19
Chung, Sung Hoon WA30
Chung, Timothy H TD15, WA21
Churchill, Andrew SA57, TC23
Chutani, Anshuman WB02
Chyong, Chi Kong MA14
Ciarallo, Frank W. WE25
Ciarleglio, Michael SB58
Cicorella, Paolo TD37
Cil, Eren SC28, WB25
Cillo, Alessandra MB15, WB15
Cimenler, Oguz WB33
Cimren, Emrah MC43, TA18, TB14
Ciocan, Dragos Florin SC13
Cipriano, Lauren SB34, WC31
Cire, Andre MC08, MD08
Cirillo, Cinzia WB13
Cizaire, Claire WD09
Claggett, Jennifer TD40, WA32
Clarke, John-Paul MD57, TB23
Clarke, Leon TD21
Cleaz-Savoyen, Richard WD09
Clemen, Robert MA17, WB62
Clements, Janet WD34
Clermont, Gilles WB31
Clewlow, Regina WE57
Cline, Jon WA32
Closs, David TC44, WD65
Coban, Elvin TD11
Cobb, Barry SD01
Cochran, James MD52
Codella, James TB31
Coe, Edwin TB34
Coene, Sofie SD18
Coffman, Jr., Edward G. MA27
Coffman-Wolph, Stephany WA67
Coffrin, Carleton MB64, MC64, TA08
Cohen Mohliver, Aharon SA52
Cohen, Dov SD23
Cohen, Maxime SA26, WC09
Cohen, Morris A. MB01, MD27, TC26
Cohen, Steven SD34
Cohen, Ted WB64
Cohn, Amy SB57, SC08, MA31, IS-M, MD54, TD57
Coit, David SB37, MC37, TA35, WA54
Cokins, Gary SA55
Coleman, Thomas WD08
Coles, John SA64, IS-T
Colin, Jeroen TD18
Collier, Trevor SB66, SC66
Collignon, Stephane WE30
Collins, Andrew SA32, WA07, WB33
Collins, John WE14
Collins, Ross MC16
Colosimo, Bianca M. TD37
Colosimo, Mark WB41
Comez, Nagihan WC29
Cominetti, Roberto SD24
Conejo, Antonio J. MB43
Conlon, Joseph WA03
Connelly, Ryan WC13
Connor, Margery MB55, MC17
Connors, Daniel MD66
Consigli, Giorgio WE21
Constantinescu, Emil WD21
Constantino, Miguel WB16
Cont, Rama MC29
Contractor, Noshir WB46
Contreras, Javier MC14, TA59
Converse, Sarah TA12
Conway, Daniel WB54
Cook, Deborah WE30
Cook, Wade SC66, MD23
Cooley, Brent SC55
Cooper, Ken SD55
Cooper, Orrin WE63
Cooper, William TC05, WE09
Corbett, Charles MA40, MD69
Cordova-Vallejo, Ximena WD68

Corley, Bill WA05
Corlu, Canan Gunes SB49
Corr, David WE47
Correa, Jose SD24
Correia, Isabel TB38
Cortazar, Gonzalo IS-T
Coskun, Mehmet Erdem WB65
Cosmas, Alex MC55, WA23
Costa Jr, Luiz Carlos WA14
Costa, Alberto MA20
Costa, Ana Paula WB63, WE20
Costa, Antonio F.B. TA23
Côté, Marie-Claude MC08
Côté, Murray MB34
Cotton, Tanisha MA22, MD56
Coudert, Antony SC45
Coulon, Michael WB29
Cox, Criston SB55
Cozad, Alison TC04
Cozzarin, Brian SA40
Craft, David TC34
Craig, Anthony WA32
Craig, Tim MD31
Crainic, Teodor Gabriel SB47, MA47, WB38
Crama, Pascale TC03, WA27
Crama, Yves IS-T
Cramton, Peter SC45, SD45
Craparo, Emily SC32
Crespi, Giovanni WD22
Crespo Pereira, Diego WE48
Crocker, Keith MA69
Crook, Jonathan WC53
Crook, Kevin TC32
Crossley, William WA23, WB57
Crotty, Michael MD52
Cruz, Jose MC69
Cu, Tung SA64
Cuevas, Rodolfo TA57
Cui, HaiXia WD46
Cui, Na TB51
Cui, Ruomeng SA07, TC54
Cui, Tony WB50
Cui, Xiangyu WB10, WE19
Cui, Yao WC25
Cui, Zhijian MA28, TB41
Cummings, Anne MA52
Cundiff, John TA16
Cunha, Claudio WC57
Cure, Laila MB56
Curley, Shawn TB42
Curran, Mike MA55
Curtis, Frank E. MD22
Curtis, Will SA58

D

da Silva Junior, Ivo WD14
Dabia, Said SC47
Dada, Maqbool WC65
Dadush, Daniel SB24, WE24
Dadvand, Arash WA30
Dag, Berrak TD30
Dahleh, Munther WC69
Dai, Bin WB66, WC28
Dai, Jim SB07, SC05, WB11, WB29
Dai, Jing TA59, WD12
Dai, Tinglong SC01, MD28, TC65
Daily, Bethany MC34
Daim, Tugrul WC59
Dale, Virginia TA62
Dalkiran, Evrim SA20
Dallery, Yves SA07, SD56
Dalton, Chris MA10
D'Ambrosio, Claudia TD24
Damiani, Barbara IS-T
Damien, Paul SA37, SB17, WD14
DAmours, Sophie MD16
Danandeh, Anna TD06
Dandurand, Brian WD63
Dang, Chuangyin TD67, WC08
Dang, Cong TC22
Dang, Jr-Fong WE62
Daniel, Kenny SB51
Danna, Emilie SA08
Darling, Thomas TA64, TD64
Darvish, Parviz TA43
Das, Devashish SD37
Das, Sidhartha TA41
Das, Tapas SD43, WB08, WD23
Dasci, Abdullah WA44
Dasgupta, Tirthankar TD33
Dash, Sanjeeb SC24, TC24
Daskin, Mark MA03, MA56, TC07, TD66
Dasu, Sriram TC68
Dautel, Thomas SA14, WD43
Dauzere-Peres, Stephane SA18
Davendralingam, Navindran WA23
Davidson, Rich MD54
Davies, Andrew TC41, WB59, WE59
Davies, Jane MA40
Davis, Andrew TA17
Davis, Ashley MA56
Davis, Lauren IS-T, TC53, TC64
Davroux, Romain SC64
Dawande, Milind SD27, TA69, TB69, WB28
Dawson, Benjamin SB41
Day, Bob SB45, MB45
Day, Jeff SC16, SD32, TB68, TC55
de Almeida, Adiel T WB63
de Bruyn, Johan MA54, MB55
De Cicco, Michael SB33
de Farias, Ismael MA24
De Jonghe, Thomas TD18
de Kok, Ton SC47, SD01
de Kort, Wim MA31, IS-M
de Koster, Rene TD52, WB52
de la Cadena, Rodrigo MC44
de la Garza, Jesus MB66
de la Torre, Luis MB64
De la Torre, Sebastián MC14
de Lange, Gertjan TD08
De Maere d'Aertrycke, Gauthier WA22, WE21
de Matta, Renato IS-M
De Meyer, Arnoud SC41
De Reyck, Bert TA50, WB18
De Rock, Bram IS-T
de Souza, Cleidson TC65
de Vericourt, Francis TD17, TD28
de Weerdt, Mathijs WE14
Dearden, James TC17
Deb, Kalyanmoy TA63, TC48
Deb, Mrinmay WE26
Debo, Laurens SC28, MD28, TA27, WB69, WC40
Deck, Stacy MA65
Decker, Brian TD36
Deckro, Dick MD58
Deflem, Yannick TD03
Defourny, Boris SD43, MB12 TC12, WA20
Defraeye, Mieke TD27
Degirmenci, Guvenc SB36
Degraeve, Zeger WB18
Dehghan, Ali WD02
DeHoratius, Nicole TB50, WB31
DeJonghe, Cedric TC14
Dekker, Rommert WB68
Del Castillo, Enrique TD33
del Rio Vilas, David WE48
Delaurentis, Dan TD47
Delen, Dursun SD50, TC53
Deleris, Lea MD15
Delgado, Felipe MA51
Dellaert, Nico SC47
Dellarocas, Chrysanthos WC42
Delmelle, Eric SB38
Delquié, Philippe MA15, MB15
DeMartino, Richard MA40
Demerouti, Eva TA50
DeMiguel, Victor SD02, TD01
Demirci, Ece Z. MD45
Demirel, Edil IS-T
Demirel, Suleyman SC44
Demirezen, Emre MD39
Demirkan, Haluk TB59
Dempe, Stephan WD22
den Boer, Arnoud WA13
DeNegre, Scott WD24
Deng, Changrong SD25, TB45, TD45
Deng, Houtao SA33, SC53
Deng, Jianjun MD43, WA43, WC12
Deng, Shijie MC27, WB29
Deng, Shiming WA65, WB01
Deng, Wen TA48
Deng, Xinwei MA37, MB35
Deng, Yinglu WA42
Deng, Zhibin TD60
Dengiz, Berna WA38
Dengiz, Orhan SA36
Denholm, Paul MC14, TA35
Denny, Kevin TC51
Denton, Brian MA31, MB12, IS-M, MC12, MD36, TA36, TB31
Denuit, Sylvie MA23
Deo, Sarang SA27, SB64, SD29, MB25, MC26, TA27
DePriest, Paul SD37
DePuy, Gail MA65, TB56
Derigs, Ulrich SA04
Desai, Salil MC33
Desai, Vijay WC11
Deshmukh, Abhi TC35
Deshmukh, Abhijit MA31, IS-M
Deshpande, Ajay TA59
Deshpande, Rahul TA48
Deshpande, Vinayak SA25, TB27, WB27
Desmond, Jeffrey SC54, MA36
Dessouky, Maged SB51, SD47, MA47, TD51
Detti, Paolo MB18
Devalkar, Sripad SC30
Devetsikiotis, Michael IS-T
Devlin, Anna SA42
Dewan, Pooja SC16, SD32
Dewan, Sanjeev SA42
Dexter, Franklin MA34, MB31, TB50
Dey, Debrabata SA31, MB25
Dey, Santanu S. SA24, MB24, TD24, WA24, WB24, WC24
DeYong, Camille IS-M
Dezio, John TB32
Dhamodharan, Aswin TB34
Dhurandhar, Medha MA31, IS-M
Di Lorenzo, Francesco SB52
di Tria, Massimo WE21
Di, Xuan MA48
Diallo, Saikou SC23, WA49
Diana, Tony TA57
Dias, Bruno WD14
Diaz, Rafael SB23, TC49
Dickerson, John MD08
Dickinson, Peter WA43
Diecidue, Enrico SA17
Diehl, Robyn IS-T
Dieker, Ton SC19, WA11, WB49
Difang, Wan WE28
Diffendorfer, Jay WA32
DiLellio, Jim SA43
Dilkina, Bistra SD16
Dillon-Merrill, Robin SA23
Dimitrov, Ned SC08, WA21
Dimitrov, Stanko SD66
Dinakar, Karthik SD51
Ding, A. Adam TB19
Ding, Chao WC09
Ding, Ding WB11
Ding, Fang WA17
Ding, Hongwei WC66, WD68
Ding, Qing WC29
Ding, Waverly SC03
Ding, Yichuan MA31, IS-M, IS-T, WD64
Ding, Yu SB33, SB35, SD23, MD35, TD35
Dingus, Cheryl SA23
Diniz, André WD14
Dirkse, Steven SC10
Dirnberger, Jeremiah MB32
Dissanayake, Gamini TB21
Dissanayake, Sahan WB16
Diwekar, Urmila WD21
Dixit, Ram SC12
Dixit, Vinayak V. MB48
Do, Hung SA25
Doan, Kien SD48, TA48, TA51, TC48, WC22
Dobbs, Neil TC24
Dobson, Greg TD66, WB11
Doctori Blass, Vered WB64
Dodin, Bajis WD18
Dogru, Mustafa K. WA03
Dolgun, Leman Esra MA63
Dolinskaya, Irina MB64, WE58
Donaldson, Alexander David TC23
Dong, Fang WD07, WE65
Dong, Jin SC35, SD55, MC59, TA59, TB65, TC62, TD02, WC04,

WC44, WC66, WD67, WD68, WE44, WE52
Dong, Jing WD11
Dong, Jingyan MB35, TB33, WA33
Dong, June MA69
Dong, Lingxiu SB30, SD30
Dong, Yan MA41
Dong, Yuanyuan WB18
Dong, Yuexiao SD53
Donk, Dirk Pieter van TA50
Donnelly, Tom WB58
Donohoo, Pearl WA14
Donohue, George SD64, TC23
Donohue, Karen MA44, TD50, WA50, WB50
Doolittle, Erin WD63
Dornfeld, David WD68
Dorr, David WC59
Doty, Morgan SC54
Doucette, Emily SA58
Doudareva, Evgueniia MA44
Douglas, Rohan SA06
Downes, Pat WB34
Downing, Mark TA62
Downward, Anthony IS-M, TA14
Drake, Kristen MD04
Drake, Matthew J. SB46
Drakopoulos, Kimon SB13
Dresner, Martin MD47
Drew, Rachel TA64
Drezner, Tammy SB38, TC38
Drezner, Zvi SB38, SD38, TC38
Dronzkowski, David TC07
Dror, Moshe TB01, TC51, WA68
Druehl, Cheryl MA41, MC40, TB40, TC69, WB64
D'Souza, Warren SC31, WC20
Du, Dongping SD50, MB33, IS-T
Du, Du SA06
Du, Lili WC48
Du, Linna IS-T
Du, Longyuan SB48, WB48
Du, Ruo SA56
Duan, Lian SC50
Duan, Peng MD57
Duan, Rong MB65
Dube, Parijat TA02
Dubrawski, Artur SD23
Duclos-Gosselin, Louis SB53
Duenyas, Izak MB45, TC45, WB09, WB44, WB65, WC25
Duffie, Darrell SA06
Dugardin, Frédéric TC06
Dughmi, Shaddin TB45
Dula, Jose MD20, SA66
Dulin, John TC59
Dunkel, Juliane SA01
Dunn, Jocelyn TA33
Dunn, Peter MC34
Dunson, David IS-M, MD12
Duquesne, Christophe-Mari WA23
Durach, Christian TB44
Durango-Cohen, Elizabeth TC54
Durango-Cohen, Pablo WE47
Durgee, Jeffrey F. SA28
Durukan Sonmez, Ayse WD52
Dussault, Benjamin SA04
Duthie, Jennifer MD48, TC61
Dutt, Nilanjana SD52
Dutta, Goutam SB55, TB32
Duzgun, Ruken MC19, MC21
Dwivedi, Harsh TB65
Dyer, James SA43
Dykes, Bryce SC54

E

E, Fei IS-T
Easley, Robert SB39
Easton, Todd MD24
Eberhard, Andrew C. MD24
Ebrahimi, Nader WD33
Ebtehaj, Milad WB68
Echambadi, Raj SD27
Eckhause, Jeremy WC43
Eckstein, Jonathan MB04, MB20
Edem-Hotah, Joseph SA27
Edirisinghe, Chanaka SC20, MA02, TB19
Edmondson, Amy SD40
Edwards, David IS-T
Egging, Ruud MB43, TA47
Ehrenmann, Andreas SB20, SD14, WE21
Ehrenthal, Joachim WB03
Ehrig, Timo WC41
Eidem, Eirik TA61
Eidsvik, Jo MB17, TC17
Einstein, David TD64
Eiselt, H. A. TC38, WE52
Eisenstein, Don TD66
Eister, Craig SC55
Ekici, Ali SA34, SC47
Ekin, Tahir WB12
Eksioglu, Burak WA03
Eksioglu, Sandra TB16, WD68
El Hachemi, Nizar TC08
El Karoui, Noureddine WB12
El Ouardighi, Fouad WA68, WD30
El-Haj Ben-Ali, Safae SB38
Ela, Eric TB35
Elhedhli, Samir WD48
Elia, Josephine A SB20, TC16
Elidrisi, Mohamed TA67
Elimam, A.A. WD18
Elkamhi, Redouane SA06
Elkins, Debra SA23, SC23
Ellis, R. Darin WC23
Elmachtoub, Adam MC09
Elmaghraby, Salah WA06
Elmaghraby, Wedad SD45, MA13, WC01
Elsayed, Elsayed SB33, SB37, MC37, TA37, TB37
El-Sheikh, S. A. SD63
El-Taha, Muhammad WE07
Emadi, Seyedmorteza WB27
Emrouznejad, Ali MC66
Engau, Alexander WA60
Engevall, Stefan WA67
Engineer, Faramroze MD24
Ennes, Michel WD14
Enns, Eva WC31
Enoka, Maro SC32
Epelman, Marina MD31
Epplin, Francis TB16
Epstein, Rafael SC55, WD16
Eran, Haggai MD66
Erat, Sanjiv MD50, TB40
Erdem, Asli Sencer WB44
Erdem, Ergin MC56, TD56
Erden, Zeynep MB40
Erdogan, S. Ayca TA36
Eren, Ezgi SC12
Erenay, Bulent MA65
Erenay, Fatih Safa MD17, TA31
Erera, Alan SA47, WD51
Ergun, Ozlem SD44, MD64, TB12, WB69
Erhun, Feryal TA06, TC69, WC49, WE69
Erickson, Jared SB03
Ernst, Damien MB12
Erol, Serpil WC61
Errico, Fausto MA47
Erzurumlu, Sinan SA40, SB40, MA30
Escudero, Laureano TD14
Esenduran, Gokce MC01, TA69
Esensoy, Ali Vahit WD64
Eskandarzadeh, Saman MC13
Eskigun, Erdem TC32
Espinoza, Daniel MB24, TA24, WC16
Espiritu, Jose IS-M, IS-T, TD35
Etschmaier, Maximilian M. WC48
Ettl, Gregory SD16
Ettl, Markus MC09
Etzion, Hila TA39
Eurek, Kelly TB35
Evans, Antony TC57
Evans, Emily SC58
Evans, Gerald MA31, MA65, IS-M, WB07, WC58
Ewing, Lee WA58
Eyvindson, Kyle SB63
Ezell, Barry SA23, SB23, SD15

F

Fabregas, Aldo SA36, WA04
Fabri, Peter WA56, WB37
Fagerholt, Kjetil TA61
Faghih Roohi, Shahrzad MB33, IS-T
Fajardo, David MA47
Falconi, Stefanie WC50
Fallah-Fini, Saeideh MB66
Fan, Neng SA22, WA20
Fan, Weiguo TC67
Fan, Ya Ju WD50
Fan, Yueyue SA22, TB16
Fan, Yun TD46, WB46, WC46
Fang, Dongping MD59
Fang, Fei TD13
Fang, Gang MA08
Fang, Kan TA18
Fang, Shu-Cherng TD60
Fang, Xiang SC56
Fang, Xiao TB67
Fang, Xin TC25
Fang, Yan TB44
Fang, Yue WD30
Farahmand, Kambiz WD47
Farhadi, Farbod TB57
Farias, Vivek SA29, SB13, SB29, SC09, SC13, SD13, MB11, MC07, MD17, WC11
Farrokhvar, Leily WB38
Farrokhvar, Paiman MB56, WA47, WC56
Farzan, Azin TC27, WC27
Fathi, Faranak MD35
Fathi, Yahya TB61, WB12
Faturechi, Reza TC51
Faulin, Javier WC38, WE48
Fearing, Douglas SB57
Federgruen, Awi SC01, MA28, MB30
Federspiel, Florian MC15
Fefferman, Nina WB33
Feigh, Karen TD23
Feijoo, Felipe SD43
Fein, Adam SD34
Feinberg, Eugene MA11
Feizollahi, Mohammadjavad WB33
Felder, Frank A. TA35, WA54
Feldman, Jon TA09
Feldman, Pnina MB28, TD28
Feliciani, Courtney WA56
Feng, Annabelle SD01, SD26, MB26, TB66
Feng, Gengzhong WA45, WA68
Feng, Haolin TA29
Feng, Liming MD19, WA29
Feng, Qianmei SB37, MC37
Feng, Tianjun MC15
Feng, Tianke TC68, WC13
Feng, Wen-Hsin MA37
Feng, Youyi WC18
Feng, Zhuo WC28
Fenhagen, Don MC55
Feofiloff, Paulo IS-T
Ferguson, Mark SA06, SB27, MA09, WA28
Fernandes, Cristina IS-T
Feron, Eric TB23
Ferrand, Yann WA34
Ferreira, Rodrigo WE20
Ferris, Michael WC44
Fichtner, Wolf MD14
Fidan, Neslihan WB10
Figueira, Jose SA63
Figueroa, Cristian WB62
Figueroa-Lopez, Jose MD29
Fiksel, Joseph MC43, TB14
Finin, Tim SC65
Finkelstein, Stan SD64
Fischer, David WD31
Fischetti, Matteo MC24, MD24
Fisher, Donald L. WB51
Fisher, Michele MA54, MD55, TB66
Fisher-Vanden, Karen TD21
Fitoussi, David MD42
Fixson, Sebastian SB41
Flach, Bruno WD12
Fleischer, Lisa SD60
Fleischhacker, Adam WD46
Fleischmann, Moritz SB27, TB27
Flenner, Gary TB58
Fleten, Stein-Erik MB19, WB14
Fliedner, Thomas MA27
Fliege, Joerg WC32
Flisberg, Patrik MD16, WC51
Flory, John MA35

Flötteröd, Gunnar SC11, SD48
Floudas, Christodoulos A SB20, TC16
Flynn, Barbara B WC29
Fodstad, Marte MB43, TD14
Fominykh, Elena SA66
Fong, Duncan MA13
Fontaine, Magali TA31
Fontem, Belleh SC58
Fontenot, Dean TB46
Foraker, Joseph WA21
Forgie, Sarah TB50
Forrester, Richard MB20, MD46
Foster, Justin TB62
Fourer, Robert SB03, TC10
Fowler, John SA18, IS-M, TB63, TD63
Fox, Bill MC58
Fradkin, Yakov MD54
Fragkos, Ioannis WB18
Fraigniaud, Pierre SC11
Franceschetti, Anna SC47
Franco, Francisco SA47
Franco, L. Alberto TB64
Franden, Michael SB10
Frandsen, Thomas TA40
Fransoo, Jan C. SB44, MB47, MD69, TA50, TB51, TC47, TD50
Frazier, Peter SB19, MB49, MD06, TA49, WB49
Frazzoli, Emilio WD07
Fredendall, Lawrence TA34, TC56
Frederick, Shane SB15
Frederiksen, Lars TC41
Freeman, Nick WD66
Frei, Frances MB01, TC26
Frelinger, David SD15
Frenk, Hans SB09
Frenken, Paul TB52
Freyss, Maxime WC61
Fricker, Christine SA51
Fridgeirsdottir, Kristin MA09
Friedewald, John MA56
Friedlander, Michael P. WB22
Friedmann, Oliver SD04
Fries, Carlos Ernani SA66
Friesz, Terry SA48, MA48, WA30
Frisk, Mikael MD16
Frisvold, George WC28
Froidh, Oskar WD61
Frutos, Mariano IS-T
Fry, Michael MC27, WB31, WB64
Fu, Bin SB18, SC18
Fu, Leiming WE67
Fu, Michael MA42
Fu, Mingang MC56
Fu, Ye MD59
Fu, Yuhui SC35, TC62, WE44
Fuchs, Erica MB41
Fuchs, Mary Ann TD26
Fujisawa, Katsuki TA20, WE22
Fukasawa, Ricardo SC24
Fukuda, Mituhiro TA20, WE22
Fukunaga, Yasuto TB59
Fuller, Anne WA39, WA56
Fuller, David SD14
Fuller, Douglas WA39, WA56
Fulton, Lawrence WB34, WB53
Furman, Jeff MB41
Furman, Kevin TA47
Furuha, Masabumi SB51
Furukawa, Tomonari TB21
Fylstra, Daniel H. TB10

G

Gaba, Vibha SC52
Gabel, Jessica SA50
Gabriel, George SB23
Gabriel, Steven SB20, MB14, TA43, WC43
Gabteni, Semi WA23, WC57
Gacitua, Jaime WD16
Gade, Dinakar MA24
Gaimon, Cheryl SB40, SD03, TC40, WB40
Galbreth, Michael WA69, WB69
Galenko, Alexander SC08
Galindo, Gina MC38
Gallant, Scott WA49
Gallego, Guillermo SB28, TC50, TD09, WB09
Gallego, Julian MA22, MC16, MC43
Gallien, Jeremie SB64, SC64
Gallino, Santiago TB25, WD25
Gamarnik, David SD59, TA07, WE11
Gamrath, Gerald SA08, WC08
Ganesan, Rajesh TD23
Ganguly, Subhamoy MC56, TD04, WD31
Ganju, Kartik SD66
Gans, Noah SB22, TA11
Ganzfried, Sam SB04
Gao, Fei SA09
Gao, Feng MC59, TA59, WC04, WE44
Gao, George MD27
Gao, Gordon SC39
Gao, Jia WA66
Gao, Jie MC65
Gao, Long TC30, WE30
Gao, Nan TD69
Gao, Siyang TD49, WC20
Gao, Song SD48, MB48, WB51, WC48
Gao, Su TD06
Gao, Xiaoli SD53
Gao, Xiaoling MD34
Gao, Xuefeng SC19, WA11
Gao, Yang TB48
Gao, Yanhui WD67
Gapeev, Pavel MB02
Garcia del Valle, Alejandro WC38, WE48
Garcia, Alfredo MC04, WC60
Garcia, Reinaldo TA59
Garcia-Gonzalo, Jordi MB16
Gardenghi, Melissa WD63
Gardinier, Timothy SC55
Gardner, Beth TA12
Garg, Rajiv SA39
Garin, Maria Araceli TD14
Garmendia, Elizabeth IS-T
Garrett, Jr., Walter A. MC66
Garrow, Laurie MA09, MA57
Gartner, Nathan H. TA48
Garvey, Myles IS-M
Gary, Michael WC46
Gass, Saul SC06
Gassmann, Horand TB03
Gast, Nicolas SA51
Gatchel, Robert MD53
Gatti, Maira TC65
Gaughan, Chris WA49
Gaukler, Gary SD23, WA01
Gaur, Vishal MD27, SA30, SB32, TB25, TB30
Gautam, Natarajan SB36, SC12, MB08, MC43
Gaver, Don MC58
Gavirneni, Srinagesh SD34, TA69, TB69, WD46
Gaytán I, Juan MB63
Gazmuri, Pedro TA57
Ge, Dongdong WD22
Ge, Ling WB67
Gebraeel, Nagi SA50, SC37, MA35, MB33, IS-T
Gedik, Ridvan SA44
Geismar, Neil MA18, MD18, TA68, WB28
Geissen, Tim WA52
Gel, Esma SA34, TA66, TD63, WE25
Gendreau, Michel SB47
Gendron, Bernard MC08
Geng, Qin WB65
Geng, Xianjun SA28, TB42
Geng, Yue MC43
Geng, Zizhen MC41
Genoese, Massimo MD14
Gentles, Andrew SC12
George, David MB08, TB11
George, Gerard WA27
George, Sajeev Abraham TB65
Georgiadis, Patroklos WA69
Georgiev, Pando WA62, WC20
Gera, Bharat WD15
Geraghty, Kevin MA04
Gerber, Burcin WE34
Gerhardt, Ira WD07
Gerhardt, Katharina WE23
Geunes, Joseph SD08, MB21, TC68, WC03, WD24, WE47
Geva, Amir MB59
Geyer, Alois TB02
Ghaddar, Bissan TC20
Ghadimi, Saeed TC21
Ghaffari, Asma SC18, SD56
Ghaffari, Hamid SC31
Ghamami, Samim WD54
Gharehgozli, Amir Hossein WB52
Ghasemkhani, Hossein TB39
Ghate, Archis MA42, TA05, TD12
Ghavamzadeh, Ardeshir MC31
Ghazi Nezami, Farnaz WA54
Ghobadi, Kimia SC31
Ghoddusi, Hamed TB29
Gholami, Roya MC66
Ghoniem, Ahmed MD25, TB57, WE26
Ghose, Anindya SB42
Ghosh, Bikram WA69
Ghosh, Priyanko TB32
Ghosh, Rahul SC65, TC65
Ghosh, Soumyadip WD49
Ghoshal, Abhijeet MD39
Giacometti, Rosella WE21
Giacomoni, Marcio MB63
Giallombardo, Giovanni SA24
Gibas, Cynthia SD12
Giesecke, Kay SA06, SB06, SD19, MD29, TA19
Giesen, Ricardo MA51, WC61
Gilbert, Kenneth SD46, WC55
Gilbert, Steve SB44
Gilberto, Pérez Lechuga WB15
Gilland, Wendell SA25, SD34
Gillen, David WA23, WE45
Gillerlain, Zachery MC27
Gilliland, Michael WD55
Giloni, Avi TC13
Ginchev, Ivan WD22
Gino, Francesca MB01
Girardeau, Pierre SA21, TA14
Giraud-Carrier, Francois MB69
Girotra, Karan SC19, MC25, TB28, TD25, TD28, WB26, WC01
Glass, Todd WA34
Glasserman, Paul MA29
Glass-Hardenbergh, Katherine MA44
Glavin, Mitchell SC66
Glazebrook, Kevin SB22, TD15
Gleixner, Ambros SA08, SD04
Glick, Roger WA51
Glinz, Irma WD41
Glover, Fred MC04
Glynn, Peter TB07, WA07
Gmiglionico, Giovana SA24
Gnanlet, Adelina TD65
Gobbi, Massimiliano WD63
Gocgun, Yasin MC12, TD12
Godfrey, Joseph MB66
Godlewski, Edward SD55
Goel, Ankur SA41, TA30
Goel, Saumya TA24
Goel, Vikas TA47
Goentzel, Jarrod TC43
Goes, Paulo SC42
Goethals, Paul WA33, WA35, WC37
Goetschalckx, Marc TA52, WD47
Goez, Julio C. MC24
Goh, Joel MA36, MB18
Goh, Khim Yong SB39
Goh, Thong WB35
Gokce, Elif TA18
Gokpinar, Bilal TA41
Golbeck, Steven WB29
Goldberg, Andrew SB24
Goldberg, David SD59, WA11
Goldberg, Noam MB24
Golden, Bruce SA04, TB56, WE34
Golden, Linda WA19
Goldfarb, Brent MB41
Goldfarb, Donald SA01, TB60
Goldhaber-Fiebert, Jeremy SB34, SD31
Goldner, Keith A. MC52
Goldsman, David MA46, TC53, WA07
Goldstein, Susan TD26
Goli, Roshan WB24
Golovin, Daniel TA12
Golovnya, Mikhail SA10

Gomes, Carla SD16
Gomez, Fredy WC59
Gong, Fengmei MA39
Gong, Min TD67
Gong, Xiting MC28
Gong, Yeming WA52
Gonzalez, Andres David WB35
Gonzalez, Carlos Ivan WC44
Gonzalez, Cristian SC55
Gonzalez, Gerardo SC32
Gonzalez, Guillermo SC55
González, Jaime E. SC51
Gonzalez, Tere TB66
Gonzalez-Mendoza, Miguel TB63
Gonzalez, Virginia TA59
Gonzalez-Rivas, George WA10
Goodchild, Anne WE47
Goodman, Erik TA63
Goodnough, Lawrence TA31
Goodson, Justin MC47
Goossens, Dries SA45
Gopal, Anand TC42, WA59, WC01
Gopal, Ram SB55, WB41, WD42
Gopaladesikan, Mohan TC46
Gopalappa, Chaitra TD31
Gorbenko, Alexander MD45
Goren, Selcuk SC43, TB62
Gorin, Tom MD13, TB09
Gorman, Michael SC16, SD32, MB46, MD46, TA55
Gose, Alex TA36
Goshev, Stefan SC08
Gotoh, Jun-ya MC19
Gouveia, Luis SC36
Govindaraj, Suresh MA13
Goya, Dorothy MA65
Goyal, Manu SD26
Goyal, Vineet WB01
Goycoolea, Marcos WB16, WC16
Grabarnik, Genady SA65, TA02
Grabosch, Alfons MA56
Grabowski, Martha SA59
Graham, Matthew SA53, IS-T
Grahn, Håkan TD32
Gramacy, Robert SB35, MA37
Granados, Nelson TC26
Granot, Daniel TA01
Grant, Tim MB58
Grasman, Scott E. MD43, TB54, WC38
Graves, Stephen C. TC39
Graves, Todd SD15, SD33
Gray, Genetha TB04, WC15
Grechuk, Bogdan TC29, WC21
Greco, Salvatore SA63
Green, Linda SB29, SC34, SD64
Greenia, Daniel MC41
Greenwald, Amy TA45
Greenwood, Brad SA42, SC39, TC42
Greer, Kendrick MB16
Gresh, Donna MD66
Griffin, Audrey WD67
Griffin, Jacqueline SC46, MA31, IS-M
Griffin, Josh TB04
Griffin, Paul SA38
Griffiths, Natalie TA62
Grishin, Stas SD56
Groenevelt, Harry WE03
Groer, Chris SA04
Groetsch, Volker WB17
Gross, George SD43
Grossmann, Ignacio TA47, TD24, WA62, WD21
Groznik, Ana SD34
Gruber, Aviv MA35
Gruen, Thomas WB03
Grushka-Cockayne, Yael SB15, SD03, TA50
Gruteser, Marco WB51
Gu, Bin WC42
Gu, Xi SB55
Gu, Zhuojun TC45
Gu, Zonghau TB10
Guajardo, Jose A. MB01, MD27, TC26
Guajardo, Mario WC51
Guan, Peiqiu TD15
Guan, Sichong WD60
Guan, Yihan SB34
Guan, Yongpei SA22, SC14, SD22, MB21
Guardiola, Ivan MB36
Guarneri, Paolo WD63
Gue, Kevin TC52
Gui, Luyi WB69
Guikema, Seth TB15, WC50, WD59
Guistino, David SA23
Gul, Burak WB44
Gul, Serhat IS-M
Gulanbaier, Tuerhong TD53
Gulding, John WA57
Guler, Kemal MA45, MD45, TC03, WA44, WD03
Gullhav, Anders Nordby MA08
Gulpinar, Nalan WE19
Gulsen, Ece WC28
Gulten, Sitki WB12
Gultepe, Aysegul WA38
Gumus, Mehmet MA13, MB26, TB01, TC30, WA15
Guner, Ali WB61
Gunluk, Oktay SC24, TC24, WE44
Gunnec, Dilek SD60, MA41
Gunpinar, Serkan WA56, WD44
Guo, Cui TA20
Guo, Hong SB39, TB67
Guo, Hui TB19
Guo, Jinshuai MA31, IS-M
Guo, Jue WC19, WD44
Guo, Li Jie SD55
Guo, Pengfei SA07, WA44
Guo, Xin MC29, MD29
Guo, Zhe IS-M
Guo, Zhiling SB39
Gupta, Alok TA45, TC45
Gupta, Aparna TB19
Gupta, Diwakar MB45, TA44
Gupta, Shubham TD23
Gupta, Vijay WD21
Gupta, Vijay Kumar WC10
Gupta, Vishal SA02
Gupte, Akshay TD24
Gupte, Mangesh TD45
Gur, Yonatan SC13, SD24
Gürel, Sinan WC57
Gurgel, André WE20
Gurler, Ulku MC27, WB62
Gurnani, Haresh MC50, TA44, TD30, WC01
Gurrola, Emmanuel IS-M
Gurumurthi, Suri WB68
Gurvich, Itai SA11, SD07, TB66, WC27
Gusikhin, Oleg IS-M, MD54
Guterbock, Tom WD34
Gutfraind, Alexander SC08, MB23, WA21
Guzelsoy, Menal WD24
Gwon, Hyejeong WB44

H

Ha, Albert Y. WB02
Ha, Brandon WE30
Ha, Chris WB66
Hackebeil, Gabriel MD03
Hadad, Erez SA03
Hadizadeh, Ali IS-T
Hadjiliadis, Olympia TA19
Hadka, David MD63
Haensel, Alwin WA13, WB13
Hafer, Lou MB03, TB03
Hafizoglu, Baykal WE25
Hafliger, Stefan TA40
Haftka, Raphael WB21
Haghani, Ali IS-M, IS-T, WA61, WB66, WD18, WE58, WE61
Haghnevis, Moeed MD49
Haghpanah, Nima MC45
Hagspiel, Verena WA25
Hagtvedt, Reidar MA64, TB50
Hahn, Gerd SB55
Hahn, Joe SA43
Haight, Robert MB16
Haijema, René MA31, IS-M
Hajbabaie, Ali MA47, TC48, WA61
Haji Agha Bozorgi, Ali WB04
Hajibabai, Leila WC51
Hale, Kimberly SA32
Hall, Bill MB57
Hall, David WD46
Hall, John TC64, WA64
Hall, Nicholas G. MA27, MB18, MC18
Hamaoka, Yutaka IS-T
Hamedi, Masoud IS-T, WA61
Hamel, Andreas TD29
Hamid, Zeyana WC56
Hamidi, Mohsen WD47
Hamman, Richard WB21
Hammuda, A.M.S. SB37, MC37, TB37
Hampapur, Arun MC55
Hampshire, Robert SC11, SD51
Hamzeei, Mahdi TD24
Han, En-Pei TD47
Han, Ke MA48
Han, Lanshan SD48, MA31, IS-M, MC27, TD47, WB22, WC22
Han, ShuiHua TA59, WC50
Han, Sung Won MD53, WB37, WC36
Hanany, Eran TA01, TD28
Hancerliogullari, Gulsah TB57, WB44
Hanke, Michael TB02
Hann, Il-Horn SA42, SB42
Hann, Rosine WC59
Hannah, Lauren IS-M, MD12
Hansen, Mark SA57, SB57, SD64, MB32, MC57, TC23
Hansen, Thomas Dueholm SD04
Hansman, John TB23, TC23
Hanson, Tim SA37
Hanzon, Bernard TB02
Hao, Li MA35
Hao, Lin MC42, TA45, TD39
Hao, Peng WB51
Haouari, Mohamed WC06
Haran, Elizabeth WC19
Hargaden, Vincent TB66
Harmany, Zachary TB20
Harmon, Mark TD07
Harmon, Robert TB59
Harpring, Russell MA65
Harris, Christina IS-T
Harrison, J. Michael TD09
Harrison, Julie SC66
Harrison, Ken MD63
Harrod, Steven TD32, WB32
Harsha, Pavithra SD28, MD09, WC69
Hart, Jessica SD15
Hart, William SC04, MB03, MD03, TA03
Hartley, Dean MA58
Hartman, Joseph TC24, WC13, WC17
Hasan, Samiul MC48, TA51
Hasdemir, Baris SA38
Hasenbein, John SD07, SD23, WE11
Hasheminia, Hamed WA23, WE45
Hasija, Sameer MA28
Hass, Christian MA45
Hassanzadeh Amin, Saman WA47
Hassidim, Avinatan SD09, MA53
Hastings, Katherine WC04
Hattel, Jesper TC48
Haugh, Martin MA29, MB30
Haughton, Michael WC66, WE07
Haugstvedt, Daniel WB14, WC14
Hausman, Warren WD25
Haviv, Moshe WC27
Hawn, Olga SC52, SD52, WC41
Hazen, Gordon MB17, WB67
He, Fei TD15, WA15
He, Jerry SA41
He, Jingrui TD48
He, Lin TB44
He, Miao MB59, MC59, TD02
He, Ping TB18
He, Qie WE24
He, Qing TD48
He, Shiwei SC16, SD32, TD32, WB32
He, Shuangchi SB07, SC05
He, Simai MC28
He, Xuili TA13, WA65
He, Yanyi SD43
He, Yuhong TA01

Heal, Geoffrey TD67
Healey, Christopher MC49
Hearn, Donald MC53
Heavey, Cathal TD30
Heching, Aliza SA65, MD59, TD11
Hedman, Kory SA14, MC14, WA54
Heegaard, Poul MA08
Heese, H. Sebastian SB28, MB18, MD25, TB34
Heier Stamm, Jessica SA64, MD64
Heier, Andrew IS-M
Heinz, Stefan SA08, TC08
Heipcke, Susanne TD08
Heitz, Christoph TD59
Hellemo, Lars TD14
Helm, Jonathan SD31, TA34
Helton, Cary TA32
Hemmati, Soheil WD24
Henchey, Matt SD38, MA23
Henderson, Shane MB49, TD34, WD28
Hendrickson, Chris SC43, WE69
Hendrix, Kathleen SC54, TD64
Henningsson, Mathias IS-T
Henry, Andrea TA53
Henry, Andrew J. WC34
Henry, Stephen WC24
Heppell, James WC32
Heragu, Sunderesh MA31, MB56, IS-M, WC58
Hernández Gress, Eva Selene WB15
Hernandez, Ivan SA44
Herrmann, Jeffrey SA34, WA17
Herrmann, Philipp SA42
Hertz, Alain MB47
Hertzler, Erik TD63
Hescott, Benjamin SB12
Hespanha, Joao TB21
Hess, John TB56
Hesson, Alaina SB46
Hester, Patrick SA32
Hetrakul, Pratt WB13
Heydar, Mojtaba MC51
Hickman, Mark SC51, MA51, MD51, TC51, TD32
Hicks, Illya MC60, MD60
Higbie, Jon SC55
Higgins, Michael SA14
Hildebrand, Robert SA24
Hileman, James TB23
Hill, Arthur V. WA50
Hill, Craig WB59, WE59
Hill, Michael WC41
Hill, Stephen WC47
Hilliard, Michael TA62
Hinrichs, Curt SD46
Hirsch, Michael SB58, MC20
Ho, Teck-Hua SD26, MC50
Ho, Violet MD42
Ho, Yi-Chun TD42
Hobbs, Benjamin SD14, MA14, MA17, MC14, TC14, TD43
Hobbs, Jan MC32
Hoberg, Kai TD03
Hochbaum, Dorit SA17
Hoda, Samid TA47
Hodge, Bri-Mathias S. SB43
Hodgson, Thom J. WB18, WD01
Hoenig, Udo SA18
Hofer, Christian MD47
Hoff, Randy TC06
Hoffman, David WC19, WC67
Hoffman, Karla SD45
Hofstetter, Joerg WB03
Hojjat, Seyed ali WB67
Holder, Allen SD12
Holguin-Veras, Jose SA48, SB48, MB64, MC64, MD64
Hollander, Justin SA38
Hollywood, John WA64
Holmes, Geoff TD34
Holt, Jo Ellen TD26
Holt, Luke IS-M
Hong, I-Hsuan MC23, WE62
Hong, Seock-Jin SA66
Hong, Xing IS-M
Hong, Yili SD35, TA37
Hong, Yoo-Suk MB65
Honhon, Dorothee SC03, SC25, MC01, MD25, TD17
Hooker, John MC08, MD08, TB08, WD19
Hopp, Wallace SC54, MA36, WD30
Hopper, Tim MC03
Hora, Manpreet MB69, WA44
Hora, Stephen MA17, WC23
Horesh, Raya MA49
Horne, Gary SC32
Hosking, Jonathan SB37
Hosseini, Narges TA34, TD56
Houde, Sebastien TC43
Hough, Patty WB21
Hovenkamp, Ashley IS-T
Hovey, Ivan IS-T
Howard, Ron MB17
Howard, Steven TC55
Howell, Kimberly WE28
Howley, Robert WE45
Hsing, Ya-Hui IS-T
Hsing, Yu WC19
Hsu, Cheng WD59
Hsu, Po-Hsuan TD03
Hsu, Vernon SA30, IS-M
Hsu, Yu-Ting TA51, WB51
Hsuan, Juliana TA40
Hu, Bin TC45
Hu, Bo TA28
Hu, Cheng-Hung WC45
Hu, Guiping WA16
Hu, Haigen TA63
Hu, Haiqing MD59
Hu, Jian TC21, TD66
Hu, Jiaqiao TD12, WD49
Hu, Joice SA30, WC65
Hu, Mengqi WC62
Hu, Ming SB28, SC01, MA01, MB13, TD01, WB09
Hu, Peng MC28
Hu, Qiying TD01
Hu, S. Jack TC37, WA25, WA37, WC33, WE68
Hu, Shanshan MC30, MD09
Hu, Xianbio MB48, TB48
Hu, Xing SC13
Hu, Xinxin MB18, TD02, WC01
Hu, Yu SA42
Hua, Zhimin IS-T
Hua, Zhongsheng TB18
Huang, Bo TB60
Huang, Bob TC19
Huang, Boray MA31, IS-M
Huang, Changjian WA19, WC53
Huang, Edward TA52
Huang, George SC18
Huang, He SD48, MC29
Huang, Hsin-Chan SB17
Huang, Jianhua SB33
Huang, Junfei MD11
Huang, Kai SB08
Huang, Ke-Wei SB39, TB25
Huang, Ming-Hui SD65
Huang, Paul SD17, TC29
Huang, Ping WD64
Huang, Qiang SB33, MB35, MD33, WE33
Huang, Rong WB12
Huang, Rongbing MB38, MC38
Huang, Shuai MA33, MB33, IS-T, TA53, TB37
Huang, Siming MC02
Huang, Tingliang SD25, TB26, TC01
Huang, Wei WD46
Huang, Wenzhen WB37
Huang, Xiao MB26, TA39
Huang, Xuan WA53
Huang, Ya-Lin TD31
Huang, Yan MB42
Huang, Yongxi TB16
Huang, Yun WB46
Huberman, Bernardo TC50
Huchzermeier, Arnd TB41
Huebner, Alexander H. WE26
Huff, Jerry TD63
Huggins, Eric MB46
Hughes, Danny Ray WC43
Hughes, Dave WA58
Hughes, Ed MB10
Huh, Woonghee Tim SA37, SD31, TA26, WD03
Hui, K.S. MB35
Hui, Yer Van WA66
Huisman, Ronald WE14
Hult, Henrik TB49
Humphrey, Wesley WD26
Hundia, Amit TC46
Hung, Hui-Chih MA31, IS-M, WB06
Hung, Ying MB33, IS-T, TB53
Hunt, Kelly MD36
Hunter, Susan IS-T
Hunting, Marcel WD22
Huo, Yumei SB18, SC18
Hur, Minhoe TB53
Hurink, Johann SD18
Hurtado, Cristian MC44
Hurtado, Margarita WD41
Hurtado, Sergio SC55
Huschka, Todd MA31, IS-M
Hutchison-Krupat, Jeremy SB40, SC41, SD41
Hutson, Kevin MD46
Hutton, David SC34, TC36, WC31
Huynh, Nathan TA34, TC56
Huynh, Victoria MD32
Hwang, Elina SD42
Hwang, Sung Ook TD69
Hwang, Woonam SB15
Hyatt, David Graham WA32
Hylden, George WB10
Hyndman, Kyle TD17

I

Iacocca, Kathleen MA26
Iancu, Dan TC29, WB01
Iaquinta, Gaetano WE21
Ibrahim, Ameera WE26
Ibrahim, Rouba SA11
Icyuz, Ilksen TC32
Ierome, Steve SD53
Ifrach, Bar MC07, TB13
Ii, David SB58
Iliescu, Dan MB09
Im, Jinwoo (James) SB34
Im, Joon-Ku TD37
Immorlica, Nicole MC45, TB13
Ince, Guven TD51
Inderfurth, Karl SB27
Infante, Florencio SC55
Ingalls, B.R.G. TD16
Ingle, Sarah MA52
Ingolfsson, Armann MA64, TD34
Inman, Brant MC12
Inniss, Enos TD44
Innorta, Mario WE21
Inomata, Wataru IS-T
Ipeirotis, Panagiotis TA67
Iqbal Ali, Agha SA38, TA68, TD51, WB68
Iravani, Foaad MA01, TC68
Iravani, Seyed SD29, SD54, MB25, TA27, WB44, WD30, WE65
Irohara, Takashi TD52
Isaac, Delfina SD53
Isaacs, Jason TB21
Isen, Alice TA17
Isik, Tugce MA11
Islam, Samsul TD61
Islegen, Ozge SB26
Ituarte-Villareal, Carlos IS-T
Iverson, Craig WD31
Ivy, Julie MA31, MD36, IS-M, IS-T, TC31, TC64, WE34
Iwamoto, Seiichi TA21
Iyengar, Garud SB01, SC26, SD11, SD13, MB18
Iyer, Ananth SA25, SA27, TB27, TC02
Iyer, Krishnamurthy SB13, MC07, TA09
Iyigun, Cem WA05, WA61, WE44
Iyoob, Ilyas MA08

J

Jabali, Ola SB47
Jabari, Saif MB48
Jackson, Brian SD15
Jacobs, Brian WD65
Jacobs, Donald SA12
Jacobs, F. Robert WC29
Jacobs, Patricia MC58
Jacobson, Evin WA31
Jacobson, Sheldon SB31, SC34, SD44, MB39, IS-M, WA04
Jadbabaie, Ali TB13, WE34
Jaffray, David SC31
Jagabathula, Srikanth SC09, SD13
Jaillet, Patrick MA53, WC60
Jain, Aditya SA28
Jain, Himanshu TC48
Jain, Manish TD15
Jain, Nitish TD25
Jain, Shabnam TA53
Jain, Shailendra SB28
Jain, Shelen TB66
Jain, Siddhartha MD08
Jaller, Miguel MB64, MC64
Jamal, Abul WC19
James, Tabitha WE30
Janakiram, Mani WC50
Janakiraman, Ganesh TA26, WD03
Jang, Hoon WC36
Jang, Kil-Woong WB45
Jang, Shi-Shang SA33
Jang, Young TC61
Jang, Yunemi MB48
Jank, Wolfgang MA13, TB56
Jansen, Michiel MA31, IS-M
Janssen, Rene MB58, WA04
Jaramillo, Paulina SB43
Jarrah, Ahmad SC47, WE47
Jarugumilli, Krishna TD68
Jarugumilli, Shrikant TB54
Jasin, Stefanus SB09
Jayaraman, Raja MB56, WA47, WB35, WC56
Jayaraman, Vaidy TA69
Jaycocks, Amber SA32
Jaye, Michael MC58
Jazizadeh, Farrokh WE34
Jelenkovic, Predrag SB11
Jemai, Zied SD56
Jennings, Otis SA50, SD07
Jensen, Bo MC03
Jensen, David SC55
Jeon, Joo Young SC35
Jeon, Seonghye WC07
Jeong, Hyun Bin TC12, WA20
Jeong, Jaehwan SC20
Jeong, Myong K (MK) SB54, TB37, TB53
Jeong, Young Seon TC33
Jeong, Youngsul IS-T
Jeppesen, Lars SD39
Jerath, Kinshuk SD25, TC65
Jha, Krishna MB32
Ji, Ping WE20
Ji, Qiang TD48
Ji, Xiaopeng TD46
Jia, Fan TB38
Jiang, Albert SB04
Jiang, Hao MD21
Jiang, Houyuan SA24
Jiang, Huijing MA49
Jiang, Nan MD48
Jiang, Ruiwei SA22, SD22, MB21
Jiang, Tingting SD29, IS-T
Jiang, Wei MB37, MB65, MD53, WA45, WA68
Jiang, Xiaochun TC53
Jiang, Xiaoyue WC69
Jiang, Xinjia WA66
Jiang, Yiwen MA31, IS-M
Jiang, Zhengrui WE42
Jin, Dong (Kevin) MA49
Jin, Feng WE44
Jin, Jianyong WB38
Jin, Jing SD48
Jin, Judy TC33, TD33
Jin, Mingzhou MB56, TA32, WE01
Jin, Qingwei TD60
Jin, Ran TC33, TC37
Jin, Shan SD43, TB14
Jin, Shengpeng SA59
Jin, Tongdan MA43, TA58, TD35
Jin, Xiaoning WC33
Jin, Yue TB66, WA59
Jira, Chonnikarn Fern TA69, TB69
Joglekar, Nitin SA40, SD40, MA30
Johar, Monica WE42
Johari, Ramesh SB13, SD11, MC07, TA09
John, Richard SD15, WA15
Johns, Jehn IS-T
Johnson, Alan SC44, WA49
Johnson, Andrew MA31, IS-M
Johnson, Andy SA26, SB66, MD22
Johnson, Ellis MD57
Johnson, Kris SB02, MD44
Johnson, M.Eric SB64, WB56
Johnson, Matthew WA21
Johnson, Michael SA38, TA64
Johnson, Paul TA67
Johnson-Hall, Tracy WA44
Jones, Barbara WC67
Jones, Bradley SB35, WD45
Jones, C. TD16
Jones, Charles IS-T
Jones, Dylan SB63
Jones, Erick TA64
Jones, Ken WC04
Jones, Lee TA48
Jones, Philip WE03
Jordan, Brian MA31, IS-M
Jordan, Victoria TC56
Jore, Ravindra SA53, IS-T
Jose, Victor Richmond TC02, WC17
Joseph, John SC52
Joseph, Roshan TC37, TD33
Joshi, Anupam SC65
Joshi, Deepika TC68
Joshi, Karuna SC65
Joshi, Vyahriti IS-T
Jot, Sapan MD20
Jouini, Oualid SA07, MD11
Ju, Hientaek TC41
Juan, Angel A. WC38
Judd, Jason TA16
Juditsky, Anatoli TC22
Jun, Chi-Hyuck WD50
Jung Oh, Hyun IS-T
Jung, Jongbin WB12
Jung, Kyung Sung MD18, WB28

K

K, Aditya SA53, IS-T
Kabadurmus, Ozgur MB36
Kabirian, Alireza WC03
Kabul, Mustafa TC01
Kacar, Necip WC53
Kachani, Soulaymane TA02, TD13
Kageyama, Masayuki TA21
Kaisar, Evangelos I. TA61, TD61, WB04
Kaiser, Chris SB55
Kakade, Sham SD09, TB13
Kakihara, Satoshi MC22
Kakkad, Amitkumar TA41
Kalagnanam, Jayant MA49, TD14
Kalashnikov, Vyacheslav WD22
Kalashnikova, Natalya WD22
Kalbfleisch, Jack SD53
Kalczynski, Pawel J. TD62
Kalifi, Kari MA63
Kalinchenko, Konstantin MA02, MA19
Kalkanci, Basak TC47, WC49
Kalsi, Karanjit SD56
Kamali, Behrooz WB38
Kamarianakis, Yiannis TD48
Kamarthi, Sagar TA33
Kamath, Chandrika WD50
Kambhatla, Nanda SC59
Kambour, Edward MD13
Kamgarpour, Masoud WE45
Kaminsky, Philip MA13, TC25
Kammerdiner, Alla WA20
Kan, Sophia TD10
Kan, Xi MB33, IS-T
Kandiah, Venu MC63
Kang, Chongqing MA43
Kang, Chulmin TA29
Kang, Hyounggoo SC52, WC41
Kang, Jihoon TD53
Kang, Pilsung TD53
Kang, Wanmo SD49, TA29
Kang, Yong Ha WB18
Kang, Yuncheol WE08
Kangaspunta, Jussi SC15
Kani, Iraj TA02
Kannan, Anjuli MB54
Kannan, Aswin TA04
Kanoria, Yashodhan TC11
Kao, Yi-hao WE09
Kapoor, Ajesh WA38
Kapur, Kailash WB33, WB45, WD45
Kapuscinski, Roman SC44, MA30, WA62
Kara, Imdat WA38
Karademir, Serdar MB20
Karaesmen, Fikri WB26
Karaesmen, Itir MA13
Karagul, Hakan WB18
Karakayali, Ibrahim WB69
Karamanis, Dimitrios SB21
Kardes, Erim MA17
Karger, David MB11
Karichery, Sureshan MD57
Karim, Amer WD01
Karisch, Stefan MD55
Karmarkar, Uday MD26
Karray, Salma WD02
Karsten, Frank TA25, WA67
Karsu, Ozlem WA63
Kart, Lisa SA55
Kartal-Koç, Elçin WA05
Karwan, Mark SA58, SC32, SC63
Kash, Ian SA45, SB57
Kashiha, Mona WD48
Kashio, Hiroshi MD41, IS-T
Kaspi, Haya WE11
Kasuba, Cortney IS-M
Katai, Ferenc TC10
Katariya, Abhilasha WA08
Kateeb, Ibraheem MB33, IS-T
Katehakis, Michael WA08, WD03
Katok, Elena MA05, MC50, TD50, WA50
Katona, Zsolt WC42
Katsifou, Argyro MD25
Kattuman, Paul WC19
Katz-Rogozhnikov, Dmitriy MC55, WE11
Kaul, Padma MA64
Kavadias, Stelios SA41, SD41, MA41, TA27, TC17, WB40
Kavadias, Stylianos SC41, MA52
Kavanagh, Jennifer SD15
Kavet, Robert MB17
Kavulya, Geoffrey WE34
Kawai, Ayako TB59
Kaware, Ravindra MC33
Kay, Michael WA66
Kay, Min MA15
Kayabas, Poyraz SA05, MA31, IS-M
Kayis, Enis SB28, TC03, WD03
Kaza, Siddharth TC67
Kazaz, Burak SB30, SC02, WA28
Kazempour, S. Jalal MB43
KC, Diwas SD29, MC26, TD27
Ke, Ginger Y. WB47
Ke, Ke MA69
Ke, Wei TC09, WB09
Keck, Steffen SA17
Kedad-Sidhoum, Safia SC18
Keeling, Kellie MB46, IS-M
Keene, Karen MA46
Keeney, Ralph SB05, SB15, TC63
Kefeli, Ali IS-M
Keha, Ahmet TA47
Kehoe, Rebecca SB52
Keisler, Jeff SC15, MB15, TA64
Keko, Hrvoje WB14
Kekre, Sunder SB30
Keles, Dogan MD14
Keller, Chris MC39, WB54
Keller, L. Robin MC15
Kellerer, Hans SD18, MD18
Kellison, Bruce WA19
Kello, Jennifer MA31, IS-M

Kelton, W. David WB64
Kemahlioglu Ziya, Eda TC69
Kempf, Karl MB54, TD63
Keng, Naiping TB54
Kennedy, Alex IS-M
Kennedy, Deanna MA52
Kenney, Melissa MA17
Kenney, Rachael TC46
Kepes, Alejandro WD67
Keppo, Jussi TB30
Kerbache, Laoucine WC03
Kercheval, Alec MC29
Kerivin, Hervé WD63
Kerl, Paul MC52
Kerner, Yoav MD28
Kesaraju, Vishnu SA05
Kesavan, Saravanan SB32, MD01, TD25, WB27
Keskin, Burcu SA64, TD68, WC47, WD47
Keskin, N. Bora TD09
Keskin, Nur TB69
Keskinocak, Pinar SC46, MA34, MA31, IS-M, MD64, TB12, WE25
Kettelle, John WE57
Ketter, Wolf TA45, TC45, WE14
Kettinger, William J. MC69
Kettunen, Janne WA16
Keun Koo, Hyeng MD02
Kewcharoenwong, Panitan WD51
Keyhani, Mohammad SB40
Keyserling, Monroe SD44
Khademi, Amin MD36
Khadilkar, Harshad TB23, TC57
Khajavirad, Aida TC20
Khaled, Abdullah TA32
Khan, Xenos SB53
Khani, Alireza SC51
Khanjari, Neda WD30
Kharbeche, Mohamed TB57, WC06
Kharoufeh, Jeffrey SB36, MA35
Khawam, John MD41
Khodadadegan, Yasaman WD56
Khojandi, Anahita SA37
Khorrami, Babak MB57
Khoshneshin, Mohammad SC50, TB67
Khosrojerdi, Amirhossein IS-T
Khouja, Moutaz WA02
Khuntia, Jiban SC39
Kianfar, Kiavash SB38, SC24, MA24, WE24
Kiassat, Corey WA41
Kiekhaefer, Andrew WA07
Kiekintveld, Christopher SB04, TD15
Kienzle, Martin TB65
Kilic, Onur Alper WA03
Kilinc Karzan, Fatma TC22
Killingswoth, Brenda IS-T
Kim, Amy MC57
Kim, Bongsuk TB53
Kim, Bosung TB23
Kim, Bowon WA68
Kim, Bumsoo WD02
Kim, Byung Cho WC39
Kim, Byung-In MD47, WA51, WE08
Kim, Changhyun WA65
Kim, Daeki WB03, WB44
Kim, Deok-Hwan TD58
Kim, Doyoon TD46
Kim, Hailey MC26
Kim, Hangseok TD62
Kim, HongSeon WC10
Kim, Hwang Ho WC18
Kim, Hyun Kyung WD41
Kim, Hyun-Jin TD59
Kim, Iljoo TA67
Kim, Jae Ho TC12
Kim, Jae-Hwan WB45
Kim, Jeunghyun SB29
Kim, Jinho TB37, TB53, TC33
Kim, Jisun WC59
Kim, Jong-Seok SA66
Kim, KiHyung TC35
Kim, Kwang-Jae MB65, TD59
Kim, Kyoung-Kuk SD49, WA03
Kim, Michael SC37, WB45
Kim, Namhyoung WC50
Kim, Norman TB53
Kim, S. Phil WE68
Kim, Sang Won SB25, MD45
Kim, Sang-Hyun SC27, MA28, MC25, MD26
Kim, Seo Young TD65
Kim, Seokjin MB38, MC38
Kim, Seong Dae WA40
Kim, Seongbae MD47
Kim, Seong-Hee MC49, TC53, WB49
Kim, Seong-joon WC45
Kim, Seongmoon WB12, WC10
Kim, Seoung Bum SA50, SB50, TD53
Kim, Sujin SD49, MB49
Kim, Sung-Hee TC46
Kim, Taehyeong WE61
Kim, Tae-Sung IS-M
Kim, Yeonkyu WB32
Kim, Yong Hoon MC48
Kim, Yong Seog WA51
Kim, Yoo-Ah SB12
Kim, Youn Sung TD65
Kim, Younghun TA59
Kimbrough, Steve WA67, WB43
Kimura, Shinnosuke IS-T
Kimura, Yutaka TA21
Kincaid, Rex K. WB57
King, Douglas SC34
King, Greg WB65
King, Kathleen MD44, TA25
King, Marvin MA58
King, Russell E. WA30, WB03, WD01, WD03
Kingsford, Carl SB12, SD12
Kirchain, Randolph WC28, WC32
Kirlik, Gokhan WE63
Kirsch, David MB41
Kirschenmann, Thomas SA37
Kirshner, Sam WB13
Klabjan, Diego SC43, MA43, MC43, TC12, TD45, WC55
Klak, Lauren MB17
Klampfl, Erica SC43, TC07
Klastorin, Ted MC18
Kleber, Rainer SB27
Klee, George IS-M
Klein, Laura WE34
Klein, Michael WE31
Kleindorfer, Paul MC54
Kleinmuntz, Don MD15, WC34
Kleniati, Polyxeni WE22
Kleywegt, Anton TB12
Klimberg, Ron SD46
Klincewicz, John MC36
Klise, Katherine MD03
Knapp, Ashlee TC59
Knorr, Dave WA57
Knowles Ball, Terra WA07
Ko, Jeonghan TB38, WA25
Ko, Young Myoung MC43
Koay, Richard TB65
Koberstein, Achim SA21
Koc, Ali TD14
Kocabiyikoglu, Ayse MB28
Kocadagli, Ozan WC07
Kocaga, Yasar Levent TC13
Koch, Soeren WE65
Koch, Thorsten SA08, SD04
Koehler, Gary J. WA53
Koenig, Sven SB51
Koepke, Jason TC67
Koeppe, Matthias SA24
Koh, Tat Koon SD42
Kohn, Wolf SC20
Kok, Gurhan SC25, WB50
Koka, Balaji WA59
Koksal, Gulser MA63
Koksalan, Murat SA63, MA63, TD63, WC63
Koksalmis, Emrah WB06
Kolisch, Rainer MA27
Kolka, Ofer SA51
Kollat, Josh MC63
Komanduri, Ranga TC35
Kominers, Scott TC45
Konak, Abdullah SA36, MB36, TA52
Konanna, Prabhudev SC42
Kondo, Akira TA57
Kong, Danxia TA67
Kong, Guangwen WB25
Kong, Jiehong MD16
Kong, Nan SB31, SC20, SD31, MA31, MA37, MB50, IS-M, TB34, WB22
Kong, Qingxia WD15
Kong, Zhenyu (James) TC35, TC53, WB37
Könnyu, Nóra SD16, MB16
Konrad, Renata MA42
Konur, Dincer WE47
Koo, Jeongin WA51
Koole, Ger TB11, WA13
Koomen, Johannes TA28
Kopfer, Herbert TB47
Koppenhaver, Robert TC36
Korad, Akshay MC14
Korenkevych, Dmytro MB50
Korhonen, Pekka MA63, TD63
Koritarov, Vladimir SD43
Kortanek, Kenneth TA02
Kortbeek, Nikky MA31, IS-M
Koshal, Jayash MA21
Koskulics, Michael TA37
Koslowsky, Sam WA53
Kostami, Vasiliki TC27
Kostamis, Dimitris TA01
Koster, Arie SD60, MC21, WB24
Kotas, Petr TC48
Kotha, Reddi WA27
Kou, Steve SB06, TA29, TB29, WA29
Koushik, Dev SC55, MB09
Kouvelis, Panos SB30, SD30, MB30, MD30, WC29, WC40
Kovach, Jeremy SA41
Kovacs, Kent MB16
Kowli, Anupama TD21
Kozae, A. M. SD63
Krackhardt, David MB42
Kraft, Chip TB32
Kraft, Tim TC69, WE69
Kraiselburd, Santiago SA27, SA30
Krall, Eric SA14
Kramkowski, Stefan SC51
Krantz, David TD67
Krasnokutskaya, Elena SB25, MD27
Krass, Dmitry SD38, MD38
Krause, Andreas TA12
Kremer, Mirko TB26, WA50, WB50
Kress, Moshe MB23
Krishnamoorthy, Srinivas MB52
Krishnamurthy, Ananth TB52, TD51, WC68
Krishnan, Krishna TC61
Krishnan, Ramayya MA64, MB42
Krishnan, Vish TB40
Kristjansson, Bjarni SC10, MA04, MC03, TA03
Krityakierne, Tipaluck TC04
Krokhmal, Pavlo TC60, WC21
Kronick, Steven SC54, MA36
Kros, John MC39, WB54
Krushevskaja, Darja TD45
Kucherenko, Sergei WB15
Kucuksari, Sadik TA35
Kucukyavuz, Simge SA24, MA24, MD05, TA24, TC24
Kucukyazici, Beste WE31
Kuehn, Jason MD32
Kuhn, Heinrich SB55, WE26
Kulkarni, Niranjan SA05
Kulkarni, Radhika MA03
Kulkarni, Sameer TD23
Kulkarni, Vidyadhar MD07, TD11, WB11
Kulshrestha, Ashish MC51
Kulturel-Konak, Sadan TA52
Kumakura, Hiroshi IS-T
Kumar, Amit SC48, SD48
Kumar, Jitendra MC63
Kumar, Mahesh MA13
Kumar, Ram WE42
Kumar, Ravi MA11
Kumar, Roshen TC48
Kumar, Sameer WE62
Kumar, Subodha MC54, MD39
Kumar, Sujay MD63
Kumar, Tarun MC55
Kumar, V. MB59
Kumarasamy, Anicham SA31
Kumi, Jonathan TC51

Kumin, Hillel TB22
Kundakcioglu, Erhun MD20, TA53
Kundisch, Dennis SA42
Kung, Ling-Chieh SD09
Kung, Pin WA16
Kunkel, Amber MB44
Kunnumkal, Sumit SC09, WA41
Kunreuther, Howard TD67
Kuntz, Ludwig MD50, WD41
Kuo, Adeline MB54
Kuo, April TC32
Kuo, Chia-Wei WB09, WE02
Kuppusamy, Saravanan MD03
Kurt, Murat SB31
Kurtulus, Mumin MC01
Kurushima, Aiko TA21
Kuruzovich, Jason TC42
Kurz, Mary Beth SA44, TD04
Kushch, Svetlana SD16
Kushwaha, Tarun SB32
Kutanoglu, Erhan TA38, TA58
Kutschka, Manuel MC21, WB24
Kuyumcu, Ahmet TB09
Kuznia, Ludwig SA22, SB08, TD36
Kuzu, Kaan SC59, IS-T
Kwak, Jin Kyung WD46
Kwak, Jun-young WE34
Kwak, N. K. MC66
Kwark, Young TD42
Kweon, Sang Jin WA08
Kwon, Changhyun TA39, TB51, TC51, WD08
Kwon, Dharma SD27, TA17
Kwon, Juhee WB56
Kwon, Kysang SB03
Kwon, Roy SB21, MC02
Kwon, Ryeok-Hwan TD59
Kylinger, Martin WC51

L

Laber, Eric MA50
Labov, Simon SD23
Labrador, Miguel SA36
Lacy, Lee MA58
Lada, Emily MB10
Ladner, Daniela MA56
Laemmer, Stefan MD07
LaGanga, Linda WA34, WD31
Lagos, Guido TA24
Laguna, Manuel TD04
Lahiri, Sudi SD50
Lahrichi, Nadia SB47
Lai, Guoming SB19, SC30, MA30, WC01
Lai, Katherine SD16
Lai, Richard SA30
Lai, Tsz Wai TD20
Laird, Carl MD03
Laird, Susan TA58, TB58
Lakner, Peter SC07
Lakshmanan, Kavitha WB23
Lam, Henry WD11
Lam, Marco TD62
Lamadrid, Alberto SB14
Lamas, Alejandro WD08
Lambert, Amaury MA07
Lambert, Jim WD34
Lambert, W. Brian WC16
LaMondia, Jeffrey MA51
Lan, Guanghui SC58, TC21, TC22, WB60
Lan, Yingjie WC13
Landers, Thomas SC44, TC15
Langbort, Cedric SB14
Langella, Ian SB27
Langer, Mark MD31
Lansey, Kevin WA16
Lantz, Susan TB46
Lantzy, Shannon SC42
Laporte, Gilbert SB47
Lapp, Marcial MA31, IS-M, TD57
Lapre, Michael MB40
Larasati, Aisyah IS-M, TB16
Larco Martinelli, Jose A. TA50
Lariviere, Martin SD28, WB25
LaRocca, Sarah WD59
Larre, Omar SD24
Larrick, Rick SB15
Larsen, Allan WA38
Larsen, Christian WA08
Larson, Chad MD27, TD25
Larson, Jeffrey TB04
Larson, Kent SD51
Larson, Richard SC11, SD64, TB34, TD64
Larsson, Martin SB06
Lasdon, Leon MC04
Lasrado, Vernet TC52, WB04
Lasry, Arielle TD31
Latek, Maciej MA58, MB58
Lathrop, John SD15
Lau, Nelson WB50
Laude, Gautier MB10
Lave, Lester SB43
Lavieri, Mariel SD31, MA31, IS-M
Lavin, James WD03
Lawphongpanich, Siriphong (Toi) SA48, SB48
Lawrence, Rick TD48
Lawrence, Stephen WA34, WD31, WD62
Lawrimore, Kay WC47
Lazic, Jasmina TB02
Leber, Dennis WA17
Lebhar, Emmanuelle SC11
Lechler, Thomas MA52
L'Ecuyer, Pierre WB13
Leder, Kevin TB07
Lederer, Phil SB02
Ledolter, Johannes MA34
Lee, Changhyeok TD66
Lee, Cheolwon MA49
Lee, Chia-Yen SA26, SB66, MD22
Lee, Chieh-Hsiu J. MA31, IS-M
Lee, Chi-Guhn WA03
Lee, Chungmok TB19
Lee, Chung-Yee TB65, TC47
Lee, Deahyung TB53
Lee, Deishin TB69, TC69, TD16
Lee, Donald MD17
Lee, Dongha TB53
Lee, Dongwon TD65
Lee, Eunsu MA31, IS-M
Lee, Eva MA36, MB50, MC31, MD24, MD54, WA36, WD34
Lee, Giwhyun MD35
Lee, Gregory SD55
Lee, Hau SB26, SC64, TB25, WD25
Lee, Ho Cheung Brian SC63
Lee, Hsiao-Hui MC69, MD26, TD03, TD66, WC01
Lee, Hyangsook WB47
Lee, HyoungRo TC62
Lee, Jaegul TD40
Lee, Jaeheon MB37
Lee, Jaehyun WA08
Lee, Jaewook WC50
Lee, Jenny TC07
Lee, Jeonghwa WD50
Lee, Jinho SD08, SD23
Lee, Jinkun WC44
Lee, Jinwook SD21
Lee, John D. SD37
Lee, Joonkyum SB32
Lee, Junghee TC30
Lee, Kangbok SB18, MD18
Lee, Kashek WB66, WC28
Lee, Kristie SC34
Lee, Kyoungsun TC02
Lee, Loo Hay IS-T, TD49, WA66, WB06
Lee, Mi Lim TC53
Lee, Nam SB06
Lee, Sangbok TC56
Lee, Seokcheon WE68
Lee, Seonah WD09
Lee, Seungchul SB55, TB54, WC33
Lee, Seungkyung TB53
Lee, Shui-Pin SA33
Lee, Sunghee WB03
Lee, Taehan TC51
Lee, Taesik WC36
Lee, Taewoo MD31
Lee, Thomas WB31
Lee, Timothy IS-M
Lee, Yen-Yu WC14
Lee, Yi-Ting MC23
Lee, Young MA49
Lee, Youngho SC36, SD60
Lee, Youngrok MA31, IS-M
Lee, Yuan-Sheng SA63
Lee, Yu-Ching WD22
Lee, Yun Shin SB02
Leemis, Lawrence TB07
Lefeber, Erjen MD07
Lehlbach, David MC32
Lehlou, Nabil MB56, WA47
Lehman, Matthew WE44
Lehman, Toby WD26
Lei, Lei MD18, WC47
Lei, Ming SA66, WA32
Leider, Stephen TB01
Leifker, Nicholas WE03
Lejeune, Miguel SD02, IS-M
LeMay, Brian TC59
Lembke, Ron WA47
Lemieux, James TA13
Lemkens, Stephan SD60
Leng, Tiecheng MA30
Lengacher, David WD15
Lenté, Christophe SD18
Leon, Jorge TC61
Leonard, Karen SA64
Leow, Mindy WC53
Letham, Ben MA53
Letizia, Paolo MA69
Leung, Alvin SC42
Leung, Janny M.Y. WB52
Leung, Joseph SB18, MA18, MD18
Leung, Lawrence C. WA66
Leung, Ming-Ying SD12
Leung, Tim SB06, MB02, TA19
Leung, Ying Tat WC67
Leung, Zachary SC64, SD28
Levesque, Moren SA40, SB40, MA40
Levi, Retsef SA26, MA06, MB27, MC09, MC34, TA26
Levin, Sharon SC03
Levin, Todd MD43
Levin, Yuri SA09, WD27
Levina, Tatsiana WD27
Levine, David MD14
Levine, Evan SB23
Levis, Jack MB39, TA55
Lewin, Arie Y SD52
Lewis, Greg TA09
Lewis, Mark MA11
Lewis, Tracy WD25
Leyffer, Sven SB20, MB24, MC24
Leyton-Brown, Kevin SB04, MC45
Li, Ang TA56
Li, Chenhua SD23
Li, Chung-Lun IS-M, MD18
Li, Cuihong MB13, WA01, WC01
Li, Dong SB56
Li, Duan WB10, WC08, WE19, WE20
Li, Faming TA28
Li, Feng MA18, TB18
Li, Gang MC65
Li, Guang MB21
Li, Haitao TB66, WA44
Li, Hang SA47
Li, Hongbo WC66
Li, Hongfei MC55, WC45
Li, Jian MB37, MC28
Li, Jinfeng TD02
Li, Jing MB33, IS-T, MC53, TA53, TB37
Li, Jingrui SB37, MC37
Li, Jingshan SD37
Li, Jinlin MC65
Li, Jonathan SB21, MA19
Li, Juan SC26, TB49
Li, Jun TC26, WD27, WC42
Li, Kate MA13, MC11
Li, Kunpeng WB44
Li, Le WE09
Li, Lingfei TD29, WB29
Li, Linlin WB44
Li, Lionel TB67
Li, Meng TC68
Li, Ming TA59, WD12
Li, Mingyang SD35
Li, Minqi SC49
Li, Nannan MA59
Li, Qi MA59
Li, Qing TB63
Li, Rong IS-M
Li, Sha WA25

Li, Shan WB46
Li, Shanling TC28
Li, Shengli TB67
Li, Shu WD46
Li, Shuxiang IS-T
Li, Tao SA25, SB44, TA13
Li, Thomas SD55
Li, Wennian IS-T
Li, Xiangjin WA41
Li, Xiangyong MD25, WB13
Li, Xiaochun SB33, WA33
Li, Xiaofei TD39
Li, Xiaopeng SC48, TB51, WA48
Li, Xinxin WC42
Li, Xuesong WE22
Li, Xun WE42
Li, Yan Fu WB06
Li, Yang SC26, TD01
Li, Yaxian IS-T
Li, Yihua TC13
Li, Yijiang SD53
Li, Yuying WD08
Li, Zhalin WE30
Li, Zhaojun WB33
Li, Zhe WA35
Li, Zhe WA35, WB67
Li, Zhiguo MC55
Li, Zichao WD48
Lian, Zilong TD33
Liang, Chao SB44
Liang, Dong MD57
Liang, Faming SB35
Liang, Huigang IS-T
Liang, Xiongjian MA08
Liang, Yong MD14, TD38
Liang, Zhiyong TB33
Liang, Ziyu WE11
Liao, Haitao SC37, MB35, MD35, TA37
Liao, Xiuwu WC26
Liao, Yi TD02
Liberatore, Matthew TA55, WD18
Liberti, Leo MA20, MC24
Lichtendahl, Casey SB15
Lichtsinn, Mario SB65
Liden, Bertil WC51
Lieberman, Warren MD32, TB55
Liesiö, Juuso SC15
Lightfoot, Howard MB65
Lim, Andrew SD11, MB29, MB30, MC19, WB12
Lim, Chie-Hyeon MB65
Lim, Churlzu MA60, IS-T
Lim, Dongjae TD29
Lim, Eunji MA21, MB49, WD49
Lim, Gino J. SA03, SC31, MA23, MB31, WD52
Lim, Heejong SA25
Lim, Joonse IS-T
Lim, Michael MA38
Lim, Yun Fong TA66
Limpaitoon, Tanachai MD14
Lin, Ching-Feng MD53
Lin, Chunfang Devon SD33, MA37
Lin, Dennis K. J. MD37
Lin, Dung-Ying MB48
Lin, Feng TD31
Lin, Jane SA56
Lin, Kyle TD15
Lin, Mei SD39
Lin, Mingfeng SC42, MC42
Lin, Qihang TC22
Lin, Ruey-Fa SA59
Lin, Shu-Ping WA59
Lin, Wuqin MC26
Lin, Yen-Ting SA28
Lin, Yhu-Tin WA25
Lin, Yu-De MB59
Lin, Yu-Shiu SA47
Linares, Pedro TD43
Linck, Scott WA49
Linderborn, Autumn TA64, TD64
Linderoth, Jeff MA20, TD24, WD43
Lindfeldt, Anders WC61
Lindsey, Kathleen WD51
Linetsky, Vadim TA19, TD29, WA29, WB29
Linkletter, Crystal SD33
Lipkowitz, Michael TB53
Lippman, Steven TA17
Lisser, Abdel MB60
List, Barry MB39
List, George TB61
Litvinov, Eugene SB14, TC43
Liu, Andrew SB31, SB43, SC14, MA14, MC27, TA14, TC14, TD43, WC22
Liu, Bing TC68
Liu, Cong SD22, TB14
Liu, De WC42
Liu, Fang WD25
Liu, Fei MA49, TD02
Liu, Gang TC53
Liu, Henry MA48, MB48
Liu, Heping MD04, WA33
Liu, Hongju WC42
Liu, Jian SD35
Liu, Jingang SC49
Liu, Jingchen TB49
Liu, John WE22
Liu, Jun WA03
Liu, Juqi SC56
Liu, Kaibo TA53, WA37
Liu, Lei WC50
Liu, Ming WA19
Liu, Nan SC34, TA36
Liu, Pai WC34
Liu, Qian SD26
Liu, Qizhang SA51
Liu, Ruoyu WB48
Liu, Shan SB34
Liu, Shuguang TC30
Liu, Shulin WC26, WC42
Liu, Tao (Ted) WA33
Liu, Tian Mu TB36
Liu, Tieming TB16, WD65
Liu, Wei WD64
Liu, Wenda TD23
Liu, Xi TA37
Liu, Xiang MA32
Liu, Xiao SB37, MC37
Liu, Xiao Hu SD55
Liu, Xiaomo TC67
Liu, Xinmei MC41
Liu, Xuan MC55
Liu, Yanchu MB02, TC19
Liu, Yi MC57, WD39
Liu, Yifeng MC28
Liu, Yimin SC43, TC07
Liu, Yongjun IS-T
Liu, Yue MC51
Liu, Yufeng MA50
Liu, Yunan SB07, WD11
Liu, Yung-wen SA31
Liu, Zhen SD02, MB19, MD19, MD43, TC16, WA31, WC12, WD21
Liu, Zhixin SC18, MA27, TB18
Liu, Zhuping WA01
Liu, Zigeng TC44
Liu, Zugang (Leo) MC69, TD68
Liu, Zuoyi WB32
Livesay, Dennis SA12
Llorente, Miguel A. WC38
Lo Prete, Chiara TD43
Lo, Andrew SA29
Lo, Chon-Hou WE62
Lobel, Ilan SB13, SD09, TB13
Lobel, Ruben SA26, WC09
Lobo, José WA43, WC40
Loch, Christoph MB15, TB41, TC17, TC40, TD50
Lock, Michael TB31
Lockhart, Richard SD33
Lodi, Andrea SA08
Lodree, Emmett MC64
Loebbecke, Claudia SC65
Loehne, Andreas TD29
Logendran, R. Logen WB28, WC18
Loggins, Ryan IS-M
Lohmann, Timo WC44
Loidolt, Bryce SD15
Lökketangen, Arne WB38
Lokman, Banu WC63
Long, Elisa SB34, SC34, MB25
Long, Hongwei WC29
Long, Ralph SC54
Long, Troy TC34
Long, Zhuoyu MC18, WB01
Longo, Francesco SC65, TC65
Lopes, Juliana WC57
Lòpez Hoffman, Laura WA32
Lopez, Cristina WE01
Lopez, Francisco SA66
Lopez, Nicolas IS-M
Lopomo, Giuseppe TB45
Loredo, Elvira SA32
Lorig, Matthew WA29
Lou, Chenlu TB62
Lou, Jianying MB37
Lou, Yingyan MA48, MC51
Loughin, Tom SD33
Loutskina, Elena SD41
Louveaux, Quentin WA24
Love, Robert MC55, WA62
Lovell, David SA57
Lowe, Jim TC59
Lowe, Timothy WE03
Lownes, Nicholas MA51
Lozano, Leonardo SC51, TB08
Lu, Bojun WE20
Lu, Cheng TD60
Lu, Chung-Cheng MD48
Lu, Jye-Chyi (JC) TC33
Lu, Kathy MA31, IS-M
Lu, Lauren Xiaoyuan SC01, SD26, MB26, MC01
Lu, Liang SC18, TB18
Lu, Mengshi TC03
Lu, Shu TD22
Lu, Xin WC60
Lu, Xuan WC48
Lu, Ye TB18
Lu, Yina MB01
Lu, Yingda TA42
Lu, Yingdong TD11
Lu, Yixin TA45, TC45
Lu, Zhaosong WB60
Luangkesorn, Louis TD64, WB31
Lübbecke, Marco E. WC08
Lubin, Benjamin MA45
Lubin, Miles MB12
Lucas, Cormac SD02, MC20
Ludwig, Heiko SB65
Luedtke, Jim MA20, TB66, TD24, WB24
Lüer, Armin WD52
Luh, Hsing WE07
Luken, Brittany MA57
Luna, MÔnica M. M. SA66
Lunday, Brian WB20
Lunday, Kevin WB20
Lundberg, Russell SB23
Luo, Hao SC18
Luo, Hezhi WA60
Luo, Jiabin TB47
Luo, Jianzhe WB11
Luo, Jiaxi TC67
Luo, Jifeng WB39
Luo, Jin-hui WC10
Luo, Kai WC03
Luo, Meiling MC65
Luo, Sirong TD13
Luo, Wei MD30
Luo, Wenhong TA55
Luo, Yao WD49
Luong, Binh TD47
Lupuloff, Dana SC54
Luss, Ronny WE22
Lustig, Irv WA55
Lv, Hairong MC59, TA59, WC04
Lv, Xinjie MC59, TA59, WC04, WE44
Lyle, Matthew MA39
Lyon, Joshua SA14, TA35, WA54
Lyytinen, Kalle TD40

M

Ma, Dongxue MB56
Ma, Haiming TA37
Ma, Jing MC60
Ma, Juan SA60
Ma, Jun TB03
Ma, Likang SA03
Ma, Rui MA48
Ma, Shiqian SA01, TB60
Ma, Xiaoyu MA31, IS-M, WB56
Ma, Zhongwen WB65
Macal, Charles SA49, MD49
Macció, Danilo SB50
MacCormack, Alan SB41
MacCrory, Frank MD42
MacDonald, Erin WA32, WE69
Machado, Marcela, A.G. TA23

Macht, Gretchen TC66
MacKenzie, Cameron TA44, TC15, TD44
MacLean, Len MB19, MD02, WE21
Maculan, Nelson TB62
Madadi, AliReza TD04
Madaeni, Seyed Hossein TA35
Madan, Dilip MB02
Maddah, Bacel MD25, WE26
Madden, Tim WC13
Madhavan, Arjun WC13
Madhok, Anoop SB40
Madigan, David MA53, MD53
Madlener, Reinhard SA43
Maenhout, Broos WA18
Magazine, Michael MC27, MD03, WA34, WB31
Maggioni, Francesca SC22, IS-T
Maglaras, Costis SC07, MD28, TB13
Magos, Dimitris TB08
Mahajan, Ashutosh SB20, MC24
Mahalik, Matthew SD43
Mahatma, Shilpa MC55
Mahdavi Pajouh, Foad SA60, MC20, MD60
Maheshwari, Amit WA38
Mahjoub, Reza TB31
Mahoney, Suzanne SD15
Mähring, Magnus MB15
Mai, Feng WD66
Maillart, Lisa M. SA37
Maimon, Oded SD37
Maio, Wei-Chung WE19
Mak, Ho-Yin MA38, TD38
Mak, Lin Chi TB21
Makarov, Igor MD45
Mak-Hau, Vicky WA31
Makis, Viliam SC37, WB45
Makiya, George TD40
Malakooti, Behnam WC17, WE44
Malamud, Semyon TB02
Malapert, Arnaud TC08
Malavade, Sharad WB08, WD23
Mallik, Suman WB44, WB65
Mallor, Fermín TB62
Mallya, Dave MC55
Malo, Pekka WC63
Mamani, Hamed SA31, MA01, MB25
Mamun, Sha MA51
Mamula, Kim TC59
Manago, Saverio WA53
Mancilla, Camlo TD56
Mandelbaum, Avishai SA11, TD27
Mandviwalla, Munir SC42
Mani, Deepa TA42
Mani, Vidya SA28, MD01, TD25, WB27
Manning, Stephan SD52
Manshadi, Vahideh TC11
Mantel, H. Ronald WA52
Marais, Karen TB23
Marangon, Luana WD14
Marcato, André WD14
Marcia, Roummel TA22, TB20
Marcotte, Patrice WB13
Mardan, Setareh SA13
Mareay, R. SD63
Marecki, Janusz SB04
Margot, Francois SC30, TB24, WC11
Margulies, Susan MC60
Marianov, Vladimir TC38, WD52, WE52
Marinesi, Simone MC25
Markham, Ina MB46
Marla, Lavanya MA64, TC57
Marmor, Yariv TD27
Marquis, Jon TD63
Marshall, Henry WA49
Martagan, Tugce WC68
Martell, David MC16
Martin, Hilary WC59
Martin, Kiel SB58
Martin, Kipp MB03, MD03, TB03
Martineau, Patrick MB18
Martinelli, Gabriele TC17
Martinez, Dayna Lee WB08, WD23
Martinez, Diana SB50, MD20
Martinez, Diego WB37
Martinez, Nadia MD20
Martínez-de-Albéniz, Victor SC25, SD01, MA25, MC30
Martin-Utrera, Alberto SD02
Martonosi, Susan MD58
Marucheck, Ann SA25, SD03, SD34
Marufuzzaman, Mohammad TB16
Marx, Matt MB41
Masarie, Alex MC16
Masihabadi, Sina MA24
Masini, Andrea WD41
Mason, Jennifer MC12, MD36
Mason, Scott J. SA18, SA44, MA31, IS-M
Masoumi, Amir MB56
Massala, Otso TC17
Massey, Cade MA15
Massey, William TB11
Massini, Silvia SD52
Massol, Olivier TA43
Mastinu, Gianpiero WD63
Masursky, Danielle MA34, TB50
Matheson, David SD17
Matheson, James E. MD15
Mathur, Sameer MA13
Matis, Timothy SB36, WB35
Matisziw, Timothy TD44
Matott, Shawn TB04
Matsypura, Dmytro TC19
Mattfeld, Dirk C. SA51, MC47
Matto, Edward MC55
Maxwell, Andrew SA40
Maxwell, Matthew TD34, WD28
Mayadunne, Sanjay WD28
Mayer, Peter WC34
Mayorga, Maria MA64, MD36, TA34, WA51, WD28
Mazadi, Mahmoud WA16
Mazhari, Esfandyar TA35
Mazzuchi, Thomas WD33
McAdams, David MD45
McCardle, Kevin TA17
McClain, Evan TB23
McClosky, Benjamin MD60
McComb, Sara MA52
McCormick, Tyler MD53
McCoy, Jessica SB64, SC64, MD44
McCue, Colleen TD07
McCullock, Katelyn WD19
McCullough, Jeffrey SC39
McDermott, Chris TD65
McDill, Marc MA16
McFayden, Colin MC16
McFowland, Edward SA50
McGaha, Michelle MC16, MD56
McGill, Jeff WD27
McGinnis, Leon SB03, SC56, TB52, TC52
McInnis, Michael MD66
McJeon, Haewon TD21
McKay, Ryan SA44
McKay, Shawn SA32
McKelvey, Kevin SD16
McKerns, Mike WB15
McKinney, CJ WD31
McLay, Laura MA64, MB44, MC03, TB15, TD34
McQuaid, Dualta TC34
McSharry, Patrick SC35
Meagh, Doug SC54
Medaglia, Andrés L. SA02, SC51, TB08
Medal, Hugh SA44, IS-M
Medéllin, Rodrigo WA32
Medin, Joaquin MA65
Medina, Lourdes A. MD41
Medina-Borja, Alexandra MA65, MB66
Meeker, William TA37
Megahed, Aly WD47
Megahed, Fadel M. SA33, MB33, IS-T, TD37
Mehra, Amit MD39, WB41
Mehravaran, Yasaman WC18
Mehrotra, Mili TB69
Mehrotra, Sanjay SC22, MA56, TC21, TD66, WA12
Mehrotra, Vijay SD46
Mehta, Sameep MA59, MD66
Meijer, Leilani MA54, MB55
Meimand, Amir MA48
Meiren, Thomas TB59
Meisel, Frank TA61
Meisel, Stephan MC47
Meissner, Joern SB22
Mejdal, Sig MB52
Meketon, Marc TB32
Mele, Angelo SA39
Melecio, Joymariel MA65
Melese, Francois MC15
Meliksetian, Estepan MA49
Melkote, Srinidhi WC13
Meller, Russell TA52
Mellouli, Taïeb WD57
Melloy, Brian WA35
Melo, Everton IS-T
Melouk, Sharif SA64, SC58, TD68, WD66
Meltzer, David TD66
Melville, Prem SC55
Menachof, David WC23
Menche, Michael WE54
Mendelson, Haim SB01, TC26
Mendes, André WA38
Mendes, Glauco TA23
Méndez, Carlos Y. SA02
Mendoza, Alvaro WB62
Mendoza-Arriaga, Rafael TA19, WA29
Meneghin, Bruce MB16
Menezes, Mozart MB38, MC38, TC43
Mengistu, Birhanu WE28
Menich, Ronald TB09
Mennicken, Roman MD50
Menon, Dinesh SC45
Menon, Nirup SC39
Mercader, Rodrigo J. MB16
Mercado, Gary WD45
Mercier, Anne WD09
Mercier, Luc TD08
Merener, Nicolas WC10
Merino, Maria TD14
Merrick, Jason MC49, TB15
Mersereau, Adam SB32, MD09, TA01, WC11
Mes, Martijn MC47
Mesa Arango, Rodrigo SA47, TA51, WC48
Metcalf, Marilyn SC17
Meunier, Frédéric SB51
Meyer, Dominik WB15
Meyer, Georg TA67
Meyer, Marlize MA54, MD55
Meyer, Michael TA32
Meyer, Robert SC31, WC20
Meyer, Ted SC32
Meyers, Lauren SB17, WA21
Meyn, Sean SB14, MD21, TD21
Michael, Seiler WB33
Michalek, Jeremy SB43, SC43, WE69
Michalka, Alex TB24
Michel, Laurent TA08, TC08
Michlin, Yefim Haim SA65
Middleton, Jason SA23
Middleton, Richard TA62
Midthun, Kjetil MB43, TD14
Mihm, Jürgen SB41, SC41
Milgrom, Paul SD45
Miller, Andrew TD24
Miller, David WD66
Miller, George MA56
Miller, Gerard SC55
Miller, Roger TA14
Miller-Hooks, Elise TC51
Millhiser, Will MA31, IS-M
Mills, Alex SB29
Mills, Nathaniel MA49
Mills, Richard MC63
Millstone, Marc WB22
Miltenberger, Matthias TC24, WC44
Min, Daiki WB65
Min, Jo TB62, WE62
Min, Li IS-M
Miner, Michael WD60
Minner, Stefan WA45, WD59
Miraglia, Stefano WB59, WE59
Miralinaghi, Seyed Mohammad MA48
Miranda, Sofia TB21

Miranda, Vladimiro WB14
Mirchandani, Pitu MD51, TA38, TB51
Mirrokni, Vahab MC45, TA09, TB45, TC11, TD45
Mirzaei, Shokoufeh TC61
Mishra, Anant TA41, TB40
Mishra, Nishant SB56
Misic, Velibor TC34
Missbauer, Hubert WD65
Mistry, Nilesh SC31
Mitchell, Gary MC18
Mitchell, John TB48, TD60, WB20
Mitchell, William SC52
Mithas, Sunil MD42
Mitra, Amitava WE63
Mitra, Gautam SD19, TB02
Mitra, Sabyasachi WA39
Mitra, Subhro WE01
Mitra, Sumit WA62
Mittal, Akshay SB46
Mittal, Shashi SA29
Mittelmann, Hans A08
Mittenthal, John WC47, WD47
Miyamoto, Yuichiro WB04
Miyashiro, Ryuhei WB04
Mizutani, Tomohiko TB20
Mlinar, Tanja WD66
Mo, Jiahui TB42
Moallemi, Ciamac SB01, SC07, SD11, MB11, MB29, WC11
Moatti, Yosef SA03
Moazeni, Somayeh WD08
Mobasher, Arezou MB31
Mobasher, Azadeh SA34
Mobius, Markus TA09
Modaresi, Sajad WC09
Modarres, Mohammad WB33
Modgil, Preeti WC13
Modi, Sachin WD65
Moench, Lars SA18
Moghaddam, Kamran WD07
Mohan, Mayank MB17
Mohan, Srimathy TB63
Mohapatra, Arupa SB36
Mohapatra, Chinmoy SC48
Mohr, Doug MA55
Mohr, Shirley TD54
Moinzadeh, Kamran TB39
Moitra, Soumyo MC36, WC40
Mojsilovic, Aleksandra SD59, MC55, MD59, MD66
Molavi, Pooya TB13
Molderink, Albert SD18
Molinaro, Marco SA24, SC24
Mollaghasemi, Mansooreh WB04
Molyboha, Anton WC21
Momcilovic, Petar SA11, WA11
Monplaisir, Leslie MD38, WA31
Monroe, Richard WC66
Monsch, Matthieu MC07
Monsuur, Herman MB58, WA04
Montanari, Andrea MB11, TC11
Montaño-Barrios, Luis WD19
Monteiro, Renato D. C. WB60
Montgomery, Claire SD16
Montgomery, Douglas MD37, WD45
Montibeller, Gilberto MA15, WA63
Montiel, Luis TB17
Montjoy, Adam SA34
Montreuil, Benoit TC52, WA52
Mookerjee, Radha MC54
Mookerjee, Vijay SD27, MC54, MD39, TB69, WE42
Moore, Brian MD64
Moore, David MB40
Moore, James MA47
Mora, Hugo WD25
Moradi, Esmaeel SA60
Morais, Danielle WB63
Morales, Juan SA16
Morales, Ridley Santiago WC58
Moran, Diego MB24, SA24
Mora-Vargas, Jaime MD69, TB51, TB63
Morency, Catherine SD51
Morenko, Yana WC21
Moreno, Eduardo TA24, WC16
Moreno-Centeno, Erick SA17
Moreno-Garcia, Antonio SB25, MD27, WB27
Morey, Steve TA12
Moriggia, Vittorio WE21
Morita, Hiroshi SD66
Moritz, Brent WA50, WB50
Moritz, Sebastian WA45
Morra, Dante SD54, WE31
Morrice, Douglas MC49
Morris, Carl MB56
Morris, James MD58
Morrison, David WA04
Morrison, Layne MC55
Morrow, W. Ross TC16, WB67
Morton, Alec SC15, WA63
Morton, David SB17, SC08, SD23, MA60, MC46, WD14
Moss, Sue MC34
Mostovyi, Oleksii MC04, WE01
Mota, Caroline WB63, WE20
Mount, Tim SB14
Moura, Pedro SC36
Mourelatos, Zissimos WA17
Mourtos, Ioannis TB08
Moussawi-Haidar, Lama SA13
Movahednejad, Mahyar WB61
Moya, Hiram WD58
Mu, Liying SD27
Muckstadt, John SC26, TA25
Mueller, Matt MA31, IS-M
Muharremoglu, Alp SD01, TA26
Mujahid, Syed WC20
Mukerji, Tapan MB17
Mukherjee, Lopamudra TB22
Mukhopadhyay, Samar SB56
Muldoon, Frank MB20
Mulholland, Patrick TA62
Muller, George WD34
Müller, Juliane TA04
Mulvey, John MB19
Mumbower, Stacey MA57
Munagala, Kamesh MC45
Muñoz, Cristobal MC14
Munoz, Francisco MC14
Muñoz, Gonzalo WC16
Munoz, Juan Carlos MA51, WC61
Munson, Todd SB20, MC24
Murali, Pavan TD51, WD12
Murat, Alper SC38, MA31, IS-M, MD38, TC02, TC41, WA60, WB61, WC23, WD48, WE07
Murat, Ekrem MA56
Murguia Blumenkranz, Erika TA66, WC66
Muriel, Ana MD34, IS-T, TD69
Murphy, Frederic WB43
Murray, Alan MA38
Murray, Chase SC58
Murray, Fiona MB41
Murray, James TA41
Murray-Tuite, Pamela MC51
Murrugarra, Ruth WA38
Murthy, Nagesh TA69
Murty, Rohan SA45
Musal, R. Muzaffer WB53
Musitelli, Davide WE21
Mustata, Andrei TB02
Musumba, Mark WD39
Mut, Murat MC22
Muthukrishnan, S. TA09, TD45
Muthulingam, Suresh SB32, MD01, TA17, TB69
Muthuraman, Kumar TA29, TA30
Mutlu, Fatih WD15
Mutlu, Serpil TC56
Myers, Chad SB12
Myers, David SC32
Myndyuk, Olga SC21

N

Na, Yongkyun WC41
Nabors, Spencer WB31
Nachtmann, Heather WB56, WD48
Nadar, Emre SC26, WC40
Nadarajah, Selvaprabu TB24, WC11
Naddef, Denis WA23
Nagadeepthi, Peravali WC50
Nagai, Daisuke MD56
Nageshwaraniyer, Sai Srinivas SA53
Nagi, Rakesh MC20, WB06
Nagurney, Anna MA03, MB39, MB56, MC69, TA44, TD68
Nahapetyan, Artyom TD20
Naik, Ashwin MD57
Naik, Vijay SC65, TC65
Nair, Jayakrishnan MA49
Nair, Rahul TC51
Nair, Suresh WC65
Nakamura, Kiminori SD64
Nakamura, Yoshitaka MD41
Nakata, Kazuhide TA20
Nakata, Maho TA20, WE22
Nakayama, Kanako IS-T
Nakayama, Marvin TB49
Nakazaki, Ritsu MD41
Nakkas, Alper MC01
Nalajala, Naveen TD35
Namazifar, Mahdi MA20
Nandiraju, Srinivas TD61, WE48
Nanduri, Vishnu MA14, WB14
Naor, Michael TC69
Naphade, Milind TA59, WD12
Narasimhan, Sridhar SB39
Narayanan, Meyyappan SA40
Narayanan, Sriram TA41, WD65
Narisetty, Amar SB08
Nason, Scott SD57
Nassir, Neema SC51, MD51
Natarajan, Karthik SC64
Natarajarathinam, Malini WB54, WC47
Nault, Barrie R. SC40, MA39
Naumann, Marc SC51
Naumova, Mariya SD21
Naval, Eric MB48
Naveas, Mauricio SC55
Naveda, Fernando TA28
Navid, Nivad WE14
Nazarian, Ehsan TB38, WA25
Nazerzadeh, Hamid SB13, SC13, SD09, MC09, TA09
Nazzal, Dima TC52
Neal, Larry MC17
Neboian, Andrei MC54
Nediak, Mikhail SA09, WB13, WD27
Nedich, Angelia MA21, WD49
Neely, Andres SC55
Negrete, Matias TD21
Nehme, David SA03
Nehme, Michael SC08, MB09
Neill, Daniel SA50, SD42
Nelldal, Bo-Lennart WD61
Nelson, Barry L. SB49, SC49, WD07
Nelson, Christie MA31, IS-M, WB23
Nelson, John MA16
Nelson, Karl SD23
Nembhard, David TC66
Nemet, Greg WB43
Nemhauser, George TA47, IS-T, WE24
Nemirovski, Arkadi TC22
Nepal, Bimal TA17, TC68
Neray, Robin TD64
Netessine, Serguei MC25, MD26, MD27, TB28, TC26, TD25, WB26, WD27
Netto, Marco TC65
Nevill, Paul MA49
Newman, Alexandra MA58, MC24, WC16, WD16
Newman, Jeffrey MA09
Newman, Lee MC15
Nezamuddin, N. SC48
Ng, Daniel C. T. MA27
NG, Kien Ming MB33, IS-T, WB06
Ng, Szu Hui SD49
Nguyen Thi, Phuong Khanh SA37
Nguyen, Dang Quang MD30
Nguyen, John TA66
Nguyen, Thanh SA45
Nguyen, Trang TC20, WC24
Ni Bhradaigh, Emer MA52
Ni, John WC29
Ni, Jun SB55, WC33
Ni, Tian WA68
Nicholson, Emma MA14

Nickel, Stefan TB38
Nicol, Davdi MA49
Niculescu, Marius Florin SB39, TD39
Nie, Jiawang TA22
Nie, Xiaofeng WC58
Nie, Yu (Marco) SB48, SC48
Nielsen, Bo TB11
Nielsen, Matthew MA31, IS-M, TB31
Nielsen, Morten Bremnes TD14
Nielsen, Thomas TB11
Nieuwesteeg, Peter MC10
Niknam, Seyed SC37
Nikolova, Evdokia SD24
Nikoofal, Mohammad TC30, TD15, WA15
Nilakanta, Sree WE42
Ning, Jie TB30
Ninh, Anh SC21
Niranjan, Suman SA05
Nishihara, Michi MC19
Nishiyama, Naoki MD41
Nobles, Mallory MC31
Noel, Rebecca SC17
Nogales, Francisco J. SD02
Noh, Hyunsoo SC51, MA51
Nohadani, Omid TA33, WD56
Noorizadegan, Mahdi WD12
Noparumpa, Tim SB30
Norback, Judith TB46
Norde, Henk WE30
Noritou, Yuuki IS-T
Norman Hill, Kara SA23
Norouzi, Amirhosein TB07
North, Michael SA49, MD49
Norwood, Karen MA46
Nourazari, Sara TB22
Novaes, Antònio Galvão SA66
Novikoff, Tim SC08
Novoa, Clara TD35
Nowak, Maciek SD47
Nowicki, Tomasz TC24
Noyan, Nilay SB09, IS-M
Ntaimo, Lewis MA22, MB08, MC16, MC43, MD56, TA24, TD35
Nunez, Manuel SB55, MC69, WD18
Nurre, Sarah TC44
Nygard, Kendall WD47
Nygreen, Björn MA08

O

Obeid, Ali SA18
Oberstone, Joel MD52
O'Connell, Daniel MA31, IS-M
O'Connor, Patrick TA67
Odegaard, Fredrik TA13, TB31
Odoni, Amedeo SD64, TC23
Oeser, Nadine TA65
Oglesby, Jerry SD46, TA10
Oh, Hyelim MA39
Oh, Jeong-Ha (Cath) TD42
Oh, Jun WB32
Oh, Sechan SB65, WA28
Oh, Sewoong MB11
Ohara, Atsumi MC22
Ohlmann, Jeff MC47
Ohno, Takahiro MD56, WD62
O'Kelly, Morton TC38
Okudan Kremer, Gül E. MD41
Okwo, Adaora TD16
Olafsson, Sigurdur MA31, IS-M
Oldewarris, Stefan WA52
Olesen, Ole Bent SB66, SC66
Olinick, Eli SD36
Oliva, Rogelio SA30, MD39
Olivares, Marcelo SB25, MB01, MC26, MD45, TB25, WD25
Oliveira, Carlos WE20
Oliveira, Fernando MB43, TA43
Oliveira, Gerson WA14
Oliveira, Roberto SD13
Olivetti, Elsa WC28, WC32
Olsen, Eirik Tandberg MB19
Olsen, Tava TB50, WE57
Olsthoorn, Mark MB14
Olvera, Mariana SB11
O'Malley, Mark TB35
Omar, Ahumada WC66
Onal, Hayri WB16, WC08
O'Neill, Richard SA14, WD43
Oorni, Anssi MA63
Oosten, Maarten SB09
Oppen, Johan MB47
Oprime, Pedro C. TA23
Opsahl, Tore WA27
Oraiopoulos, Nektarios SA41, SC27, MA52
Ordanini, Andrea MB59
Ordonez, Fernando SB51, SD47, TD51
Ordoobadi, Sharon WA30
Oren, Shmuel SA14, MD14
Ormeci Matoglu, Melda WA12
Ormeci, Lerzan SA34, SB29
Orrison, John MC32
Orsdemir, Adem TC69
Ortega, Julio MD66
Ortiz, Camilo WB60
Ortiz, Michael WB15, WE22
Ortiz-Pena, Hector MC20, SA58
Osadchiy, Nikolay MA09, TB25, TB30
OShea, Edwin TB02
Oshiro, Marcio IS-T
Osmani, Atif MA31, IS-M
Osorio, Carlos WC68
Osorio, Carolina SC11, SD48, WB48
Oster, Matthew MB20
Ostrowski, James SD22, MB24, TC14
O'Sullivan, Donal WD16
Othman, Abe SB45, MC45
Ott, Marion SB45, MA45
Ott, Ursula WB17
Oulamara, Ammar SC18
Ouyang, Yanfeng SC48, TB16, TB51, TD38, TD48, WA48, WC51
Ouyang, Zhongbin SD63
Ovchinnikov, Anton SC46, MB25, A50
Owen, William WD60
Owens, Douglas SC34, SD17
Owhadi, Houman WB15
Oyuela, Laura TB54
Ozaltin, Nur Ozge TC41
Ozaltin, Osman SB31
Ozbay, Kaan WA61
Ozbey, Ozgen SC63
Ozcan, Ozan WD59
Ozdaglar, Asuman SD24, WE34
Ozelkan, Ertunga MB33, IS-T
Ozen, Asli MD34
Ozen, Ulas WA03, WE30
Ozener, Orsan SA34, SC47
Ozer, Ozalp MB06, MC50, WC25
Ozkan, Gulru TC40, WB40
Ozkaynak, Mustafa MB34
Ozlen, Melih WC63
Ozmen, Ozgur WC67
Oztekin, Asil TC53
Ozyoruk, Bahar IS-T

P

Pac, Mehmet F. TC27
Pacella, Massimo TC33, TD37
Pach, Martin WB21
Pachidou, Fotini TA40
Pack, Daniel SB58
Padilla, Jose SC23, WA49
Padmanabhan, Balaji TA67, WB42
Pages, Adela TD14
Pai, Dinesh SA55, WA41
Pala, Okan MB33, IS-T
Palak, Gokce WD68
Paleshi, Arsalan MA65
Palley, Asa WC17
Palma, Cristian MA16
Palmintier, Bryan WB62
Palocsay, Susan MB46
Pan, Feng SA22, MA60
Pan, Rong TA35, TD35
Pan, Wenting SD56
Pan, Xiajun Amy SD39, MC01
Pan, Youqin WA53, WC19, WD01
Panchamgam, Kiran SA04
Pancotto, Marcelo WB40
Pandelis, Dimitrios TA66
Pandey, Vijitashwa WA17
Pandit, Vinayaka MD66
Pang, Guodong SA11, TA07
Pang, Jong-Shi MA48, TB16, TD22, TD38, TD60, WA22, WC22, WD22
Pang, Min-Seok TA39
Pang, Zhan WB26, WC29
Pangburn, Michael WA02, WA26, WC32
Pant, Gautam TA67
Pant, Raghav SC44, TC15, WD50
Papadaki, Katerina SB21
Papageorgiou, Dimitri TA47
Papamichail, K. Nadia WA63
Papapanagiotou, Ioannis IS-T
Papavasiliou, Anthony SA14, MD14
Papp, David WA12
Pappu, Vijay WC20
Paquet, Marc TD69
Parasuraman, A. MB59
Pardalos, Panos MC20, TD20, WA20, WA62, WC20, WE23
Pariazar, Mahmood SA44
Parija, Gyana SC59, MA59, MD66
Parikh, Neal MB04
Parikh, Pratik TB34
Parish, Esther TA62
Park, Chiwoo SB33, TB33
Park, Chuljin MC49
Park, Gigyoung SC36, SD60
Park, Hae-Sang WD50
Park, Heejung WA14
Park, Hyun Min IS-M
Park, Jane WE26
Park, John SC02
Park, Kanghee TC62, TD62
Park, Kun Soo MD02
Park, Kwangtae MB65
Park, Minjae TB37
Park, Seung Jae SC30
Park, Sungsoo TB19
Park, Sunju WD62
Park, Taeho TC39
Park, Taejin TB53
Park, Woojin SC58
Park, Young-Hoon WD46
Parker, Chris MC42, TB28
Parker, Geoffrey SC40, SD39, WA43, WC69
Parker, Nathan TA62
Parker, Rodney MC41, TB30
Parkes, David SA45, MA45
Parlakturk, Ali SA28, TC01, TC69
Parlier, Greg TC58
Parlour, Christine TA27
Parnell, Gregory MC17, MD15, TB15, WA58
Parpas, Panos WC12
Parra, Oscar WC68
Parrilo, Pablo SD24, MB22
Parsa, Hossein WE01
Parsons, Jay WD19
Parvan, Kiavash WD18
Parvin, Hoda MD11, TA66
Paschalidis, Ioannis C. SA02
Pasiliao, Eduardo TD20
Passonneau, Rebecca SD53
Passos Filho, João WD14
Pastukhov, Grigory TD20
Pasupathy, Kalyan WC56
Pasupathy, Raghu MB49, IS-T, WD49
Pasupuleti, Venkata Vijay K WC10
Pataki, Gabor TA60, TB24
Patankar, Jayprakash WE63
Pate-Cornell, Elisabeth SC23
Patek, Stephen TB12, WB20
Paternina-Arboleda, Carlos WD19
Pathak, Praveen TA42, TB67
Patrick, Jonathan MC12, TA36
Patrick, Kevin WB16, WC08
Patterson, Ray TD34, WD42
Pattillo, Jeffrey SA60, SD20
Patty, Bruce MD32, TB55
Paudel, Krishna TA16
Paulo da Costa, Joari WC12
Pavlicek, William WD56
Pavlin, Michael MA01, TC27
Pavlov, Valery MC11, WE57
Pavlov, Yuri P. SD63

Pavur, Robert WD01
Pawlowski, Suzanne SA64
Paynabar, Kamran TC33, TD33
Paz, Sandro WA38
Pazour, Jennifer TA52
Pearce, Bryan TA34, WE01
Pedraza-Martinez, Alfonso J. MD64, WB52
Peeta, Srinivas SC48, SD48, MC48, TA51, TC48, TD47, TD48, WB51, WC48
Peeters, Carine SD52
Pei, Jinxiang TD45
Pekec, Sasa SD25, TB45, TD45
Pekgun, Pelin TB09
Pekny, Joseph F. SB43, SC14
Peloquin, Adam IS-M
Peña, Javier TC22, TC60, WD60
Pena-Alcaraz, Maite WD61
Pender, Jamol TB11
Pendus, Cezar SC55
Peng, Fei IS-M, MD31
Peng, Hao SB37, MC37, TA48, TD48
Peng, Jianping MB42, MC42
Peng, Jiming MD19, TA60, TB22, WA60
Peng, Lifang MA59, WD39
Peng, Qian TB50, WE02
Peng, Siyang MA31, IS-M
Peng, Xianhua TA29, TB29
Peng, Yidong MC56
Penmetsa, Nabita TC28
Perakis, Georgia SA26, SD28, MB27, MC07, MC09, MD09, TA26, WC09
Perdu, Lien SB55
Pereira Soares, Murilo WC12
Pereira, Mario WA14
Perera, Sandun WC29
Perez Duenias, Federico MB23
Perez Valdes, Gerardo TD14, WD22
Perez, Cinthia WC03
Perez, Eduardo MC43, MD56, TD35
Perez, Gloria TD14
Perez, Gustavo WE67
Perez, Marilia MB33, IS-T
Perez, Noel MB64, MD64
Perona, Marco WD41
Perron, Laurent TD08
Perry, David MA11
Perry, Marcus MC33, MD58, WD45
Perry, Ohad WC27
Perumal, Ganesh WD08
Pessach, Dana SB51
Petering, Matthew MC51, TA61
Peters, Jeffrey TD47
Petersen, Jon MD57
Petersen, Niels Christian SB66
Peterson, Anders WC61
Peterson, Elmor L. MB12
Peterson, Scott SB43
Peterson, Tim MA31, IS-M
Petra, Cosmin G. MB12
Petrakis, Ioannis MA45
Petri, Michael TD47
Petroski, Joe MA16
Peukert, Christian WA59
Pfund, Michele SA18
Phadnis, Shardul WA17
Phaladiganon, Poovich TD53
Pham, Khanh SC58
Phan, Dzung MA49, WA20
Philai, Natesh MA50
Phillips, Jeffrey SC54
Phillips, Lawrence SC17
Phillips, Robert TC09, TD09
Philpott, Andy TA14
Pibernik, Richard WA45, WB17
Picard, Rick SB35
Piché, Robert TA04
Pickle, Linda SA12
Pierru, Axel SB20
Pierson, Margaret TB26, WA26
Pilehvar, Ali WC01
Pimplikar, Rakesh MA59
Pinar, Ali SC08, WA20
Pindoria, Sandip TA03
Pinedo, Michael SB18, MD18
Pinhanez, Claudio TC65
Pinker, Edieal MC18, MD26
Pinsonneault, Alain MD42
Pinto, Jose M. WA62
Piper, Brian WE58
Plambeck, Erica SB26, TB69
Plante, Bob WC45
Plevritis, Sylvia SC12
Ploykitikoon, Pattravadee MB40
Plumlee, Matthew TC37
Plummer, John MC04
Poch, Leslie SD43
Pohl, Edward SA44, MD58, WB35, WB56, WD64
Poirrier, Laurent WA24
Pokharel, Shalligram WB66
Pokutta, Sebastian TB24, WC24
Polansky, Ronny MC43
Polik, Imre SB08, MC24
Pollack-Johnson, Bruce WD18
Polson, Nicholas WB12
Polyak, Boris TC22
Pong, Ting Kei WB60
Pope, Brandon MA31, IS-M
Popescu, Dana MA09
Popescu, Ioana MB28, TD28
Popova, Elmira SA37, WD14
Popp, David TD21
Portal, Benazir WB04
Posner, Marc TA18
Post, Brian WB51
Pottenger, William M. MA31, IS-M, WB23
Poupart, Pascal TD36
Pourhabib, Arash SB35
Poursaeidi, Mohammad H. MD20
Powell, Adam SD29
Powell, Dennis SD15
Powell, Warren SB22, SD43, MA12, TA12, TA49, TC12, WA20
Prabala, Chandrasekhar WE61
Prabhu, Vittal WC44, WE08
Pradeau, Thomas SB51
Pralat, Pawel SB11
Pranoto, Yudi TA32
Pranzo, Marco MB18
Prasanna, G N Srinivasa WA62, WC50, WD08, WE61
Pratsini, Eleni TB27
Prava, Venkat MA17
Prawesh, Shankar TA67, WB42
Precup, Doina MA12
Prekopa, Andras SC21, SD21
Prencipe, Andrea SB41, WB59, WE59
Price, Carter TB56
Price, Devon MC34
Price, Stuart WE34
Prieto, Diana WB08, WD23
Primbs, James TC19
Prince, Mike WD24
Prins, Christian SB47
Proano, Ruben TB34
Prokopyev, Oleg A. SA37, SB31, SB36, SC20, MB20, MC04, MC20, TA36
Provost, Foster TA67
Prudencio, Ernesto MC35
Pruitt, Kristopher MC24
Pryor, Jennifer MD08
Przytycka, Teresa SB12
Psaraftis, Harilaos N SA47
Psarros, Ioannis TD61
Puchinger, Jakob WB04
Puertas, Monica WA38, WA56, WB37
Puerto, Justo SB38
Pugalee, David MA46
Pujowidianto, Nugroho IS-T
Puranam, Phanish SD40
Puranam, Srinivasa WA08
Puri, Surinder MC55
Puterman, Martin MC12, WC31
Putt, Mary WC36
Pyke, David TC13
Pyrgiotis, Nikolaos TC23

Q

Qi, Anyan TC25
Qi, Jin MC18, MC21
Qi, Lian MA26
Qi, Xiangtong SC18, TB18, TD67
Qi, Yunwei TC24
Qian, Dong WC19, WD44
Qian, Jianbo WB06
Qian, Li IS-T
Qian, Peter MA37, MB35, MD53
Qiang, Patrick MA69, TA44
Qiang, Xiaoning MC31
Qiao, Wenxin WA61
Qin, Fei TD30
Qin, Ruwen TC66, WA08
Qin, Tao MB59, MC59
Qin, zhaoqiong WD26
Qin, Zhiwei (Tony) TB60
Qing, Xiao TD48
Qiu, Feng WB24
Qiu, Jiaming WE23
Qiu, Lucy WC62
Qiu, Minmin WC66, WD68
Qiu, Peng SC12
Qiu, Robin WB46, WB59
Qiu, Shanshan WE07
Qu, Xiuli MC56, IS-T, TC53, TD56
Que, Xiaocun MD22
Queyranne, Maurice WC16
Quinn, Alexander SA53, IS-T
Quiroga, Bernardo F. WA50
Quiroz-Aguilar, Francisco WD66

R

Rabadi, Ghaith TB57, WB06
Rabinovich, Elliot WA26
Rabotyagov, Sergey SD16
Rader, David MD46
Radeva, Axinia SD53
Radwan, Essam MB48
Raeiszadeh, Pouya MC31
Raffo, David WC59
Rafinejad, Dariush TC69
Raghavan, S. SD60, MA41, WD24
Raghunathan, Srinivasan TD42
Rahman, Mohammad SA42, MA39
Rahmandad, Hazhir SB17, MB66, WB33
Rahmani, Morvarid MD26
Rai, Sudhendu TA28
Rainwater, Chase SA18, SA44, MD58
Raith, Sydney IS-M
Rajagopalan, Hari WC47, WD28
Rajagopalan, Raj MD26, TA01, TC27, WB25
Rajan, Balaraman MC34
Rajan, Uday TA27
Rajapakshe, Tharanga SD18
Rajappa, Gautham TB63, WB38
Rajneesh, Rajneesh MA31, IS-M, WA06
Raju, Jagmohan MD39
Ralph, Daniel SD14
Ralphs, Ted SA08, MB03, MC24, WD24
Ram, Camelia WA63
Ramachandran, Karthik SA41, SB40, MC50, WA27
Ramachandran, Vandana TC42
Ramakrishna, Hindupur TB55, WC38
Ramamohan, Varun IS-M
Ramamurthy, Vivek WE26
Raman, Ananth SA30
Ramanan, Kavita SD07, WA11
Ramaprasad, Jui SA42
Ramdas, Kamalini SD41, TB28
Ramirez-Marquez, Jose Emmanuel SA44, SD35
Ramos, Tales WD14
Ran, Bin TD48
Rand, William WA59, WC42
Randhawa, Ramandeep SB07, SC28, MC11, WB25, WC27
Ranjan, Pritam SD33
Ranjithan, Ranji MB63, WD47, WE58
Rankin, Yolanda SB65, MD65
Ransbotham, Sam WA39
Rao, Ashok TA28
Rao, Harish SB55
Rao, Nageswara WA15
Rao, Tvikram MA65
Rao, Uday TD30, WA34, WB31
Rappa, Michael WC55

Rardin, Ronald MB56, MD31, WA47, WC56, WD64
Rasekh, Lila MD13, TC13
Rash, Evan MB54
Rashidi, Eghbal MB56, WA47, WC56
Rashkova, Iva SC64
Rastpour, Amir MA64
Ratcliffe, Aaron SA25, SD34
Rath, Sandeep SA28
Ratisoontorn, Nantaporn MB13
Raturi, Amitabh WD66
Rausch, Sebastian WC43
Ravat, Uma MD21, WA22
Ravindran, Kiron TA42
Ravindran, Ravi SB63
Raviv, Tal SA51, SB51
Rawls, Carmen MC64
Ray, Saibal MB26, MC30, MC50
Ray, Saswati SD23
Raychaudhuri, Samik SA53
Raz, Gal MA41, MB25, WB64
Razzaghi, Talayeh WB04
Read, Daniel SB15, TA50
Reagans, Ray MB41
Rebennack, Steffen SD43, WD16
Reddy, Chandan SC55, MC56, TB56
Reddy, Chandra MA49
Reed, Josh SB07, SC07, SD07, MA07
Reed, Patrick MC63, MD63
Reese, Shane SD33
Reeves, Kingsley A. WB33, WD59
Régin, Jean-Charles TA08
Regis, Rommel MD04, TA04
Rei, Walter B47, MA47
Reich, Brian MC35
Reich, Daniel TC21
Reif, Brendt MD32, MD55
Reifsnider, Odette MD36
Reindorp, Matthew SA40
Reinhardt, Gilles WE31
Reitter, Norman TB55, WD16
Reklaitis, Gintaras V. SB43, SC14
Remington, Karin MC53
Ren, Changrui MB59, MC59, TB65, TD02
Ren, Yuqing TB42
Rendleman, Jr., Richard J. MB52
Resende, Mauricio SC60, MC20
Resurreccion, Joanna TC15
Retana, German SB39
Reynolds, Jr., Marion R. MB37
Reynolds, Tom TB23
Rezvanizaniani, Seyed Mohamma WC33
Rhim, Hosun TC41
Rhodes, James WA28
Ricciardi, Nicoletta MA47
Rice, Dan IS-M
Rice, Sarah WB41
Richard, Jean-Philippe MA24, MD24, SA20, TC20, TC32, WC24
Richstein, Jörn C. TA45
Rickard, Ryan WD55
Rida, Hussein SA13
Riddell Powers, Sarah MC37
Rideout, Douglas MC16
Rider, Christopher SB52
Riezebos, Jan TA50
Rifai, Omar SA47
Riggs, Robert WE68
Righter, Rhonda TB11
Rios Prado, Rosa WE48
Rios, Javier WC58
Rios, Luis A. SC52
Rios, Luis Miguel TB04
Rios-Zalapa, Ricardo IS-M
Rizi, Seyed MA58
Robbins, Matthew SB31
Robbins, Tom WB07
Roberts, Fred S. SA35
Roberts, Mark SB31
Roberts, Stephen TD36
Robinson, Anthony WA16
Robinson, Hylton MA54
Robinson, Lawrence WA34
Robinson, Matthew MC44
Robinson, Mike SC23
Robinson, Stephen TD22
Robison, Zach MB34
Rocca, Matteo WD22
Rocha e Oliveira, Paulo MD09
Rocha, Patricio SD43
Rochford, Linda MA52
Rockafellar, R. Tyrrell MA02, WB21
Rodrigo de Queiroz, Anderson SD08, WD14
Rodrigues, Renato WC43
Rodríguez-Sarasty, Jesús A. WB45, WD01
Roels, Guillaume MA25, MA40, MD26, TD01
Rogers, Dale WA47
Rogers, Luke SD16
Rohack, James MA31, IS-M
Rohleder, Thomas MA31, IS-M
Rohlfs, Wilko SA43
Rolland, Erik TD34, WD42
Romanko, Oleksandr IS-M
Romanosky, Sasha WC19
Romeijn, Edwin SC56, MA56, MD31, TC34
Römer, Michael WD57
Romero, Gonzalo MB27
Romich, Andrew SC58
Ronconi, Debora IS-T
Rong Li, Shirley WC47
Rong, Ying TB44, TD38
Rönnqvist, Mikael MD16, WC51
Roos, Kees SB24
Roose, Tiina WC32
Root, Sarah SA44, SD08, WD51
Rosa, Charlie MD32
Rosales, Claudia WB31
Rose, Carolyn SD51
Rose, Marc WA57
Rosen, Howard WB32
Rosenberger, Jay MD20
Rosenhead, Jonathan TB64
Roset, Alain MC54
Rosoff, Heather SD15, WA15
Ross, Kevin MA09
Ross, Kim TD61, WE48
Rossetti, Manuel WB56
Rossit, Daniel IS-T
Roth, Aleda SD65, MC66, WA44, WD46
Roth, Brian SC48
Roth, Richard WD66
Roth, Wendy TB19
Rothkopf, Alexander WA45, WB17
Rothschild, Casey TB15
Roughgarden, Tim TB45
Roumani, Yazan WA56
Rouse, Paul SC66
Rouskas, George SA36
Rousseau, Louis-Martin SD51, MC08, TC08
Roy, Arkajyoti WD56
Roy, Bernard SA63
Roy, Debjit TB52, TD51
Royset, Johannes TB21, WA21, WB21
Ru, Jun TC39
Rubera, Gaia MB59
Ruberry, Mike TC45
Rubin, Paul MC03
Rubio, Enrique WD16
Rubleske, Joe WA32
Rudin, Cynthia SD53, MA53, MD53, WC36
Rudloff, Birgit TD29
Rueher, Michel TA08
Ruggiero, John SB66, SC66
Rui, Huaxia TB02, WA42, WC65
Rui, Xiaoguang SC35, TC62
Ruiz Mora, Carlos MB43
Ruiz, Juan TD24
Rump, Christopher WE52
Runger, George SA33, SC53, TD33, WC50
Rungtusanatham, M. Johnny WD46
Rupérez Micola, Augusto WB43
Ruschin Rimini, Noa SD37
Ruschin, Mark SC31
Rush, William TA67
Rusmevichientong, Paat SC09, SC25, WC09
Russell, Robert WC13
Rust, Roland T. MB59
Ruszczynski, Andrzej TC03, TC29, WB12
Ryan, Jennifer IS-M, TB66, WA59
Ryan, Sarah TB14, TD69
Ryoo, Hong Seo TA20
Ryu, Jong-Hyun SD49
Ryu, Kunjin TB21
Ryzhov, Ilya SB22, MA12, TA49

S

Saar-Tsechansky, Maytal TA67
Saat, Rapik MA32
Saberi, Amin TC11
Sabharwal, Ashish MD08
Sabhnani, Girishkumar MB57
Sabounchi, Nasim SB17
Sabouri, Alireza SA37, SD31
Sadighian, Ali TD13
Sadrsadat, Hadi WB66, WE58
Saedi, Samira TA53
Safaei, Nima SC35
Safaripoor, Sadegh SC51
Safdar, Nasia TB31
Safro, Ilya MB24
Saghafian, Soroush SC54, MA36
Saglam, Mehmet MA19, MB29
Saglam, ‹mit TA22
Saha, Syamantak MC59
Saharidis, Georgios WB47
Sahba, Pedram MC11
Sahin, Ozge SA09, TC09, WB09, WC25
Sahinidis, Nick MA20, TA04, TB04, TC04, TC20
Sahinidis, Nikolaos IS-M, IS-T
Sahinyazan, Feyza MB44
Sahu, Sambit TA59, WD12
Sahu, Subrat SB50
Said, Adnan TA31
Sainathan, Arvind TD66
Sajjadi, S. Reza WD47
Sajjadi, Seyed Javad MC31
Saka, Behlul MD31
Salari, Ehsan MA56, MD31
Salazar, Carlos TB54
Salazar, Juan WD21
Saldana, Carolina WC44
Saldanha da Gama, Francisco TB38
Salleh, Ihsan SD25
Salman, Sibel SA34
Salo, Ahti SC15
Saltzman, Matthew MB03, TB03, WE63
Salvagnin, Domenico SA08
Samaras, Constantine SB43
Samiedaluie, Saied WE31
Samieenia, Mohammadjavad MC30
Samoff, Erica TC31
Samorani, Michele MC56, TD04, WA34, WD31
Samudra, Apurva IS-T
Samuel, Andrew TB15
Samuelson, Doug TC64, TD07, WA64
Samuelson, Stephen SD29
Sanchez Arocha, Alejandro WC66
Sanchez Arocha, Octavio WC66
Sanda, Gaute Egeland MB19
Sandholm, Tuomas SB04, SB45, SC45, SD45, MC45, MD08, TB45
Sandikci, Burhaneddin TD66
Sandoval, Felipe WE47
Sanford, Paul TA10
Sa-ngasoongsong, Akkarapol WD01
Saniee, Iraj MB60
Sanjeevi, Sujeevraja SC24, MA24
Sanli, Tugrul TB09
Sansom, Stephanie TC36, TD31
Santana, Alfredo WB08, WD23
Santen, Nidhi TD21
Santiago, Leonardo SD40, TA40
Santithammarak, Vanlapha WD58
Santos, Cipriano TB66
Santos, Joost TC15
Sapna, KP WE07
Sarath, Bharat MA13

Saria, Suchi SC29
Sarica, Kemal TD43
Sarin, Subhash TA16
Sarkar, Avijit TB55, WC38
Sarkar, Sourish WE30
Sarker, Bhaba TA16
Sasaki, Hiroshi SC59
Sasanuma, Katsunobu SC11
Sasaya, Toshinori IS-T
Sathasivan, Kanthimathi WC66
Sato, Ryo TB59
Sattar, Tanvir WB56
Sauma, Enzo MC14
Saunderson, James MB22
Sauppe, Jason WA04
Sauré, Antoine MC12
Saure, Denis Roland TD17, WC09
Savasaneril, Secil WA66
Savaskan, Canan TB01
Savelsbergh, Martin MD24, IS-T WD51
Savin, Sergei SB29, SD29
Savla, Ketan WD07
Savva, Nicos SC27, SD29, MD41, TB28
Sawhill, James MA26
Sawik, Tadeusz WA30
Saxena, Akanksha WC50
Sayal, Mehmet TC03, WD03
Saydam, Cem WC47, WD28
Sayyady, Fatemeh TB61
Scarpel, Rodrigo TC04
Scarpino, Samuel WA21
Scarsini, Marco MB28, TB13
Scerri, Paul SA58
Schaefer, Andrew SB31, MD36, TA36, WB31
Schaller, Jeffrey WA06
Scheibe, Kevin WE42
Scheinberg, Katya IS-M
Scheinberg, Katya IS-M, TB60
Schell, Gregg SD31
Scheller-Wolf, Alan SC11, SC26, SC30, MD07, TD11, WC14, WC40
Scherrer, Christina SA38
Schiffmann, Wolfram SA18
Schiro, Dane WA22
Schmidt, Michael TB52
Schmidt, Ulrich MC34
Schmidt, William SA30
Schnalzer, Kathrin TB59
Schneider, Andreas MB40
Schneider, Frank TC12
Schneider, Helmut WC55
Schneider, Kellie MD58
Schneider, Mark SB45
Schnellenpfeil, Tilman TD69
Schoenfelder, Jan MB31, TB34
Scholten, Marc SB15
Scholtes, Stefan SB02, MD50
Schroeder, Daniel SB58
Schruben, Lee WA07
Schuller, Alexander TA45
Schultz, Ken TB50
Schultz, Kenneth L. TB50
Schultz, Ruediger WB21
Schulz, Andreas SA01
Schumacher, Dirk SA03
Schumacher, Kathryn SC08
Schummer, James WB67
Schurr, Jochen SB22
Schutten, Marco MC47, TA58
Schutz, Doug SC42
Schütz, Peter TA47
Schwartz, Jay TA18
Schwartz, Michael SD16
Schwartz, Russell SD12
Schweitzer, Lisa MC51
Scinto, Phil MD37
Scott, Joseph K. SA20
Scott, Warren TA12
Scovel, Clint WB15
Scurlock, Corey WB31
Scutari, Gesualdo TD22
Seal, Kala MC39
Searcy, Steven TA16
Secchi, Enrico SD65
Secomandi, Nicola SB30, SC30, MD07, WC11, WC14
See, Brendan MB45
Sefair, Jorge A. SA02
Segura, Jose V. TB02
Sehgal, Ishan TD55
Seiddmann, Abraham MC34
Seidscher, Arkadi WD59
Seifert, Matthias SA17, MC15
Seifert, Ralf MD25
Seixas, Michel WA38
Sekhar, Himanshu SD17
Selander, Jan WC51
Sellmann, Meinolf MD08
Sels, Veronique WA18
Semlitsch, Raymond TD44
Semmens, Darius WA32
Sen Gupta, Rajorshi WD39
Sen, Alper MD45, WB44
Sen, Suvrajeet SA21, MA24, TC24
Sengul, Irem IS-M, TC64
Senol, Mehmet Burak SC38, WC23
Sentz, Kari SD15
Seo, Joo Hwan WE26
Seo, Michael MB33, IS-T
Seppi, Duane SC30
Serban, Nicoleta SA64, SC37, MB33, MC31, IS-T
Seref, Onur MD20
Serel, Dogan WE03
Serrano, Alejandro SA30
Serrano, Felipe MB24
Servi, Les MA03
Seshadri, Sridhar SC30, TA30, TB25, TB30
Sethi, Suresh P. SA25, SB44, SD01, TA13, WB02, WC29, WE42
Sethuraman, Samyukta MB08
Setia, Pankaj SC39
Sever, Derya SC47
Sewell, Edward IS-M
Seyed, Javad WD60
Seyhan, Tolga MB38, SC14, TC17, TD38
Sglavo, Udo TD55
Shabalin, Pasha SA45
Shabani, Nazanin TA16
Shachter, Ross SB34, TA15, TB17
Shafiee, M. Ehsan MB63, MD04
Shafieepoorfard, Ehsan TD21
Shah, Devavrat SB11, SC09, SD13, MB11, TA07
Shah, Nilay MC12, MD36
Shah, Rachna TD26
Shahabuddin, Syed SC50
Shahinpour, Shahram SD20
Shaki, Yair MA07
Shakkottai, Srinivas SB36
Shamayleh, Abdulrahim TC56
Shamir, Noam WE25
Shamsul Iwardi, Aiman TC46
Shan, Xiaojun IS-T
Shan, Xiaojun MB23, IS-T, TC64
Shanbhag, Uday SB04, SB14, SB31, MA21, MD21, TD21, WA22, WD49
Shang, Guangzhi WA69
Shang, Jennifer TC28
Shang, Kevin SC26, SD01, MC05, MD30, TA26
Shankar, Ravi TB33
Shanthikumar, George SA25, SB26, TA17, WE68
Shao, Fang WC46
Shao, Jinyan MC59, TA59, WC04, WE44
Shao, Qifeng WE65
Shao, Yufen SC47, TA47
Shapiro, Alexander MA02, TB12, WC12, WE21
Shapoval, Andriy MD24
Sharer, Elizabeth WC47, WD28
Sharifi, Elham WB66, WE58
Sharifi, Mona SA31
Sharkey, Thomas TC44, WB20, WE23
Sharma, Mayank SC59, WB01
Sharma, Sushant TD48
Sharpe, Michael MA31, IS-M, MD31
Sharypova, Kristina TC47
Shaw, Ben SB65
Shaw, Paul TD08
She, Jinjuan WA32
Shebalov, Sergey TD57
Shechter, Steven SA37, SD31, MC12, TD36
Sheffi, Yossi WA17, WA32
Sheikh, Shaya WE44
Shen, Houcai SA05
Shen, Jinglai WC22
Shen, Li MC41
Shen, Shu WA42
Shen, Siqian TC14, WB24
Shen, Wei TD48, WB51
Shen, Wenjing TD02
Shen, Xiaobei MB37
Shen, Z. Max SB26, MA38, MB38, IS-M, MD14, TB44, TD38, WD68, WE26
Sheng, Olivia TB67
Shenoy, Nitin IS-T
Sherali, Hanif SA20, SB08, TB57, WB20
Sherry, Lance TD23
Sheth, Arnav TD19
Shetty, Bala MD39, TA68, TB68
Shewchuk, John WE30
Shi, Chunming WB41
Shi, Cong SA26, MC09
Shi, Jianjun SB33, MA35, MD33, TA53, TC33, TC37, WA37
Shi, Jianmai WB47
Shi, Jim MC13
Shi, Jing MC56, TD56
Shi, Leyuan WC08, WC20
Shi, Lihui WD45
Shi, Mengze MA01, MB13
Shi, Pengyi WB11
Shi, Ruixia TC39
Shi, Wenbo WE62
Shi, Yong SD63
Shi, Yun WE19
Shi, Zhenyu (Edwin) WE58
Shiau, Norman SB43
Shier, Douglas WC04
Shih, Hsu-Shih SA63
Shih, Pai-Ta WE19
Shim, Sangoh WA06
Shim, Yohan MB14
Shimkin, Nahum WE11
Shin, Dongyoub TD46
Shin, Hayong SD49
Shin, HoWook WB46
Shin, Hyoduk TB39, TC54, TD16, WA69, WC25, WE25
Shin, Hyunjung TC62, TD62
Shin, Incheol MA49
Shinano, Yuji SA08
Shinde, Amit MD49, WC50
Shinde, Shilpa WD45
Shiner, Brian IS-T
Shinozaki, Hidetaka IS-T
Shirazi, Ehsan IS-M
Shirinakm, Sara MC56, TB37
Shirvani, Shirin SD20
Shittu, Ekundayo WB43, WC69
Shivendu, Shivendu MA39, MD42, TA42, TB39
Shkolnik, Alexander MD29, TA19
Shlakhter, Oleksandr MD38
Shmoys, David SC09, MB27, TA12
Shmueli, Galit SC29
Shnaiderman, Matan WD30
Shoemaker, Christine TA04, TB04, TC04
Shoemaker, Stowe WD09
Short, Walter TB35
Shortle, John SA57, WB49
Shrivastava, Abhishek SA35, MB35
Shroff, Ness MB08
Shu, Jia SA51, TD30
Shu, Jun SC36
Shu, Lianjie MD53
Shukla, Nagesh SD50
Shulman, Herbert MC36
Shum, Stephen WB02
Shumsky, Robert MD26
Shvartsman, Alex TA08
Shwartz, Larisa SA65
Shylo, Oleg MC04, TA36
Si, Xiaoyan TC32
Sibdari, Soheil TC13, WB67
Sibinga, Cees Smit MA31, IS-M
Sicco, Alessandro WD41

Sidaoui, Mouwafac WB17
Siddiqui, Afzal SA43
Siddiqui, Sauleh SB20, TA43
Siebers, Peer-Olaf WC23
Siebert, Johannes SA63
Siemsen, Enno MD50, WA50, WB50
Sievenpiper, Crispian SD50
Siirola, John SC04
Silva, Oscar S. TA23
Silva, Ricardo MC20
Sim, Melvyn MC18, MC21, WB01
Sim, Thaddeus TC46
Simaiakis, Ioannis TB23, WB57
Simao, Hugo SD43, TC12, WA20
Simatos, Florian SC07, MA07
Simchi-Levi, David SA01, SB02, WB62
Simmons, Leslie WA40
Simon, Jay MC15
Simone, Francesca WE68
Simsek, Ahmet Serdar TC09, TD09
Sinclair, Andrew SA58
Singer, David WD07, WE65
Singh Rathore, Ajay Pal TA17, TC68
Singh, Moninder MD59, MD66
Singh, Param Vir SD42, MB42
Singh, Vikas TB22
Singham, Dashi WA07
Sinha, Amitabh SC30, TC25
Sinha, Ankur WC63
Sinha, Kingshuk MD01
Sinha, Nitish TD19
Sinha, Prasun MB08
Sioshansi, Ramteen MA14, MC14, TA35
Sipilä, Hans WC61
Sir, Mustafa SA44, MC36
Sirichakwal, Issariya MC18
Sisikoglu, Esra MC36
Skandari, Reza TD36
Skaro, Anton SA26, MA56, WB67
Skerlos, Steven TC07
Slevitch, Lisa IS-M
Slikker, Marco TA25, WA67, WE30
Slonim, Anthony D. MD17
Slotnick, Susan IS-M
Slowinski, Roman SA63, MD23, TC63
Smalley, Hannah SC46, MA34
Smallman, Bettina MA34
Smeers, Yves SB20, SD14, WA22, WB43, WE21
Smilowitz, Karen SD29, SD47, SD54, MB64, WE58
Smit, Gerard SD18
Smit, Laurens WD03
Smith, Adrian MB44
Smith, Alice E. SA36, MB36
Smith, Brian WB56
Smith, Hugh WD50
Smith, J. Cole SB08, SC58, SD08, SD36, MA60, MD24, TC24, WB24, WD24
Smith, Jeffrey WC67
Smith, Jim MB29, TC17
Smith, Laurence MC04
Smith, Lones SD39
Smith, Michael SA42
Smith, Milton IS-T, WD58
Smith, Stephen SA09, SC25, SC30, WC14
Smith, Steven MC12, MD36
Sniekers, Daphne TB36
Snoweon, Jane MA49
Snyder, Angela SA38
Snyder, Larry SC14, MB38, TB44, TD38
So, Rick WC65
Soares, Werner WE20
Sobel, Matthew MD30
Sobral, Marcos WB63
Sodomka, Eric TA45
Sogin, Samuel MA32
Soh, Seung Bum WC27
Soheili, Negar WD60
Sohn, Sugje TB54
Sohoni, Milind SA27, WA41
Sokol, Joel TA47
Solak, Senay SA38, MD57, TA64, TD21, TD23, TD57
Soldner, Mallory SC46
Soll, Jack SB15, MA15
Solomon, David TA58, TB58
Solomon, Marius MC43
Solorio, Carlos WB45
Sölveling, Gustaf MD57, TB23
Somanchi, Sriram SD42
Somani, Abhishek MD49, WE14
Sommer, Svenja MB15
Son, Young-Jun SA53, MD49, TA35
Sonderegger, Elaine TA08
Song, Cen WA15
Song, Chang MC64
Song, Dong Yoon TC48, WB51
Song, Irene TA02
Song, Jeannette WD25
Song, Jie TD49
Song, Joe SC12, SD12
Song, Joon Jin IS-T
Song, Lijie WB31
Song, Peter SD53
Song, Sanling MC37
Song, Yingda MD19
Song, Yongjia TA24
Sonmez, Erkut MD07
Sonuc, Sibel SD36
Soofi, Ehsan WD33
Soper, Alan SD18
Sorensen, Stephen TC36
Sorokin, Alexey MD43, TD20, WA62
Sorokine, Alexandre TA62
Soroush, Hossein TC06
Sorrell, Toni IS-T
Sosa, Manuel SB41, SC41, SD40
Sosic, Greys TA39, WB69
Soto, Ismael MB60
Soukhal, Ameur SD18
Souyris, Sebastian TC32
Souza, Gilvan Gil SB27
Sowers, Richard SB06
Sowlati, Taraneh TA16
Sox, Charles TC68, WB02, WC47
Soyer, Refik WB12, WB53, WD33
Soylu, Banu SC63, IS-M
Sozuer, Sibel MC27
Spanton, Shantih SD08
Spassov, Vikenti WB52
Speakman, Skyler SD42
Spee, Detlef TB52, WA52
Spencer, Gwen TA12
Speranza, Grazia MB47
Sperl-Hillen, JoAnn TA67
Spetzler, Carl SA15, TA65
Spicer, Jessica MA31, IS-M
Spieksma, Flora TA11
Spieksma, Frits SA45, SD18, IS-T
Spiliopolous, Kostas SB06
Spinler, Stefan MC54, MD41
Sprintson, Alex SB36
Sprock, Timothy SC56
Squillante, Mark S. SA65, MB08, TD11, WA11
Sreekumaran, Harikrishnan TA14
Sribhashyam, Sumitra WA63
Srinivas, Sharath TA28
Srinivasan, Kannan MB42
Srinivasan, Padmini SC50
Srinivasan, Sankara SC39
Srinivasan, Sudharshana IS-T, WB06
Sriskandarajah, Chelliah MD18, WB28
Srivastava, Rajiv WA66
Srour, F. Jordan SA47
St. John, Rachel MA16, WB16
Staats, Bradley SD40, MB01
Stacey, Jennifer WC47
Stallaert, Jan WB39
Stamatiadis, Chronis TA48
Stanciu, Alia TC46
Stanfield, Paul MB33, IS-T
Stanley, Debra TD64
Starhill, Philip MD22
Starr, David SA44
Stauffer, Gautier TB24
Staum, Jeremy TD29, WA19
Stavert, Robert MB25
Stavrulaki, Effie WC32
Stecke, Kathryn SA28, WB26
Steele, J. Michael TA11
Stefanescu, Catalina MB28
Stefani, Raymond T. MC52
Steffy, Daniel E. SA08, SD04
Steglich, Mike TB03
Steiger, Robin TB08
Stein, Cliff MB18
Stein, Joshua SD31
Steiner, George TC18, WB06
Steinker, Sebastian TD03
Stempfhuber, Dirk TB41
Stephan, Paula SC03
Stephens, Mia SB10
Sterzik, Sebastian TB47
Steuer, Ralph TC63
Stier-Moses, Nicolas E. SD24
Stiller, Sebastian SA29
Stilp, Kael MD64
Sting, Fabian TB41, TC40
Stockbridge, Rebecca TC21
Stoikov, Sasha SC07
Stolyar, Aleksandr TA07
Stone, John TB61
Stonebraker, Jeff SC15
Storch, Richard MC56
Storer, Robert TD56, WE45
Storlie, Curtis MC35
Stotz, Adam MC20
Stout, Natasha SD54, TC36
Stoyan, Stephen TB20
Street, Nick SC50, TB67
Strinka, Zohar SC56
Strong, Ray SB65, WA28
Strumsky, Deborah WA43, WC40
Strusevich, Vitaly SD18
Stucky, Susan SB65
Stylianou, Antonis SA39
Su, Che-lin WB27
Su, Jack MC23
Su, Ping TC30
Su, Qin SA56, WD26
Su, Xuanming SD26, MC50
Su, Xuemei TD02
Su, Yea-Huey MA59, MB59
Su, Yiqiang MB21
Subasi, Ersoy TB53
Subasi, Munevver Mine TB53
Subramaniam, Ramanathan TA13
Subramanian, Dharmashankar SD17, TA12, TC29
Subramanian, Hemang WA39
Subramanian, Ravi MB69
Subramanyam, Ramanath MD42
Sudit, Moises SA58, MC20
Sue Wing, Ian WC43
Suhl, Leena SC51
Sui, Yanfei SC51
Sukhu, Yves MA31, IS-M
Sullivan, Kelly MA60
Sullivan, Patrick TB35
Sullivan, Tim WB15
Sultana, Rudy SC45
Sumaili, Jean WB14
Summerfield, Nichalin TB01, WA68
Sun, Bo WB07
Sun, Daewon WC39
Sun, Dengfeng WC48
Sun, Haoying SB44
Sun, Jie WE48
Sun, Jin WC44
Sun, Li TB56
Sun, Linyan MC65
Sun, Peng SB02, TD17, TD28
Sun, Siyuan MA31, IS-M
Sun, Wei SA26, SD28
Sun, Xu Andy SA54, TC43
Sun, Yepeng MA31, IS-M
Sun, Yepeng WC58
Sun, Yu-An TA28
Sun, Yue WC60
Sun, Zhanbo TD48, WB51
Sun, Zhengwei MB17
Sundaramoorthi, Durai SA53
Sundararajan, Mukund SB13, MC07, TA09
Sung, Chen-Han TA58
Sung, Jaeyoung MD02
Suppa, Uli MC47
Suresh, Santhosh WA62
Suriano, Saumuy TC37

Susarla, Anjana SB42, MD42, TA42, WC42
Sutherland, John TA18
Sutton, Warren SD66
Suzuki, Atsuo TC38
Suzuki, Hiroto MD56
Svaiter, Benar F. WB60
Sviridenko, Maxim WB01
Swaminathan, Jayashankar SA28, SC64, MC01, MD01, TA41, WB27
Swann, Julie SA64, SB64, SC54, MC31
Swaroop, Prem SB57, MC57
Swartz, Colleen SD37
Sweda, Timothy SC43
Sweeney, Brooke WB07
Swirszcz, Grzegorz TC24, TD48
Szechtman, Roberto MB23
Szidarovszky, Ferenc WC28
Szmerekovsky, Joseph SA05, IS-M, MC18, WE01
Szwed, Paul MB58
Szymanek, Radoslaw TB08

T

Taaffe, Kevin SA44, TA34, TC56, TD56, WA51, WE01
Taboada, Heidi IS-M, TD35
Tae, Hyunchul WE08
Tafazzoli, Ali MB57
Taghavi, Ali SC38, TC02
Taguchi, Azuma MA57
Tahbaz-Salehi, Alireza TB13
Takahashi, Kei WD62
Takahashi, Rirka MA57
Takano, Yuichi MC19
Takashima, Ryuta SA43, TD19
Takezawa, Naoya WC10
Talla Nobibon, Fabrice IS-T
Talluri, Srinivas TA41, TC44
Tambe, Milind SB04, TD15, WE34
Tamor, Michael TC07
Tan, Chin Hon TC14, WC17
Tan, David SB52
Tan, Jian MB08
Tan, Kok-Choon WA66, WE48
Tan, Run-Yan WE48
Tan, Tarkan MD69
Tan, Tom TB28
Tan, Yang WA05
Tan, Yong SC39, MB42, MC42, TA45, TB39, TD39, TD42
Tan, Yue TD11
Tanaka, Ken-ichi WB04
Tanaka, Makoto TC43, TD43
Tancrez, Jean-Sébastien MD25
Taner, Mehmet R. MB44
Taneri, Niyazi SC41, MD41
Tang, Christopher S. MC26, WA26
Tang, Jen WC45
Tang, Lixin MA18, TB18
Tang, Loon Ching SD35
Tang, Pingzhong SC45, TB45
Tang, Sammi TA44
Tang, Shoupeng WD61
Tang, Wenjie TA17
Tang, Yen MD24
Tang, Zaiyong WC19
Tanrisever, Fehmi SA40, MA30
Tanriverdi, Hüseyin TA50
Tansitpong, Praowpan SA28, WB26
Tanyeri, Basak WC29
Tao, Zhi WC32
Tarhini, Hussein TA51
Tarim, Armagan WA03
Tariq, Awais TA49
Tas, Duygu SC47
Tas, Sinan WB23
Taseli, Aysun IS-M
Tavares, Leonardo TA40
Tawarmalani, Mohit SA20, MA24, TC20, WC24
Taylor, Don WD51
Taylor, Kendra TA64
Taylor, Terry SA27, SB26
Tayur, Sridhar SA26, SC01, MD28, WC49
Teboulle, Marc WE22
Teisberg, Elizabeth SD41
Teixeira, Rafael TC65
Tejada-Calvo, Desiree IS-M
Tejada-Calvo, Iris IS-M
Tejswaroop Reddy, Geetla SD38
Tekaya, Wajdi WC12
Tekin, Eylem TD13, WA08
Tekiner-Mogulkoc, Hatice TA35, WA54
Telang, Rahul SA39
Tello, Steven WC46
Temizkhan, Orcun WE42
ten Hompel, Michael TB52, WA52
Teng, Gary IS-T
Teng, Wenbo TB50, WE02
Teng, Yu SD31, MA31, IS-M, WB22
Teo, Chung Piaw SA51
Tereyagoglu, Necati SB25, MC25, WD27
Terlaky, Tamás MC22, MC24
Terry, Thompson SA10
Terwiesch, Christian SB25, SD29, MA36, MD27, WB27
Tesfatsion, Leigh MD49, WE14
Tetzloff, Isaac WB57
Teytelman, Anna TB34
Tezcan, Tolga TB66, WB11
Tezcaner, Diclehan MA63
Thakkar, Sneha WC13
Thakur, Lakshman WC65
Theil, Florian WB15
Theisen, Kacie TC07
Thekdi, Shital WD34
Theofanis, Sotiris WB47
Thibault, Hubert WA01
Thiele, Aurelie MA44, MC19, MC21, MD02
Thill, Jean-Claude WD48
Thimmapuram, Prakash SD43
Thoet, Bill WE54
Thomas, Andrew MB42
Thomas, Barrett MC47
Thomas, Bex MD12, WB55
Thomas, Doug WA50
Thomas, Lyn MC58, TC19
Thomas, Neil TA62
Thomas, Valerie MD43
Thomas, Vince SC55
Thomé, Fernanda WA14
Thomé, Luiz Mauricio WA14
Thompson, Dave MC45
Thonemann, Ulrich MC50
Thorborg, Jesper TC48
Thorsen, Andreas TA51
Tian, Fang WB69
Tian, Hengliang WB51
Tian, Peng MD25, WB13
Tian, Qiming WE52
Tian, Shaonan TB19
Tian, Ye TB48, TD60, WA60
Tian, Zhigang SD35, MC37, TB37, TD35, WA37
Tian, Zhili MD30, WC40
Tiemessen, Harold TB27
Tilson, Vera MC18, TD66, WB11
Timkovsky, Vadim G. MA27, TC19
Tindle, John SD17
Tino, Clayton MD57
Tipi, Evren WD01
Titman, Sheridan TB29
Titus, Richard SB63
Tiwari, Santosh TA63
Tiwari, Vikram SD34
T'Kindt, Vincent SD18
Toffel, Michael TA69
Tohmé, Fernando IS-T
Tokgoz, Emre TB22
Toktay, Beril MA30, TA27, WA28, WB69
Tolk, Andreas WA49
Tomasgard, Asgeir MB43, TD14
Tomlin, Brian SD30, MA28
Tompaidis, Stathis TB29
Tong, Chunyang MD26
Tong, Jingjing WC37, WD48
Tong, Jordan WB50
Tong, Shilu WB02
Tong, Xianqiao TB21
Tong, Yue MB47
Tongarlak, Mustafa SC49, TC69, TD16
Topaloglu, Huseyin SB09, SC09, MA11, TA36, TD34, WC09, WD28
Toptal, Aysegul SB56
Toriello, Alejandro WE24
Toriumi, Shigeki MA57, TD58
Törnquist Krasemann, Johanna TD32, WC61, WD61
Toso, Rodrigo SC60
TÖth, Sándor SD16, MA16, MB16, WB16
Towns, Natalie SA38
Toyasaki, Fuminori MC69
Tracy, William TC42
Trafalis, Theodore WD02, WD50
Trafton, Jodie SB34
Trail, Casey TC06
Tran, Tony TC08
Trani, Toni SD64, TC23
Transchel, Sandra SC02
Trapp, Andrew SC20
Traut, Elizabeth SC43
Trauth, Kathleen TD44
Treadway, Morris WA55
Trépanier, Martin SD51
Trevino Garza, Gerardo WC66
Triantis, Kostas MB66
Trichakis, Nikolaos SA29, MD17
Trick, Michael MC03
Trinkle, Brad TD62
Tripathi, Arvind TA45
Tripathi, Sanjay SD17
Trivedi, Kishor SC65, TC65
Troncoso, J. MD16
Trosset, Michael W. MD12
Troy, Phil TC13
Truong, Van-Anh TC31
Tsai, June TC61
Tsai, Ming-Hone MA59
Tse, Edison WC41
Tseng, Chung-Li WE19
Tseng, Sheng-Tsiang SA33
Tsetlin, Ilia TC17
Tseytlin, Yulia TD27
Tsitsiklis, John SB01
Tsoukalas, Angelos MD24
Tsoukalas, Gerry TB29, TC29
Tsuchiya, Fuminori IS-M
Tsuchiya, Takashi MC22
Tsui, Kwok-Leung MB35, MD53, TC53
Tsujimura, Motoh WC28
Tsung, Fugee SA33, MB37, MC23
Tsurkov, Vladimir IS-T
Tsyurmasto, Peter TB21
Tu, Wanzhu MA31, IS-M
Tu, Yicheng TB43
Tu, Yufeng SB55
Tucker, Amy SD41
Tucker, Anita MB40, TD26, WB56
Tucker, Eric IS-T
Tulabandhula, Theja MA53
Tulpule, Mandar TC49
Tunasar, Cenk MC55
Tunc, Huseyin WA03
Tunca, Tunay SB25, TB39
Tuncer Sakar, Ceren SA63
Tural, Mustafa TB24
Turan, Fikret Korhan SC43, TB62
Turcic, Danko SD30, MD27, TD25
Turcotte, David SA38, TA64
Turgut, Ozgu WA31, WA60
Turkay, Metin WE63
Turkcan, Ayten MD56, TC56
Turkiyyah, George SA47
Turner, John SA54, SD25, WC36
Turner, Jonathan TD66
Turner, Thomas TD58
Turnquist, Mark MC64
Tuszynski, Jaroslaw SD23
Tutum, Cem Celal TC48
Tuv, Eugene SA33, SC53
Tuzhilin, Alexander WB42
Tuzuner, Akiner SC43, TB62
Twomey, Janet MD35
Tyagi, Rajesh MA43, WB55
Tzabbar, Daniel SB52
Tzur, Michal SB51, TC25

U

Uckun, Canan SB09
Uday, Payuna TB23
Uddin, Ghulam TA33
Udenio, Maximiliano TD50
Uhan, Nelson TA18, TC46, WA67, WC22
Uichanco, Joline TA26
Ukai, Takamori TC38
Ukkusuri, Satish SA47, SD48, MC48, TA48, TA51, TC48, TD47, WC22, WC48
Ulku, Sezer MC01, WE69
Ullman, Jonathan TC45
Ulrich, Karl TB40
Ulu, Canan SC25, TD17
Uludag, Onur TC52
Ulusal, Elif MC60
Ulusoy, Gündüz TD18
Umpfenbach, Edward TC02
Underwood, Daniel MA31, IS-M
Unnikrishnan, Avinash TC48
Unver, Utku SB31
Upadhyaya, Belle TA37
Urban, Tim MB47
Urda, Julie TD50
Uristani, Angelo WE21
Uryasev, Stan MA02, TB21, TD10
Uster, Halit SD36, TD69, WD51
Ustun, Berk WC12
U-tapao, Chalida MB14
Uyar, Emrah TB09
Uzsoy, Reha SA05, MA42, MB63, IS-M, TB07, TC31, TD68, WB18

V

V.Natarajan, Karthik TA01
Vaaben, Bo TC57
Vahid, Saba TD68
Vahn, Gah-Yi WB12
Vaidyanathan, Bala MA60
Vairaktarakis, George SC18
Vakharia, Asoo MA69
Valdes, Gonzalo IS-T
Valencia, Juan MC44
Valenti, Benedetto MA31, IS-M
Valentine, Melissa SD40
Valenzuela, Fernando SC55
Valenzuela, Karla TB62, WE62
Vallecoccia, Michael SC54
Valocchi, Albert MB63
Van Alstyne, Marshall SC40, SD39
Van Bilsen, Matthieu TB65
van Dalen, Jan TC45
van den Berg, Gerald MB54
Van Den Briel, Menkes WD16
van der Heijden, Matthieu TA58
van der Meulen, Frank MD37
van der Wal, Jan MA31, IS-M
van Dijk, Nico M. MA31, IS-M
Van Dinter, Jennifer WC14
van Dinther, Clemens TA45
Van Donselaar, Karel SD27
van Dorp, Johan Rene WD33
Van Dyke, Carl MC32
van Heck, Eric TA45, TC45
Van Hentenryck, Pascal MB64, MC64, TA08
van Hoeve, Willem-Jan MC08, TB08
van Houtum, Geert-Jan TA25, TB27, WA67
Van Hove, John C. MC36
Van Huele, Christophe WA18
Van Mieghem, Jan SD25
Van Nieuwenhuyse, Inneke TD03, TD27
Van Oyen, Mark SC54, SD31, MA36, MD11, TA34, TA66, WD07, WE65
Van Peteghem, Vincent TD18
Van Roy, Benjamin SB22, SD06, WE09
Van Ryzin, Garrett MA01, TC09, WA26, WB09
Van Scotter, James SA64
van Vuuren, Marcel TB52
Van Vyve, Mathieu WA24
Van Wassenhove, Luk MD64, TA69, WA69, WB52
van Wijk, Sandra TD11
Van Woensel, Tom SC47, MB47, TC47, WB03
Vandaele, Nico SB55
Vande Vate, John WA12
Vander Wiel, Scott SD33
Vanhoucke, Mario TD18, WA18
Vanli, Arda MC33
Varakantham, Pradeep WE34
Vargas, Luis WA56
Varghese, Vijith Malayil MB56, WA47, WB56, WC56
Varshney, Kush SD59, MD59, MD66
Vaton, Sandrine WD63
Vats, Atul MA34
Vattum, Lars Magnus TA61
Vaze, Vikrant SB57
Veatch, Michael MC44, WC11
Veeraraghavan, Senthil SB25, SC28, MC25, MD28, TA27, TC27, WD27
Veksler, Michael MD66
Vela, Adan TD23
Velasco-Bermeo, Nestor TB63
Velázquez, Josue MD69, TB51
Veldhuizen, Patrick MA54
Veliz-Rojas, Karina WC43
Vempala, Santosh WC24
Vengazhiyil, Roshan Joseph MB33, IS-T
Venkataraman, Sriram MC66, TC40, TC56
Venkatesan, Rajkumar MB59
Venter, Gerhard WB21
Venter, Lieschen TB66
Ventura, José A. TC06, WA08
Vera, Jorge MD16
Vera, Juan TC20, TC60
Veral, Emre MA31, IS-M
Vercher, Enriqueta TB02
Veremyev, Alexander TD20
Vergara, Hector SD08, WD51
Verma, Amit SD47
Verma, Anurag SB36, SD20
Vermaat, Thijs MD37
Verter, Vedat WB69, WE31
Vespucci, Maria Teresa WE21
Vetscher, Rudolf WB63
Vial, Jean-Philippe SB24
Viana, Felipe A. C. WB21
Vidal Holguin, Carlos Julio WD01
Vidal, Elena SD52, WC41
Vidal, Thibaut SB47
Vidyanti, Irene SB17
Vieira, Manuel TA60
Vieira, Marco TD58
Vielma, Juan Pablo SA24, WB16, WC09
Viktorovna, Natalia MB63
Vila-Parrish, Anita TC59, WB03, WD03
Viljoen, Nadia SB64
Villalobos, J. Rene WC45, WC66
Villarreal, Monica MA34
Vinel, Alexander TC60
Vinokurova, Natalya SA52
Virine, Lev TC62
Viswanathan, Siva SB42, SC42, MC42, TC42
Vithayathil, Joseph TD39
Vlachou, Kleoniki SA57, MC57
Vogel, Patrick SA51
Vogelgesang, Stephanie SB27
Vogiatzis, Chrysafis WE23
Vojvodic, Goran IS-M
von Krogh, Georg MB40, TA40
von Winterfeldt, Detlof MB17, MD15
Vong, Jason IS-M
Vonortas, Nicholas WC39
Vorobeychik, Yevgeniy MD21
Voss, Stefan TB47
Vossen, Thomas WD16
Vouzis, Panagiotis IS-M
Vulcano, Gustavo SC13, TC09
Vuppala, Sunil WA62
Vyas, Anant SD43

W

Wachtel, Ruth MA34
Wadhwa, Rhythm Suren MB33, IS-T, WC33
Waeber, Rolf MB49
Waescher, Gerhard MD23
Wagman, Liad TC54
Wagner, Harvey SD05
Wagner, Michael R. WC60
Waisberg, Isaac SA52
Wakolbinger, Tina MC69
Wala, Jeremiah TC34
Walczak, Darius MD13, TB09
Wallace, Brett SD15
Wallace, Stein W. TA52
Wallace, William TB48, WB20
Wallenius, Hannele MA63
Wallenius, Jyrki MA63, TC63, TD63
Waller, Travis SC48, MA47, MD48, TC48, TC61, WC66
Wallwater, Aya TB49
Walteros, Jose SC51, TD20
Walton, Neil TA07
Walton, Tiwana MB33, IS-T
Waltz, Richard SD10
Wan, Difang WC10, WD67, WE67
Wan, Guohua TB18
Wan, Hong SC49, MA37, MB33, IS-T, WA68
Wan, Sean MA41
Wan, Xiang TA39
Wan, Zhixi MC30
Wang, Alan TC67
Wang, Baohua WB32
Wang, Ben MC33, TB33
Wang, Chaonan WA35
Wang, Chen SD47, MA17
Wang, Chia-Hung WE07
Wang, Chun MA29
Wang, Chung-Hsiao TB62
Wang, Chunye TD59
Wang, Danping TB50, WE02
Wang, Derek TA30
Wang, Dongmei SC60
Wang, Feng TD61
Wang, Fengyu SA14
Wang, Gang SC01, WD02
Wang, Gang (Gabriel) WB68, WC47
Wang, Gui SB14, TD21
Wang, Haifeng SC35, TC62, WE44
Wang, Hao MA50
Wang, Helen (Xianzhi) MB09
Wang, Hsueh Ming Stev WA40
Wang, Hui SA36, IS-M, TC37, WA25, WA37
Wang, Hui John WA25
Wang, I-Lin SA51
Wang, Jay TC50
Wang, Jia WB06
Wang, Jiamin MC38
Wang, Jian TD13
Wang, Jiang TC29
Wang, Jianhui SA22, SC14, SD22, MB21, TB14, TC14, WB14, WC62
Wang, Jianling WB46
Wang, Jihan MA31, IS-M
Wang, Jihua MB63
Wang, Jing TA67
Wang, Jingqi TD16, WA69
Wang, Jun SD59, MD66
Wang, Kaibo TD37
Wang, Kan TB33
Wang, Kan (Kevin) MC33
Wang, Lei WD39
Wang, Liang MD34
Wang, Lie MB22
Wang, Ling WC01
Wang, Lizhi SB43, SD43, IS-T, WA16
Wang, Marshal WE28
Wang, Min MB30
Wang, Ning TB48
Wang, Pingfeng MD35, WA54
Wang, Qianfan SC14, MB21
Wang, Rowan MD11
Wang, Ruxian SB28, TD09
Wang, Shouyi TB53
Wang, Sijia TB42
Wang, Sijian MA53
Wang, Wei WC66
Wang, Xi SB07

Wang, Xiaoqing WC66, WD68
Wang, Xin SC48, TD48
Wang, Xudong MB35
Wang, Yan TD35
Wang, Yi TB27
Wang, Yijie MB33, IS-T
Wang, Yilun TB04
Wang, Yimin MC30
Wang, Yiming SD20
Wang, Yingying WA30
Wang, Yitong MC15
Wang, Yulan WA44
Wang, Yunzeng SC56, MB26
Wang, Yuting MC04
Wang, Zhenbo TD60
Wang, Zhenming SA57
Wang, Zhi Jun MB59
Wang, Zhongxian WB56
Wang, Ziteng TD60
Wang, Zizhuo MA57, WB01, WD22
Wang, Zuozheng MD47
Wanko, Patrick MB33, IS-T
Ward, Amy SB29, SC03, MA07, MB05
Ward, Angela WE63
Ward, Julie SB28
Warfel, Joseph SD54
Warsing, Don WA30, WA66, WB03, WB18, WD03
Wasil, Edward SA04
Watanabe, Daisuke TD58
Watanabe, Ryohei WD62
Waters, Julie SB23, SC23, WC49
Watkins, James SA29
Watson, Jean-Paul SC04, SD22, MB04, MD03, WA20, WD16
Wattal, Sunil SB42, SC42
Watts, Bradley IS-T
Weatherwax, Melissa SC55
Weaver, Robert WA30
Weber, Bruce MC42
Weber, Charles MB40
Weber, Elke TD67
Weber, Holger SA18
Weber, Thomas TB54, WC31, WE09
Webster, Mort TD21, WB62, WC12, WD61
Webster, Scott SB30, SC02, WA28
Wechsung, Achim MA20
Wee, Kwan Eng SB30
Weerasena, Lakmali WC63
Wehenkel, Louis MB12
Wei, Bo TB07
Wei, Ermin WE34
Wei, Mike WD27
Wei, Peng WC48
Wei, Ran MA38
Wei, Yehua SA01
Weigelt, Carmen WB43
Wein, Lawrence SD31, MA23, TA31
Weintraub, Andres MD16, SC55, WB16, WD16
Weintraub, Benjamin TD33
Weintraub, Gabriel SB25, MA25, MC07, MD45
Weir, Jeffery WC62
Weissensteiner, Alex TB02
Wellman, Michael MD21
Wells, Lee J. MB33, IS-T, TD37
Wen, Zheng SB22
Wendell, Richard TA15
Werker, Greg WC31
Werner, Adrian TD14
Wernz, Christian WC34
Weston, Shellwyn SA52
Wets, Roger SC04, WD16
Whetsel, Sean MB33, IS-T
Whinston, Andrew TB02, WA42, WC65
Whitacre, Jay SB43
Whitaker, Jonathan MD42
Whitaker, Linda SD03
White, Leroy MD23
Whitefoot, Kate TC07
Whiting, Phil MB60
Whitney, Daniel SB41
Whitt, Ward SA11, SB07, MD02, WD11
Wiecek, Margaret WC63, WD63, WE63
Wierman, Adam MA49
Wiers, Vincent TA50
Wightman, Jennifer SA23
Wightman, Pedro SA36
Wikum, Erick TCu55
Wilck, Joseph TB63, WB38
Wild, Stefan TA04, TB04
Wiley, Mark MB10
Wilhelm, Wilbert TA16, TC56
Wilkinson, Robert G. MD37
Willcox, Karen WB15
Willemain, Thomas Reed WC49
Willems, Pieter MD37
Willett, Rebecca TB20
Williams, Brian SB35
Williams, Charles WC41
Williams, Darrell MD41
Williams, Wes WD31
Willis, Henry SB23
Willoughby, Keith MB34
Willsky, Alan MB22
Wilson, Alyson SD33
Wilson, David MB33, IS-T
Wilson, James R. WD01
Wilson, Jill WB06
Wilson, Kaycee WC15
Wilson, Paul MC66
Wimonkittiwat, Poomyos MA19, MB29
Winbush, Sylvester IS-T
Winkler, Anne SC03
Winters, Jeff MA55
Wittland, Michael SA08, WD41
Woeckl, Juergen SA56
Wogrin, Sonja SD14
Wolf, Christian SA21
Wolf, Jürgen SA45
Wolff, Ronald TB11
Wolfler, Roberto SB51
Wollega, Ebisa TC62, WC12
Wolman, Eric MA03
Wolsey, Laurence WB24
Wolter, Kati SA08, SD04
Wong, Angelica MD03
Wong, David Shan Hill SA33
Wong, Hannah SD54, WE31
Wong, Wing Shuet WC68
Wood, Kevin WC16, WD16
Wood, Sam MD10
Woodall, William H. SA33, MB33, MB37, IS-T, TD37
Woodruff, David SC04, MB04, MD03, WD16
Woodside Oriakhi, Maria SD02, MC20
Wooldridge, Abigail R. MA31, IS-M
Woolford, Douglas MC16
Wooten, Joel TB40
Word, Daniel MD03
Works, Paul MA58
Worley, Owen MA43
Worrall, Dave TB68
Wortman, Martin TC35
Wray, John MC39
Wright, Ronald TC46
Wu, Bairong SD35, MC37
Wu, Baiyi WC08
Wu, Bingqing TA16
Wu, Brian WC46
Wu, Chaojiang WD50
Wu, Chihwen TC65
Wu, D.J. SB25, SB39
Wu, Dexter MC02
Wu, Di SA48, SB48
Wu, Jeff MB33, IS-T
Wu, Jiahua MB13
Wu, Jianghua IS-T
Wu, Jingchen WA03
Wu, Li-Ping MC23
Wu, Lynn TB39
Wu, Mingchang WC65
Wu, Owen MC06, TA30, WA62
Wu, Qi TA30
Wu, Robert SD54, WE31
Wu, Shinyi SB17, WC34
Wu, Tao WC08
Wu, Teresa WC62, WD56
Wu, Tsung-Lin MB50
Wu, Wei MA34
Wu, Xiaole Sherri SB30, SC27
Wu, Xiaoqing SB51
Wu, Xing WC04
Wu, Xingwei MD29
Wu, Yaozhong MC50
Wu, Yichao MA50
Wu, Yijiang TC41
Wu, Yu SD11
Wu, Yue TA66, TB47, TD13
Wu, Zhengping TC03
Wuchty, Stefan SB12
Wunderling, Roland WD60
Wynter, Laura TD48, WB51
Wysk, Richard A. MD41

X

Xanthopoulos, Petros MB50
Xi, Hui MD49
Xia, Cathy MB08, TB11, TD11
Xia, Hui MC27
Xia, Mingjun MD47, TA38
Xia, Nan TA01
Xia, Shuangjun MA31, IS-M
Xia, Yusen IS-M, MC50, WD46
Xiang, Chester WB47
Xiang, Yisha SB37
Xiao, Guoxian TD69
Xiao, Hui WB06
Xiao, Jingjie SB43, SC14
Xiao, Wenli TC40, WB40
Xiao, Wenqiang MA30, WA27
Xiao, Y.B. SA05
Xiao, Yixuan MC30
Xiao, Zhiwei WA33
Xiaoqin, Zhao WE28
Xie, Chi MD48
Xie, Jing SB19, TA49, WB49
Xie, Min SD35, MA33
Xie, Ming SD55, WC44, WD67, WE44, WE52
Xie, Richard MB57
Xie, Ryan Shiguang MD17
Xie, Wei SB49
Xie, Weijun WA48
Xie, Xiaolei SD37
Xie, Xiaoqing TC02
Xin, Mingdi WB39
Xing, Dadi SC49, MA33
Xing, Dahai WD65
Xing, Liudong WA35
Xing, Songhua MC55
Xing, Tao TB48, WA48
Xing, Wenxun TD60
Xiong, Chuanhui SD34
Xiong, Jie WC19, WD44
Xiong, Yupei SA04
Xu, Dong SA53
Xu, Hongsheng WA20
Xu, Huayu SB51
Xu, Jianjun WC18
Xu, Jie TC44, WA07, WA15
Xu, Jiefeng WA38
Xu, Jingyang WB06
Xu, Jinpeng WA45
Xu, Jiuping TD39
Xu, Kefeng MA41
Xu, Kuang SB01
Xu, Lihong TA63
Xu, Lijuan SB33, MB35, WE33
Xu, Lizhen WA42
Xu, Nuo WA53
Xu, Pan IS-T
Xu, Shubin WA02, WD30
Xu, Susan SC36, WE26
Xu, X.L. SA05
Xu, Xiaowei MA26, MC28, WA68
Xu, Xingbo MA29
Xu, Xun MA31, IS-M
Xu, Yan SB08
Xu, Yang WD39
Xu, Yanyi WA13
Xu, Ye MA38
Xu, Yi SC25, SD26, MA41, WA27
Xu, Ying SC01
Xuan, Chen TA47
Xue, Liangjie WC45
Xue, Ling MA28
Xue, Yajiong SB55, IS-T
Xue, Zhengliang MC09

Y

Yadav, Om Prakash TA17
Yadav, Prashant SA27, SC64
Yaesoubi, Reza SA31, WB64
Yagi, Kyoko TD19
Yahav, Inbal SC29
Yahiaoui, Houssame SB51
Yalaoui, Farouk SC63, MD63, TC06
Yamamoto, Yoshitsugu MC19, MC38
Yaman, Hande SA24, MD45
Yamanaka, Hideki WC26
Yamashita, Hideaki TD52
Yamashita, Makoto TA20, TB20
Yan, Jianyuan MD59
Yan, Jing WB46
Yan, Lu SC39, MB42
Yan, Qiqi TB45
Yan, Shu MC02
Yan, Xinghao SB56, MB26
Yang, Dongning WA41
Yang, Feng SC49
Yang, Guangyuan WB68
Yang, Hai SA48
Yang, Hui SD50, MB33, IS-T, TC53, WB37
Yang, Jack WD54
Yang, Jian IS-M, MC28, TD67
Yang, Jing SA12
Yang, Jun MA30
Yang, Kai MA31, IS-M, MC56, TB37, TB56, WB56
Yang, Kai-Chuan TD30
Yang, Kum Khiong WC68
Yang, Liu TD28
Yang, Lixing MD51, WA48
Yang, Muer WB31, WB64
Yang, Nan MC30, TC30
Yang, Qingqing SA56
Yang, Qingyu SD35, TC35
Yang, Rui TA60
Yang, Ruina TB65
Yang, Sheng WA37
Yang, Song Alex TB30
Yang, Won Seok IS-M
Yang, Xiaopeng SD66
Yang, Xu MD69, WD07, WD68
Yang, Xuan TB49
Yang, Yan SD31
Yang, Zhibin TC18
Yano, Candace TB46, TC54, TD30
Yao, David D. MC09, TA07, TD11, WC18
Yao, Jing WE19
Yao, John MD28
Yao, Tao SA48, MA48, MB21, TA51
Yao, Weifeng MC19
Yao, Xiaodong TB09
Yao, Yiming MD60
Yap, Alexander SC65
Yarmand, Hamed MA31, IS-M, TC31
Yashchin, Emmanuel SB37, MA12, TA12, TC29
Yates, Justin WB23
Yavuz, Mesut TD06
Yayla-Kullu, Muge SA28, TD65, WB26
Yaylali, Emine TC31, WE34
Yazdani Sabouni, Mohammad WB28
Yazici, Hulya IS-T
Ye, Fan TD12
Ye, Hengqing TA07
Ye, Qing MC30
Ye, Shengqi MD09
Ye, Shun SB42
Ye, Yinye WD22
Ye, Yinyu MA57, WB01, WC08
Ye, Zhisheng SD35, MA33
Yeh, Arthur TC33
Yenipazarli, Arda MA69
Yeniyurt, Sengun IS-M, WD59
Yeo, Lisa WD42
Yesha, Yelena SC65
Yetis Kara, Bahar MB44
Yeung, Thomas SA37, WD12
Yezerska, Oleksandra SA60
Yi, Ji Soo TC46
Yih, Yuehwern IS-M
Yildirim, Gonca WE68
Yildirim, Utku TB09
Yildiz, Enes MC36
Yildiz, Gazi Bilal SC63, IS-M
Yildiz, Hakan TC44, WD15
Yilmaz, Levent WC67
Yilmaz, Ozhan WA66
Yim, Dobin MC42, TC42
Yin, Rui WA26
Yin, Shuya TA01
Yin, Wenjun SC35, SD55, MC59, TC62, WC44, WD67, WE44, WE52
Yin, Yafeng SA48, SB48, MC51
Yin, Yan MB45
Yoda, Kunikazu SD21
Yom-Tov, Galit TD27
Yoo, Jung-Woon MA31, IS-M
Yoo, Onesun Steve SD27, MA40
Yoon, Eunsang WC46
You, Xiaolan WA68
Young, Ray TA57
Young, Robert E. MA46
Yousefi, Arash MB57
Yousefi, Seyed Reza WC65
Yousefian, Farzad MA21, WD49
Youssef, Nataly SA60, TA24
Yu, Andrew TC06, WB18, WE30
Yu, Dennis Z WB47
Yu, Huan WA37
Yu, Min MC69
Yu, Mingzhu TC47
Yu, Qiuping WB25
Yu, Sheng WD19
Yu, Xiao WD39
Yu, Yan TB19, WD50
Yu, Yu WD57
Yu, Yugang TD52, WB52
Yu, Zhou SD53
Yuan, Fan WA36
Yuan, Jiangchuan WB29
Yuan, Jiguang WE22
Yuan, Jun SD49
Yuan, Lei MB59
Yuan, Meng Meng TB18
Yuan, Ming MA29
Yuan, Quan WD68
Yuan, Rong SC34
Yuan, Tao MB35, TA37, TC37
Yuan, Wei TB43, WD08
Yucel, Eda SA34
Yue, Xiaohang TD02
Yue, Yisong MA64
Yuen, Gigi MC55
Yuen, Ivan TB36
Yuen, Ming TC25
Yugma, Claude SA18
Yund, Walter WA59
Yunes, Tallys MD08, TB08
Yung, Daniel SC55
Yurtsever, Tanju IS-T
Yushimito, Wilfredo SB48
Yusufzyanova, Dilya SC48

Z

Zabarankin, Michael WC21
Zabinsky, Zelda SC20
Zacharias, Christos MD18
Zaerpour, Nima TD52
Zafari, Babak WC17
Zaitchik, Ben WC50
Zak, Eugene IS-M
Zakeri, Golbon IS-M, TB35
Zaklouta, Hadi WD66
Zalunardo, Nadia TD36
Zaman, Tauhid SB11
Zan, Bin WB51
Zan, Kun MB15
Zangui, Mahmood SA48
Zappa, Dan MC39
Zargoush, Manaf WD56
Zaric, Greg MA31, IS-M, TB31
Zarifoglu, Emrah MA08
Zavala, Victor M. SB14, WA43, WD21
Zayas-Castro, José L. MB56, WA56, WB37
Zdybel, Rose WC69
Zechman, Emily MB63, MC63, MD04
Zeeshan Iqbal, Muhammad TD32
Zeevi, Assaf SB07, SC13, SC28, MD28, TD09, WE09
Zeid, Abe TA33
Zellmer-Bruhn, Mary MA52
Zeng, Amy TB44
Zeng, Bo SA22, SB08, MB38, MC31, TB43, TD06, TD36, WA38, WA56, WC04, WD08, WD44, WD52
Zeng, David MD42, TA42
Zeng, Li SD37
Zeng, Sai MB59, MC59
Zeng, Xin SC56
Zeng, Zhi IS-M
Zenios, Stefanos SA31, MA31, MA36, IS-M, MD17, TB05, IS-T, WD64
Zenteno, Ana Cecilia WB64
Zepeda, David MD01
Zerehsaz, Yaser TC33
Zerom, Dawit TD62
Zhan, Dongyuan MA07
Zhan, Shanchi SD17
Zhang, Alex TB66
Zhang, Bin SD55, MB42, WC44, WE52
Zhang, Bo SD59, MB21, TA51, WD54
Zhang, Chen MB47
Zhang, Chi SD35
Zhang, Chuck MC33, TB33
Zhang, Dali MB49
Zhang, Dan SD26, MB26, MD09, TA37, TD13, WE31
Zhang, Dawei MA39
Zhang, Deanne MC10, TD08
Zhang, Di TB61
Zhang, Fan WB56
Zhang, Fuqiang SC01, SC27, MA28, MD27, TD25, WD27
Zhang, George SA07
Zhang, Guoqing SA56, TB20, WA47, WB47
Zhang, Hanqin MD11
Zhang, Hao MA25, WB25
Zhang, Hao Howard SC31, WC20
Zhang, He SC22
Zhang, Hongchao TA22
Zhang, Hongzhong TA19
Zhang, James MA39, TB39
Zhang, Jingjing WB42
Zhang, Jingying IS-T
Zhang, Jingyu MC12
Zhang, Juheng TB67, WA53
Zhang, Jun SA25, SA28, SB44, SC35, TC39, TC62, TC68, WB65
Zhang, Kuilin MD48
Zhang, Lei SB48, SC48, WB48
Zhang, Li WA19, WC53
Zhang, Liqing WE08
Zhang, Meng SC35, TC62, WC12
Zhang, Minjiao SA24
Zhang, Muhong SA14, MB21, MC14, MC21, TA35, TD35, WA54, WD56
Zhang, Nailong SD35
Zhang, Pengbo SC20
Zhang, Qiong MB35
Zhang, Rachel MB13
Zhang, Rui TC18
Zhang, Shengfan MD36
Zhang, Shenghao TB27
Zhang, Shu MA13
Zhang, Shuping TA56
Zhang, Si TD49
Zhang, Sunny WD54
Zhang, Ti MD48, TC61, WB47
Zhang, Weidong WA37
Zhang, Weini WA16
Zhang, Xi TC37
Zhang, Xiaowei TB07
Zhang, Xiaoxuan MA11
Zhang, Xili MC02
Zhang, Yahui WE67
Zhang, Yan WD26
Zhang, Yi WC39
Zhang, Yimin SA57
Zhang, Ying SB56
Zhang, Yinghao WB50
Zhang, Yu MB32, MB38, WD52
Zhang, Yuan MA31, IS-M, TB31
Zhang, Yuanhui MD36
Zhang, Zhongju SA39
Zhang, Zongming WC26

Zhanhe, Du WC26
Zhao, Cherry SD22
Zhao, Fei WC62
Zhao, Fu TA18
Zhao, Fuqiong WA37
Zhao, Hairong SB18, SC18
Zhao, Honghao MB35
Zhao, Huan MD49, WE14
Zhao, Hui SD34, MB26
Zhao, Huimin TC67
Zhao, J.Leon IS-T
Zhao, Jinye TC43
Zhao, Kexin SA39
Zhao, Lei MB47
Zhao, Li MD25, WB13
Zhao, Lili WE52
Zhao, Long SB08, TB43, WC04, WD44, WD52
Zhao, Ming SD22, TB43
Zhao, Qianchuan TD49
Zhao, Su TD13
Zhao, Tianzhi MC59, TA59, WC04, WE44
Zhao, Vivian MA44
Zhao, Wenhui MB30
Zhao, Xia MA28
Zhao, Xin TA56, WB46
Zhao, Xinna SA66, WA32
Zhao, Xiping TA56, WB46
Zhao, Xuying WB26
Zhao, Yao MA26, TC03
Zhao, Yifei TA52
Zhao, Yonggan MB19, MD02, WE21
Zhao, Yueqiong TA61
Zhdanov, Dmitry SB55, WD42
Zheng, Hanxiong SB39
Zheng, Hong MB48, MD51, TB51
Zheng, Hua SC07
Zheng, Huan TD30
Zheng, Jie TA62
Zheng, Qipeng (Phil) MD43, TC14
Zheng, Shaohui WC18
Zheng, Tongxin SB14, TC43
Zheng, Yanchong Karen MC50, WC25, WE69
Zheng, Yiming SA39
Zheng, Yousi MB08
Zheng, Zhiqiang TB42, TC39, TD42
Zhong, Haowen SB06, MA19, TB29
Zhong, Vivian SB25
Zhong, Weiya TC18
Zhong, Yuan TA07
Zhou, Enlu TD12, WD49
Zhou, Feng MB18
Zhou, Hao IS-T
Zhou, Hua MA50
Zhou, Jianer TB30, TD03
Zhou, Jing WA02
Zhou, Junyi SB33
Zhou, Ke WB10
Zhou, Mi TA56, WB46
Zhou, Ming TC39
Zhou, Qiang SB33
Zhou, Rensheng SC37, MB33, IS-T
Zhou, Ruoyi SB65
Zhou, Sean SD01, TB27, TD01
Zhou, Shiyu SB33, SD37, WA33
Zhou, Shu WA65
Zhou, Xuesong MD48, MD51, TA48, TD32, WA48
Zhou, Yan SD53
Zhou, Yangfang SC30, WC14
Zhou, Yilu WC39
Zhou, Yin TB50, WE02
Zhou, Yong-Pin TC27, WC27
Zhou, Yuan MA31, IS-M
Zhou, Yun WD68
Zhou, Zhi WB14, WC62
Zhu, Adam (Wanshan) MA30, TC03
Zhu, Huaiyu MA49
Zhu, Joe SC66
Zhu, Kangyuan TB12, WB20
Zhu, Li SA36
Zhu, Liping SD53
Zhu, Mengxiao WB46
Zhu, Shanjiang SB48, SC48, WB48
Zhu, Shiping SA56
Zhu, Tao WA60
Zhu, Valerie C.Y. MC65, WE67
Zhu, Yada SB37, MC55, WC45
Zhu, Yong MB35
Zhu, Yu SC49, MB33, IS-T
Zhu, Yuntao SC22, TA20, TD20
Zhu, Yunxia TA69
Zhu, Zhen SB31, SC20, MB50
Zhuang, Gui-jun TB50, WE02
Zhuang, Jun SA64, MB23, MD15, IS-T, TC44, TC64, TD15, WA15
Zhuang, Li MC55
Zhuang, Xiaotian TA35, TD35
Zia, Leila SB34
Ziegler, Georg MA45
Ziemba, William T. WE21
Ziengs, Nick TA50
Zigrino, Stefano WE21
Zimmerman, Ray SB14
Zimmermann, Steffen SC40
Zinchenko, Yuriy MC22
Zionts, Stanley TC63
Ziya, Serhan SB29, TA36, WB11
Zobel, Christopher TC15
Zolfagharinia, Hossein WC66
Zorn, Keith MA20, TC20
Zou, Bo SB57
Zou, Changliang MB37
Zou, Fei TA48
Zouch, Mariem WD12
Zuidwijk, Rob MD69, TC47
Zule, William TD31
Zuluaga, Luis F. SA02, TC60
Zverovich, Victor TB02
Zwart, Bert SD59, MA07
Zwick, Uri SD04
Zygalakis, Konstantinos WC32

Session Index

Sunday, 8:00am - 9:30am

SA01 Nicholson Student Paper Prize I
SA02 Risk Management in Portfolio Optimization
SA03 Computer Science / OR Interface
SA04 Vehicle Routing
SA05 Topics in Supply Chain and Production
SA06 Credit Risk
SA07 Information Sharing in Service Systems
SA08 MIPLIB 2010 - Selection, Evaluation, and Parallelization
SA09 Retail Pricing
SA10 Software Demonstrations
SA11 Large-scale Service Systems
SA12 Visualization in Bioinformatics and Computational Biology
SA13 Cargo Revenue and Pricing Management
SA14 Benefits of Modeling Power System Flexibility
SA15 Panel Discussion: The ROI of DA-DQ -Convincing Evidence of the Benefit of Decision Analysis
SA16 RAS Student Paper Research Contest
SA17 Group Decision Making
SA18 Scheduling in Semiconductor Manufacturing
SA20 Nonconvex Optimization: Theory and Algorithms
SA21 Connections Between Stochastic Programming, Dynamic Programming and Benders Decomposition
SA22 Applications of Stochastic Programming in Energy Systems
SA23 Joint Session Homeland/MAS/Law: Advances in Risk Analysis at the Local, State and Federal Level I
SA24 Advances in Integer Programming
SA25 Emerging Topics in Healthcare Operations and Supply Chain Management
SA26 Incentives Issues in Operations Management
SA27 Global Health Commodity Supply Chains
SA28 Consumer Driven Service OM Models
SA29 Healthcare Operations
SA30 Operations-Corporate Finance Interface
SA31 Game-Theoretic Healthcare Applications I
SA32 National Security Research
SA33 Journal of Quality Technology Invited Session
SA34 Logistics Applications in Health Care
SA35 Joint Session QSR/DAS: Panel Discussion: Research Trends in Homeland Security
SA36 Telecommunications
SA37 Maintenance Optimization
SA38 Joint Session LA/SPPSN: Community-Based Operations Research
SA39 Online Community and Social Network
SA40 Innovation and Entrepreneurship I: Financing
SA41 Collaboration in Innovation and Product Development Processes
SA42 Digital Channel and IT Usage
SA43 Real Options in the Energy Sector
SA44 Design and Analysis of Supply Chains Under Risk of Disruption
SA45 Combinatorial Auction Design and Applications I
SA47 Freight Transportation and Logistics
SA48 Innovations in Pricing and Financing of Transportation Systems: I
SA49 Agent-based Modeling and Simulation – Overview and Tutorial
SA50 Multivariate Methods in Data Mining
SA51 Shared Mobility Systems I
SA52 Organizational Learning: A Walk on the Dark Side
SA53 Data-Integrated Simulation Modeling
SA54 The George B. Dantzig Dissertation Prize
SA55 Adoption of Analytics and OR Methods
SA56 Cooperation and Coordination in Supply Chains
SA57 Air Terminal Area Data Uncertainty
SA58 Military Vehicle Routing Problems - Information Gathering
SA59 Health Services
SA60 Clique Relaxations in Networks
SA63 MCDM for Sorting Methods
SA64 Joint Session SPPSN/HAS: Organizational Decision Making in Disaster Relief and Recovery Operations
SA65 Services Innovation
SA66 Applications of Data Envelopment Analysis

Sunday, 11:00am - 12:30pm

SB01 Nicholson Student Paper Prize II
SB02 Supply Chain Risk Management
SB03 Optimization Software
SB04 Computing Equilibria in Large Games
SB05 Value-Focused Thinking
SB06 Financial Engineering
SB07 Analysis of Many-Server Queues
SB08 New Models and Computing Methods for Discrete Optimization
SB09 Topics in Revenue Management
SB10 Software Demonstrations
SB11 Graphs and Algorithms for the Web and Other Social Networks
SB12 Biological Networks
SB13 Dynamic Markets
SB14 New Trends in Electricity Markets
SB15 Behavioral / Descriptive Decision Models I
SB16 The Problem Solving Competition
SB17 Decision Analysis Applications in Public Health
SB18 Contemporary Scheduling
SB19 JFIG Paper Competition I
SB20 Joint Session OPT/ENRE: Global Optimization in Energy
SB21 Risk, Robustness and Chance Constraints in Stochastic Programming with Applications to Finance
SB22 Efficient Learning In Stochastic Optimization
SB23 Joint Session Homeland/MAS/Law: Advances in Risk Analysis at the Local, State and Federal Level II
SB24 Optimization Society Prizes
SB25 Empirical Work in Auctions and Pricing
SB26 Sustainability and Supply Chain Management
SB27 Product Disposition Decisions in Closed-Loop Supply Chains
SB28 Design of Service Contract: Insurance, Warranty and Return Policy
SB29 Healthcare Operations Management
SB30 Yield and Procurement Risk Management in Commodity Markets
SB31 Game-Theoretic Applications in Healthcare II
SB32 Forecasting and Learning in Retail
SB33 Nanomanufacturing and Nanoinformatics I
SB34 Data-driven Modeling in Health Care Delivery
SB35 Computer Experiments
SB36 Performance Evaluation of Wireless Sensor and Ad-Hoc Networks
SB37 Degradation Modeling and On-condition Maintenance
SB38 Locational Decisions
SB39 Economics of Information Systems
SB40 Innovation and Entrepreneurship II: Entrepreneurial Process
SB41 How Architectures Matter: Their Roles in Products, Processes, and Organizations
SB42 Social Networks and Crowdfunding
SB43 Potential Impact of Plug-in Electric Vehicles
SB44 Supply Diversification with Strategic Suppliers
SB45 Core-Selecting Auctions
SB46 Case Competition I
SB47 Rich Vehicle Routing Problems
SB48 Innovations in Pricing and Financing of Transportation Systems: II
SB49 Accounting for Input Model Uncertainty in Stochastic Simulations
SB50 Statistical Modeling for Adaptive Dynamic Programming
SB51 Shared Mobility Systems II

SB52 Mobility in and Between Organizations
SB53 INFORMS Data Mining Contest Results
SB54 INFORMS Data Mining Best Student Paper Competition
SB55 Decision Support Systems
SB56 Contracts in Supply Chain
SB57 Impact of Competition and Collaboration on Air Traffic Management
SB58 Military Vehicle Routing Problems — UAV Control
SB63 Goal Programming: Theory and Application
SB64 Health Delivery Infrastructure in Africa
SB65 Complex Services Modeling
SB66 DEA I

Sunday, 1:30pm - 3:00pm

SC01 Game-Theoretic Models in Global Supply Chains
SC02 Price Mechanisms in Risk Mitigation
SC03 Best of WORMS 2010
SC04 COOPR - A Common Optimization Python Repository
SC05 Queues in Service Systems: Customer Abandonment and Diffusion Approximations
SC06 History of Operations Research
SC07 Stochastic Models of Market Microstructure
SC08 Network Design and Interdiction
SC09 Choice Modeling in Revenue Management
SC10 Software Demonstrations
SC11 Analysis of Spatially Distributed Networks
SC12 Modeling Biological Systems
SC13 New Topics in Revenue Management
SC14 Optimization in Smart Grid
SC15 Portfolio Decision Analysis I
SC16 Panel Discussion: Analytics Applications in Railroads I
SC17 New Developments in Benefit-risk Evaluation of Medicinal Products
SC18 Scheduling Models and Applications
SC19 JFIG Paper Competition II
SC20 Recent Advances in Global Optimization
SC21 Stochastic Programming I
SC22 Stochastic Conic Programming: Applications and Algorithms
SC23 Joint Session Homeland/MAS/Law: Advances in Risk Analysis at the Local, State and Federal Level III
SC24 Advances in Mixed Integer Programming - I
SC25 Retail Operations and Assortment Planning
SC26 Inventory and Pricing Models
SC27 Incentive Issues in Supply Chain Management
SC28 Managing Service Systems
SC29 Machine Learning in Health Care
SC30 Real Option Management of Commodity and Energy Operations
SC31 Recent Advances in Radiation Treatment Planning Optimization
SC32 Large-Scale Data Manipulation for Scenario-Building and Optimization Applications
SC34 Emerging Topics in Public Health
SC35 Modeling and Prediction for Service and Energy Market
SC36 Telecommunication Network Optimization
SC37 Condition Monitoring and Prognostics I
SC38 Continuous Location Models and Applications
SC39 Health IT
SC40 Innovation in Platform Systems
SC41 How Organization and Network Structure Impact Innovation
SC42 Online Markets: Participation and Performance
SC43 Planning and Decision Making for Electric Vehicles
SC44 Asymmetric Effects in Supply Chain Disruption
SC45 Spectrum Auctions
SC46 Case Competition II
SC47 Vehicle Routing: Real-life Applications
SC48 Advances in Traffic Equilibrium
SC49 Joint Session I-Sim/QSR: Design of Experiments and Statistical Analysis for Simulation
SC50 Data Mining for Business
SC51 Transit Systems
SC52 Internal Boundaries of the Firm
SC53 Supervised Learning for System Analysis
SC54 Joint Session Doing Good/SPPSN: Doing Good with Good OR Competition: Finalist Presentations I
SC55 Joint Session CPMS/Analytics: Edelman Reprise #1
SC56 Newsvendor in Supply Chain
SC57 AAS Dissertation Prize Finalists and AGIFORS Anna Valicek Finalists
SC58 Military Vehicle Routing Problems - Risk & Uncertainty
SC59 Service Productivity
SC60 Network Design
SC63 MCDM Algorithms and Applications
SC64 Pharmaceutical Procurement and Distribution in Africa
SC65 Cloud Computing Service
SC66 Simulation and Other Models in Data Envelopment Analysis

Sunday, 4:30pm - 6:00pm

SD01 Leadtime Management in Inventory Systems
SD02 Optimization in Finance I
SD03 Panel Discussion: Can We Do Anything About Women Dropping Out of Academia?
SD04 Topics in Linear and Integer Programming
SD05 One-off Modeling with Excel
SD06 Reinforcement Learning
SD07 Queueing Network Asymptotics
SD08 Decomposition Algorithms
SD09 Economic Models in Operations
SD10 Software Demonstrations
SD11 Decentralized Decision Making and Multi-agent Systems
SD12 Panel Discussion: Computational Biology and Bioinformatics
SD13 Model Selection from General Classes
SD14 Modeling Strategic Behavior in the Energy Sector I
SD15 Adaptive Adversary Decision Analysis
SD16 Forestry: Multiobjective Modeling
SD17 Decision Analysis Practice Awards Finalists
SD18 Scheduling Models and Algorithms
SD19 Tutorials in Financial Services
SD20 Global Optimization in Networks
SD21 Stochastic Programming II
SD22 Joint Session Optimization/ ENRE: Stochastic Programming and Wind Energy
SD23 Joint Session Homeland/SPPSN/MAS: Sensors in Homeland Security
SD24 Network Games
SD25 Operations and Marketing
SD26 Operations Management and Marketing
SD27 Supply Chain Management - Models and Applications
SD28 Pricing for Service Operations
SD29 Healthcare Delivery Within and Outside Hospital Environments: Operational Improvements and Patient Outcomes
SD30 Interface of Operations, Finance, and Risk Management
SD31 Joint Session HAS/SPPSN: Disease Monitoring and Medical Decision Making
SD32 Panel Discussion: Analytics Applications in Railroads II
SD33 Technometrics
SD34 Strategies for Incentive Alignment in Healthcare
SD35 Systems Reliability and Maintenance
SD36 Discrete Optimization with Telecom Applications
SD37 Quality Modeling and Monitoring in Service Industries
SD38 New Directions in Location Analysis
SD39 Platform-based Markets, Innovation, and Ecosystems
SD40 Determinants of Project Team Performance
SD41 Innovation Strategy
SD42 Social Media and Information Diffusion
SD43 Energy Systems and Environmental Policy Modeling

SD44 JFIG Panel: Challenges in Graduate Student Management
SD45 Panel Discussion: Research Challenges in Market Design
SD46 Panel Discussion: Business Analytics in the University Curriculum
SD47 Routing with Uncertainty: Challenges in Practice
SD48 Advances in Dynamic Network Modeling
SD49 Simulation Optimization and Sensitivity Analysis
SD50 Dynamical Systems Modeling and Data Mining for Healthcare Applications
SD51 Operations for Shared Mobility Systems
SD52 External Boundaries of the Firm
SD53 Statistical Machine Learning
SD54 Doing Good with Good OR Competition: Finalist Presentations II
SD55 Joint Session CPMS/Analytics: Edelman Reprise #2
SD56 Inventory in Supply Chain
SD57 Joint Session AAS/RMPS: Keynote Talk
SD59 Quantitative Methods in Service
SD60 Topics in Networks
SD63 MCDM and Data Mining
SD64 Joint SPPSN/LAW/CPMS:Threats to Life and Limb
SD65 E-service
SD66 DEA II

Monday, 8:00am - 9:30am

MA01 Impact of Unauthorized Markets on Supply Chains
MA02 Risk Management Approaches in Finance
MA03 Panel Discussion: Leaders Offer Professional Advice to Women and Men
MA04 Future Directions for INFORMS Online (IOL) and Other IT Initiatives
MA05 Joint Session Tutorial/BOM: Laboratory Experiments in Operations Management
MA06 Non Parametric Data-Driven Policies for Stochastic Inventory Models
MA07 Approximation Methods in Queueing Systems
MA08 Cloud Computing - Research/Application Opportunities
MA09 Emerging Topics in Revenue Management
MA10 Software Demonstrations
MA11 Queueing Control
MA12 Reinforcement Learning
MA13 Pricing and Revenue Management: Data-Driven Research
MA14 Modeling Strategic Behavior in the Energy Sector II
MA15 Behavioral / Descriptive Decision Models II
MA16 Forest Management Models
MA17 Expert Elicitations: Theory
MA18 Supply Chain Scheduling with Industry Applications
MA19 INFORMS-FSS Student Research Paper Competition
MA20 Novel Relaxations and Approximations for Global Optimization
MA21 Stochastic Approximation for Stochastic Variational Problems
MA22 Stochastic Programming Algorithms and Applications
MA23 OR Applications in Emergency Planning and Management
MA24 Cutting Planes in Mixed-Integer Programming
MA25 Dynamic Models in Sourcing and Procurement
MA26 Supply Chain Marketing Interface
MA27 Project Management and Scheduling
MA28 Service Operations and Outsourcing Management
MA29 Stochastic Portfolio Selection
MA30 Joint Operational and Financial Decisions of Firms
MA31 HAS Poster Session
MA32 Railway Safety and Capacity Research
MA33 2011 QSR Best Student Paper Competition
MA34 Hospital Operations
MA35 Condition Monitoring and Prognostics II
MA36 Emergency Department and Healthcare Operations Management
MA37 Optimization Methods in Quality, Statistics and Reliability
MA38 Facility Location under Uncertainty I
MA39 Internet and Information Goods
MA40 Innovation and Entrepreneurship III: Growth
MA41 Incentives in Innovation and Product Design
MA42 An Interactive Panel/Audience Discussion: Grant Writing for New Faculty
MA43 Electric Vehicles and the Grid: Management of Electricity Consumption
MA44 Undergraduate I
MA45 Combinatorial Auction Design and Applications II
MA46 Panel Discussion: Project MINDSET: High School OR and Outreach
MA47 Urban Logistics
MA48 Modeling and Solving Dynamic Traffic Networks in Continuous Time
MA49 Smarter Energy Management
MA50 High Dimensional Statistical Inference
MA51 Public Transit: Operations and Design
MA52 Team Composition and Performance
MA53 Machine Learning, Games, and Data-Driven Decisions
MA54 2011 INFORMS Prize- Sasol
MA55 Joint Session Analytics/CPMS: IT and Analytics: Hunting as a Pack
MA56 Modeling Disease
MA57 Passenger Effects in the Airline Industry
MA58 DIME/PMESII Human Social Cultural Behavior I
MA59 IT Service Industry
MA60 Advances in Network Optimization Methods
MA63 Applications of Multiple Criteria Decision Making
MA64 New Directions for Emergency Medical Services
MA65 Applications of Operations Research in the Social Services
MA69 Issues in Sustainable Operations Management

Monday, 11:00am - 12:30pm

MB01 Empirical Research on Service Quality and Performance
MB02 Optimization in Finance II
MB03 Panel Discussion: COIN-OR Technology Forum
MB04 Alternating Direction, Progressive Hedging, and Splitting Methods
MB05 On the Analysis of Queueing Systems with Abandonments
MB06 Forecast Information Sharing: The Role of Contracts Behavior and Timing
MB07 Markov Lecture
MB08 Quality of Service in Cloud Computing
MB09 Innovations in Pricing and Revenue Management Application
MB10 Software Demonstrations
MB11 Algorithmic and Probabilistic Aspects of Inference,Graphical Models and Optimization
MB12 Joint Session Optimization/ICS: Advances in Stochastic Programming
MB13 Group Buying, Pricing and Competititon
MB14 Energy Market Modeling
MB15 Portfolio Decision Analysis II
MB16 Forest Modeling, Climate Change and Ecosystem Services
MB17 Value of Information and Multiattribute Utility
MB18 Scheduling and Project Management
MB19 Financial Risk Management
MB20 Joint Session OPT Global/Integer: Nonlinear 0-1 Programming: Algorithms and Applications
MB21 Applications and Algorithms for Stochastic Optimization
MB22 Statistical Perspectives of Nonlinear Programming
MB23 Joint Session Homeland/MAS: New Models in Homeland Security and Counter-terrorism
MB24 Integer Programming
MB25 Vaccine Supply Chains: Economics, Operations, Epidemiology
MB26 Competition and Cooperation in Supply Chains
MB27 Logistics Management and Planning - Models and Algorithms

MB28 Behavioral and Empirical Models in Operations and Revenue Management
MB29 Quantitative Portfolio Optimization
MB30 Operations and Finance Interfaces
MB31 Nurse Scheduling Problems
MB32 Recent Advances in Transportation
MB33 QSR Poster Session
MB34 Operations Research Modeling and Analysis in Healthcare
MB35 Nanomanufacturing and Nanoinformatics II
MB36 Computational Intelligence Applications
MB37 New Directions in Statistical Process Control Research
MB38 Facility Location under Uncertainty II
MB39 Panel Discussion: Becoming an O.R./Analytics Newsmaker
MB40 Knowledge Learning and Intellectual Capital (KLIC)
MB41 Innovation and the Global Economy
MB42 The Dynamics of Online Social Network
MB43 Joint Session Opt/ENRE: Operations and Planning Problems in Energy Markets: MPEC/EPEC Approaches
MB44 Undergraduate II
MB45 Procurement Auctions and Combinatorial Exchanges
MB46 Joint Session INFORM-ED/ Analytics: Panel Discussion: Role of OR/MS in Undergraduate Business Education Today
MB47 Topics in Vehicle Routing
MB48 Advances in Traffic Networks
MB49 Joint Session I-Sim/APS: Simulation Optimization
MB50 Optimization Models in Data Mining with Applications
MB52 SpORts (Sports Analytics) I
MB54 Daniel H. Wagner Prize for Excellence in Operations Research
MB55 Joint Session Analytics/CPMS: Analytics in the Petrochemical Industry
MB56 Health Care, Modeling and Optimization
MB57 Airspace Design Optimization and Analysis
MB58 DIME/PMESII Human Social Cultural Behavior II
MB59 Customer Value
MB60 Adaptive Algorithms for Pricing of Mobile Data Services
MB63 Evolutionary Multi-Objective Optimization 1
MB64 Humanitarian Logistics and Disaster Relief I
MB65 Product-Service System
MB66 Efficiency and Performance Analysis: Current Issues and Future Research Opportunities
MB69 Emerging Topics in Sustainability

Monday, 12:30pm – 2:30pm
Interactive Session

Monday, 1:30pm - 3:00pm

MC01 Retail Operations and Supply Chain Design
MC02 Optimization in Finance III
MC03 Tutorial/Panel: Bringing O.R. into the 21st Century with Social Networking and Web 2.0 Tools
MC04 Joint Session ICS/OPT: Multi-Start Methods for Global Optimization
MC05 Simple Heuristics for Optimal Inventory Policies in Supply Chains
MC06 Applying Production and Inventory Management Theory to Sustainable Energy Systems
MC07 Large Scale Dynamic Stochastic Games
MC08 Hybrid Methods I: Graph-based Propagation
MC09 Revenue and Demand Management
MC10 Software Demonstrations
MC11 Queueing and Stochastic Inventory
MC12 Approximate Dynamic Programming in Health
MC13 Interface Between Inventory Management and Finance
MC14 Transmission Systems and Network Configurations for Supporting Renewable Integration
MC15 Multiattribute Bids, Uncertainty Effect, Regime Detection and Risk Perception over Time
MC16 Forestry: Forest Fire Applications
MC17 Values and Trade-offs, When Deciding Gets Hard
MC18 Current Issues in Project Management
MC19 Methods and Applications in Financial Engineering
MC20 Heuristics for Global Optimization and Applications
MC21 Robust Optimization and Its Applications
MC22 Paths, Path Curvature and Interior-point Methods
MC23 Joint Session IAC/QSR: Asian Journal of Industrial Engineering (AJIE)
MC24 Exact Solvers for Mixed Integer Nonlinear Optimization
MC25 Incentives and Games
MC26 Empirical Healthcare Operations
MC27 Emissions, Operations, and Cap-and-Trade Regulation
MC28 Dynamic Pricing/Inventory Control
MC29 Analysis of High Frequency Trading
MC30 Risk Management in Sourcing Models
MC31 Joint Session HAS/DM: Data Mining and Decision Analysis in Health Care
MC32 Modeling Opportunities in Improving Pickup/Delivery Freight Operation
MC33 Nanomanufacturing and Nanoinformatics III: Modeling, Monitoring, and Control
MC34 Scheduling, Access and Throughput in Large Academic Hospitals
MC35 Computer Experiments at National Labs
MC36 Network Reliability and Survivability
MC37 Multiple Component System Reliability Modeling and Optimization
MC38 Location Models II
MC39 Spreadsheets in Analytical Work
MC40 Joint Session TMS/NPD: Meet the Editors
MC41 Coordinating Decentralized Innovation Processes
MC42 Information Systems and Economics
MC43 Sustainable Energy Planning
MC44 Undergraduate III
MC45 Algorithmic Game Theory
MC46 In Memoriam: Paul Jensen's Influence on OR Pedagogy
MC47 Anticipatory Optimization for Dynamic Vehicle Routing
MC48 Modeling Issues in Vehicular Ad Hoc Networks
MC49 Simulation Optimization with Constraints
MC50 Behavioral Operations Management
MC51 Emergency Evacuation I
MC52 SpORts (Sports Analytics) II
MC53 Joint Session DM/QSR: Panel Discussion: Funding Opportunities
MC54 Daniel H. Wagner Prize for Excellence in Operations Research
MC55 Joint Session Analytics/CPMS/LAW: Public Sector Analytics
MC56 Appointment Scheduling
MC57 Distributed Mechanisms for Allocating NAS Resources
MC58 Modeling and Operations Research for Defense Analysis
MC59 Managing Service Quality
MC60 Combinatorial Optimization and Matroids
MC63 Evolutionary Multi-Objective Optimization 2
MC64 Humanitarian Logistics and Disaster Relief II
MC65 Service Science and Service Operations Management
MC66 DEA III
MC69 Sustainable and Responsible Supply Chain Management

Monday, 4:30pm - 6:00pm

MD01 Empirical Session on Supply Chain Management
MD02 Optimization in Finance IV
MD03 Open-Source OR in the Real World
MD04 Surrogate-assisted Evolutionary Optimization
MD05 Mixed-Integer Optimization Approaches for Inventory Management
MD06 Bayesian Methods for Global and Simulation Optimization
MD07 Multi-class Queueing Models
MD08 Hybrid Methods II: Search
MD09 Pricing and Revenue Management with Consumer

Behavior Models
MD10 Software Demonstrations
MD11 Analysis, Design and Control of Queueing Systems
MD12 Advances in Simulation Optimization
MD13 The Next Frontier of RM Innovation – Merging and Enhancing Pricing and RM Principles and Algorithms
MD14 Renewables Integration, Demand Response and Carbon Regulation
MD15 Decision Analysis Society Awards
MD16 Forestry: Forest Industry Applications
MD17 Pierskalla Award Finalists
MD18 New Trends in Scheduling
MD19 Computational Methods in Finance
MD20 Optimization in Data Mining
MD21 Nash Games Under Uncertainty: Analysis and Algorithms for Computation and Learning
MD22 Algorithms for Nonlinear Optimization
MD23 Joint Session IAC/QSR: European Journal of Operational Research
MD24 Advances in Integer Programming
MD25 Assortment Planning
MD26 Service Contracting
MD27 Empirical Research in Operations and Supply Chain Management
MD28 Queuing Models for Revenue Management
MD29 Credit and Counterparty Risk
MD30 Interface of Finance, Operations, and Risk Management
MD31 Radiation Therapy Treatment Planning
MD32 Revenue Management with Flexible Capacity
MD33 Panel Discussion: Meet with Journal Editors
MD34 Operations Research in Primary Care
MD35 Joint Session QSR/ENRE: Reliability and Optimization in Wind Power Systems
MD36 Optimization Models in Chronic Disease Treatment
MD37 Quality Engineering
MD38 Location Models I
MD39 Coordination and Information Management
MD40 Joint Session TMS/NPD: TMS Distinguished Speaker
MD41 Product Development and Design
MD42 IT Outsourcing, Offshoring, and Sourcing Governance
MD43 Capacity Expansion
MD44 Panel Discussion: From Applying to Thriving: Panel Discussion on Graduate School
MD45 Behavioral Market Design
MD46 Advances in Statistics Education
MD47 Topics in Transportation
MD48 Transportation Supernetwork-Subnetwork Analysis
MD49 Agent-based Simulation of Complex Adaptive Systems
MD50 Decision Making in Different Contexts
MD51 Emergency Evacuation II
MD52 SpORts (Sports Analytics) III
MD53 Data Mining and Machine Learning
MD54 Daniel H. Wagner Prize for Excellence in Operations Research
MD55 Joint Session Analytics/CPMS: OR in Roundtable Companies
MD56 Nurse and Patient Scheduling
MD57 Modeling and Computational Advancements of Aviation Applications
MD58 Social Network Analysis in National Security Studies
MD59 IT Service Management
MD60 Combinatorial Optimization Techniques for Generalizations of Clique
MD63 Evolutionary Multi-Objective Optimization 3
MD64 Humanitarian Logistics and Disaster Relief III
MD65 Service Science Student Competition Prize
MD66 Workforce in Smarter Organizations
MD69 Measuring and Modeling Carbon Emissions in Supply Chains

Tuesday, 8:00am - 9:30am

TA01 Cooperation and Competition in Supply Chains
TA02 Optimization in Finance V
TA03 Using Python as a Tool for Solving Real-world Optimization Problems
TA04 Surrogate and Derivative Free Optimization I
TA05 Dynamic Optimization in Radiotherapy
TA06 Contract Complexity and Performance: A Brief Look at Theory and Behavior
TA07 Asymptotic Analysis of Stochastic Networks
TA08 Hybrid Methods III: Applications
TA09 Revenue Management in Internet Advertising
TA10 Software Demonstrations
TA11 Markov Decision Processes and Queueing Models
TA12 Computational Sustainability
TA13 Future Directions in Revenue Management and Price Optimization
TA14 Capacity and Contracts in Electricity Markets
TA15 Decision Support Models and Sensitivity Analysis I
TA16 Economics, Supply Chain and Logistics Analysis of Biofuels I
TA17 Decision Analysis in OM
TA18 Planning and Scheduling for Real-World Problems
TA19 Stochastic Models for Credit Risk and Market Crash
TA20 Advances in Global Optimization
TA21 Stochastic Dynamic Programming and Its Applications
TA22 New Optimization Algorithms and Applications
TA23 Joint Session IAC/QSR: Producao (Brazilian IE journal) Journal Session
TA24 Risk-averse Stochastic Integer Programming
TA25 Inventory Management and Related Models
TA26 Stochastic Models of Supply Chains
TA27 Conspicuous Consumption
TA28 Research Practices and Opportunities in Business Process Operations
TA29 Financial Engineering and Applied Probability
TA30 Operational and Financial Decisions
TA31 Stochastic Modelling Applications in Healthcare
TA32 Railroad Disruption Management
TA33 Nanomanufacturing and Nanoinformatics IV: Quality and Reliability in Nano-scale Systems
TA34 Hospital Operations Modeling
TA35 Joint Session QSR/ENRE: Reliability and Optimization in Electric Power Systems
TA36 Advanced Planning and Scheduling in Healthcare
TA37 Accelerated Testing Models and Experimental Design
TA38 New Directions in Location and Network Design
TA39 Competition in Electronic Marketplace
TA40 Technological Resources:(Re)configuration and Forecasting
TA41 Empirical Work in New Product Development, Innovation and R&D Management
TA42 Contracts, Incentives and Sourcing
TA43 Modeling Natural Gas Markets with OR Techniques
TA44 Managing Supply Chain Disruptions
TA45 Auctions and Trading Agents
TA46 Special Session: Teaching OR More Analytically
TA47 Maritime Logistics
TA48 Advances in Traffic Signal Control
TA49 Simulation Meets the Multi-Armed Bandit
TA50 Behavioral Analyses of Human Planners
TA51 Network Evacuation and Dynamic Modeling
TA52 Facility Logistics I
TA53 Joint Session DM/ HAS: Quality and Statistical Decision Making in Health Care Applications I
TA55 Joint Session Analytics/CPMS: INFORMS and the Analytics Movement: Where We've Been, Where We Are, and Where We Are Going
TA56 Healthcare Topics
TA57 Simulation and Analysis of the Air Transportation System
TA58 Logistics and Supply Chain Modeling & Simulation

TA59 Energy Service and Sustainability
TA60 Aspects of Semidefinite and Quadratic Optimization
TA61 Maritime Transportation
TA62 Biofuels and Renewable Sources
TA63 Evolutionary Multi-Objective Optimization 4
TA64 Joint Session SPPSN/LA/Minority: Community-Based Operations Research I
TA65 Panel Discussion: Enhancing Adolescents' Lives through Decision-Making
TA66 Management of Dynamic Work-Sharing
TA67 Business Intelligence
TA68 Panel Discussion: Academic Job Search
TA69 Environmental Issues in Supply Chain Management

Tuesday, 11:00am - 12:30pm

TB01 Contracting and Supply Chain Management
TB02 Optimization in Finance VI
TB03 Open Source Solvers and Modeling Languages
TB04 Surrogate and Derivative Free Optimization II
TB05 Innovation and Entrepreneurship: A Process Framework
TB06 ICS Prize Winners
TB07 Applied Propability
TB08 Hybrid Methods IV: CP/IP Combinations
TB09 Revenue Management and Pricing Challenges in Practice
TB10 Software Demonstrations
TB11 Queues in Service Systems
TB12 Stochastic Optimization in Networks
TB13 Price Optimization on Social Networks
TB14 Long Term Energy System Planning
TB15 Joint Session DAS/MAS: Game Theoretic and Decision Analytic Methods for Terrorist Risk Analysis
TB16 Economics, Supply Chain and Logistics Analysis of Biofuels II
TB17 Advances in Probabilistic Modeling
TB18 Scheduling and Its Integration with Other Operational Decisions
TB19 Contagion and Portfolio Modeling
TB20 Convex Optimization Tools in Nonlinear Optimization
TB21 Stochastic Optimization with Application to Search and Detection I
TB22 Quadratic Optimization and its Applications in Computer Vision
TB23 Managing the Environmental Impacts of Aviation
TB24 Integer Programming
TB25 Empirical Research in Inventory Management and Retail Operations
TB26 Customer Queuing Behaviors and Their Implications for M&SOM
TB27 Maintenance Management for Advanced Technical Systems
TB28 Novel Directions in Operations Management Research
TB29 Financial Engineering: Models and Computation
TB30 Emerging Topics in OM/Finance Interface
TB31 Modelling and Evaluation of Health Systems
TB32 Advances in OR/MS for Passenger Railways
TB33 Nanomanufacturing and Nanoinformatics V: Synthesis and Characterization
TB34 Stochastic Models in Healthcare
TB35 Capacity and Contracts in Electricity Markets II
TB36 Simulation in Healthcare
TB37 Multivariate Analysis for System Quality and Reliability Improvement
TB38 Location Analysis
TB39 E-business & Economics of IS
TB40 Idea Generation and Problem Solving in Innovation Contests
TB41 New Methods in Managing Innovation
TB42 Social Networks and Information Systems
TB43 Models and Algorithms for Energy System Design and Operations
TB44 Supply Chain Disruptions
TB45 Algorithmic and Implementation Issues in Auctions
TB46 Advances in Oral and Written Communication Instruction
TB47 Latest Developments in Container Operations
TB48 IT and Sensors
TB49 Perfect Sampling and Rare-event Simulation Methodology
TB50 Behavioral Studies in Hospitals and Healthcare
TB51 Network Models
TB52 Facility Logistics II
TB53 Joint Session DM/QSR: Data Mining for Process Monitoring
TB54 Semiconductor Industry
TB55 Joint Session Analytics/CPMS: Topics in Analytics
TB56 Patient Admissions
TB57 Runway Scheduling Problems
TB58 Changing Paradigms in Military Logistics Related OR and Simulation Practices
TB59 Service Innovation
TB60 Efficient First-Order Methods for Convex Optimization and its Applications
TB61 Sensors, Signals and Flow
TB62 Uncertainty in Power Output
TB63 Evolutionary Multi-Objective Optimization 5
TB64 Community-Based Operations Research II
TB65 Innovations in Service Delivery
TB66 Workforce Planning in the Services
TB67 Recommendation Systems
TB68 Panel Discussion: Industry Job Search
TB69 Environmental Issues in Operations Management

Tuesday, 12:30pm – 2:30pm
Interactive Session

Tuesday, 1:30pm - 3:00pm

TC01 OM Models with Customer-Driven Demand
TC02 Assortment Planning and Customer Choice
TC03 Newsvendor and Risk
TC04 Surrogate and Derivative Free Optimization III
TC05 Analysis of Misspecified Models in Revenue Management and Repeated Decision Problems
TC06 Multiobjective and Quadratic Objectives in Scheduling
TC07 Regulatory Compliance in the Automotive Industry
TC08 Hybrid Methods V: Scheduling
TC09 Topics in RM
TC10 Software Demonstrations
TC11 Learning and Marketing in Social Networks
TC12 Joint Session ICS/ENRE: Stochastic Optimization in Energy Systems
TC13 Revenue Management in Service and Manufacturing
TC14 Long-Term Power Systems Planning with New Features of Smart Grids
TC15 Decision Making in Interdependent Systems
TC16 Economics, Supply Chain and Logistics Analysis of Biofuels III
TC17 Project Selection and Assessment
TC18 Scheduling in the Supply Chain
TC19 Analytics & Optimization in the Finance Industry
TC20 Recent Advances in Deterministic Global Optimization
TC21 Advances in Stochastic Programming
TC22 Convex Optimization in Statistics and Machine Learning
TC23 Sky Team: Some Studies in Air Traffic Management
TC24 Advances in Mixed Integer Programming - II
TC25 Emerging Issues in Supply and Capacity Management
TC26 Empirical Research in Operations
TC27 Service Quality Related Models
TC28 Management of the Value Chain
TC29 Dynamic Risk Measures
TC30 Managing Supply Risks
TC31 Joint Session HAS/SPPSN: Infectious Diseases and Interventions I
TC32 Resource Planning
TC33 Functional Data Analysis Methods and Applications

TC34 Radiation Therapy Optimization
TC35 Decision Analysis Approaches and Predictive Modeling to Managing Uncertainty in Manufacturing and Service Systems Design & Operations
TC36 Choosing Interventions for Optimal Disease Response
TC37 Spatial Data Analysis
TC38 Facility Location
TC39 Tactical and Operational Issues in e-Commerce
TC40 Coordination and Management of Knowledge
TC41 Analytics for Innovation I
TC42 Information Value Chains
TC43 Regulatory Issues and Uncertainty in Energy Supply
TC44 Effects of and Responses to Disruptions in Supply Chains
TC45 Auctions and their Applications
TC46 Rejuvenating the OR Curriculum: New Approaches for New Audiences
TC47 Ocean and Hinterland Intermodal Container Transportation
TC48 ITS and Traffic Simulation
TC49 Modeling and Simulation in Public Health
TC50 Joint Session BOM/Workforce: Bounded Rationality, Framing and Reference Points
TC51 Transportation Network Security and Alternative Modes
TC52 Facility Logistics III
TC53 Joint Session DM/ HAS: Quality and Statistical Decision Making in Health Care Applications II
TC54 Modeling Retailer Inventory and Capacity Decisions: Strategic Perspectives
TC55 Joint Session Analytics/CPMS: Selling Analytics: A Multi-Industry Panel Discussion
TC56 OR Scheduling I
TC57 Understanding Tradeoffs between Congestion and Emissions in Aviation
TC58 Joint MAS/CPMS/Tutorial: Transforming US Army Supply Chains: Management Innovation in DoD
TC59 Combining Analytic Methods to Develop New (and Better) Solutions
TC60 Joint Session OPT-IP/Opt-LP: Mixed Integer Conic Linear Optimization
TC61 Energy Issues in Transportation
TC62 Energy Production Forecasting
TC63 Panel Discussion: The Future of Multiple Criteria Decision Making: Where Do We Go From Here?
TC64 Joint Session SPPSN/CPMS/LAW: Fairness and Equity in OR Models
TC65 Industry Specific Service Topics
TC66 Workforce Teams and Schedules
TC67 Social Computing
TC68 Competition in Supply Chain
TC69 Product Design, New Product Introduction and Sustainability

Tuesday, 4:30pm - 6:00pm

TD01 Pricing/Competition in Supply Chain Management
TD02 Customers and Retailers
TD03 Substitution and Inventory Characterization
TD04 Metaheuristic Methods and Applications
TD05 Optimizing Cancer Screening Using Partially Observable Markov Decision Processes(POMDPs)
TD06 Scheduling Integrated with Other Issues
TD07 Joint Session LAW/CPMS/Analytics: Current Law Enforcement Models of Assignment Mass Egress and Site Security
TD08 Industrial Software for Constraint Programming
TD09 Advances in Pricing Optimization
TD10 Software Demonstrations
TD11 Stochastic Models for Supply Chains and Service Centers
TD12 Advances in Approximate Dynamic Programming
TD13 Pricing with Inventory or Real Estate
TD14 Joint Session ENRE/OPT-SP: Stochastic Programming in Strategic Energy System Planning
TD15 Decision Analysis, Game Theory and Homeland Security I
TD16 Supply Chain Sustainability Issues
TD17 Learning, Exploration and Exploitation
TD18 Scheduling Algorithms: Project Scheduling and Control
TD19 Topics in Finance
TD20 Optimization Models for Network Robustness
TD21 Joint Optimization/ ENRE: Decision Making under Uncertainty for Energy and Environmental Systems
TD22 Variational Inequalities and Applications
TD23 Terminal and Airspace Optimization Models
TD24 Computational Mixed-Integer Nonlinear Programming
TD25 Empirical Research in Operations Management
TD26 Advancing Operations Management Through Empirical Research
TD27 Healthcare Operations: Patient Flow in Hospitals
TD28 Service Operations with Strategic Customers
TD29 Risk Allocation and Hedging
TD30 Risk and Uncertainty in Supply Chain
TD31 Joint Session HAS/SPPSN: Infectious Diseases and Interventions II
TD32 Transportation System Timetabling and Scheduling
TD33 IIE Transactions
TD34 Emergency Services
TD35 Reliability in Smart Grid and Distributed Generation
TD36 Medical Decision Making and Informatics
TD37 Statistical Process Control for Image and High-Dimensional Data
TD38 Energy Facility Location Issues
TD39 Software Business Models and Platform Dynamics
TD40 Innovation and Social Institutions
TD42 The Socioeconomic Dynamics of Information Systems
TD43 Energy & Environmental Policy Modeling in the Energy Sector
TD44 Impact of Supply Chain Disruptions
TD45 Auction Design with Multi-dimensional Types
TD46 Organizational Culture
TD47 Intermodal Issues in Transportation
TD48 Traffic Modeling
TD49 Simulation Optimization
TD50 Advances in Behavioral Operations
TD51 Humanitarian Relief Logistics
TD52 Facility Logistics IV
TD53 Novelty Score Algorithms and Their Applications
TD54 Free Website Management Tools for Subdivisions
TD55 Joint Session Analytics/CPMS: Predictive Analytics
TD56 OR Scheduling II
TD57 Airline, Airport, and Airspace Planning and Recovery Strategies
TD58 Applications in Information Systems and Decision Support
TD59 Modeling Human Behavior in Service Processes
TD60 Quadratic Optimization
TD61 Transportation Planning
TD62 Energy Pricing and Price Forecasting
TD63 Algorithms for Multi-Objective Optimization
TD64 Community-Based Operations Research III
TD65 Planning in Service Industries
TD66 Healthcare Workforce Management
TD67 Game Theory
TD68 Supply Chain Network Design
TD69 Closed-Loop and Sustainable Supply Chain Network Design

Wednesday, 8:00am - 9:30am

WA01 RFID and Sourcing Decisions in Supply Chains
WA02 Pricing I
WA03 Stochastic Demands
WA04 Advances in Network Optimization
WA05 Topics in Optimization
WA06 Classic Scheduling I
WA07 Advances in Simulation Theory
WA08 Dynamic Issues in Production and Inventory
WA10 Software Demonstrations
WA11 Stochastic Networks
WA12 New Techniques in Stochastic Optimization
WA13 Topics in Revenue and Yield Management
WA14 Multi-stage Stochastic Programming Applied to Power Systems Expansion Planning
WA15 Decision Analysis, Game Theory and Homeland Security II
WA16 Sustainable Environmental Policy and Natural Resource Management
WA17 Decision Analysis I
WA18 Scheduling Algorithms: Project, Machine and Staff Scheduling
WA19 Banking and Insurance
WA20 Global Optimization Methods in Power Systems
WA21 Stochastic Optimization with Application to Search and Detection II
WA22 Generalized Nash Equilibrium Problems: Models, Analysis and Algorithms
WA23 Scheduling and Pricing Policies in the Airline Industry
WA24 Using Cutting Planes to Efficiently Solve Hard MIPs
WA25 Product Variety and Manufacturing Complexity in Assembly/Enterprise Systems
WA26 New Directions in Operations/Marketing Interface
WA27 Incentives in R&D and Product Design
WA28 OM Problems in Service Firms
WA29 Operator Methods in Finance
WA30 Risk in Supplier Selection
WA31 Innovation and Health Care
WA32 Human, Cultural and Ecological Interactions in Sustainability
WA33 Nanomanufacturing and Nanoinformatics VI: Modeling and Quality Control
WA34 Patient Flow
WA35 Optimization, Quality and Reliability
WA36 Joint Session HAS/Homeland Security: Public Health, Homeland Security, and Disaster Response
WA37 Complex System Monitoring, Diagnosis, and Evaluation
WA38 Applications of VRP
WA39 Understanding Value and the Acquisition of Technology Innovation
WA40 Sustainability for Business Intelligence on Technology Management and New Product Development
WA41 Productivity and Competitiveness
WA42 Digital Media, Competitive Strategies, and Quantitative Analysis
WA43 Contemporary Issues in Energy Policy and Management
WA44 Supply Chain Management I
WA45 Topics in Procurement
WA47 Reverse Logistics and Supply Chain I
WA48 Topics in Freight Transportation
WA49 Military Applications of Simulation
WA50 Inventory and Forecasting Behavior
WA51 Building Evacuation and Crowd Management
WA52 Facility Logistics V
WA53 Data Mining
WA54 Sustainable and Reduced-Cost Energy Systems through Optimization
WA55 Joint Session Analytics/CPMS: Descriptive Analytics
WA56 Patient Flow
WA57 Modified Trajectory Impacts
WA58 Joint Session MAS/DAS: Military Decision Analysis
WA59 IT Service Outsourcing
WA60 Joint Session OPT-LP/Opt-IP: New Relaxations of Binary Quadratic and Multi-Objective Integer Programs
WA61 Traffic Planning
WA62 Issues in the Energy Grid
WA63 Advances in Preference Modeling for MCDM
WA64 Joint Session SPPSN/LAW: Problems in Real-World OR
WA65 Operations and Supply Chains
WA66 Analytics Tools for Logistics I
WA67 Game Theory: Strategy and Cost Sharing
WA68 Game Theory in Supply Chain
WA69 Economics of Reverse Logistics

Wednesday, 11:00am - 12:30pm

WB01 Robust Dynamic Optimization and Learning with Applications in Inventory and Revenue Management
WB02 Pricing II
WB03 Inventory Management I
WB04 Applications of Network Optimization
WB06 Scheduling and Timetabling
WB07 Applications of Simulation
WB08 Topics in Disaster and Emergency Management
WB09 Topics in Revenue Management
WB10 Financial Risk Management
WB11 Queueing Applications in Health Care Systems
WB12 Stochastic Optimization: Algorithms and Applications
WB13 Dynamic Pricing
WB14 Stochastic Optimization in Short-Term Power Generation I
WB15 Decision Support Models and Sensitivity Analysis II
WB16 Spatial and Dynamic Optimization Approaches for Conservation and Natural Resource Management
WB17 Decision Analysis II
WB18 Lot-Sizing
WB20 Joint Session: Opt Global/Network: Optimization in Wireless System
WB21 Stochastic Optimization with Application to Engineering Design
WB22 Applications of Nonlinear Optimization
WB23 Network and Power Issues in Homeland Security
WB24 Mixed-Integer Programming Theory and Applications
WB25 Operations Management With Strategic Players
WB26 Consumer Driven OM Models
WB27 Empirical Work in OM
WB28 Scheduling and Logistics
WB29 Real Asset Valuation
WB31 Improving Efficiency in Healthcare Operations
WB32 High-Speed Rail: International Experience and Research Needs in US
WB33 Large-Scale Networks and Applications
WB34 Operations Research in the Federal and Governmental Sectors
WB35 Quality Management
WB37 Complex Systems Quality Monitoring and Control
WB38 Vehicle Routing Problem
WB39 Service in E-Business and Pricing
WB40 Organizational Learning
WB41 Research and Development Planning
WB42 Personalized Recommender Systems
WB43 Modelling Energy Markets
WB44 Supply Chain Management II
WB45 Reliability
WB46 Individuals in Organizations II
WB47 Reverse Logistics and Supply Chain II
WB48 Time in Transportation Problems
WB49 Simulation Optimization: Ranking and Selection
WB50 A Behavioral Perspective on Demand and Inventory Management
WB51 Transportation Modeling and Privacy Protection
WB52 Facility Logistics VI

WB53 Bayesian Inference and Computational Issues
WB54 Joint Session INFORM-Ed/JFIG: Panel Session: Distance, Not Distant Education
WB55 Joint Session Analytics/CPMS: O.R. Practice for a Smarter Energy Industry
WB56 Topics in Health Care
WB57 Optimization and Analysis Models for Air Traffic Management
WB58 Joint Session MAS/Tutorial: Modern Design of Experiments – Recent Advances in Screening Methods
WB59 Models of Service Co-creation Processes
WB60 First-order Methods for Convex Programming and Their Applications
WB61 Networks in Planning
WB62 Carbon and Regulation Issues
WB63 Methodological and Application Issues in MCDM Models
WB64 Policy Potpourri: Pandemic Response and Sustainable Operations
WB65 Retailing and Customers
WB66 Analytics Tools for Logistics II
WB67 Applications of Game Theory
WB68 Shipping and Transportation in Supply Chain
WB69 New Business Models for Sustainable Operations

Wednesday, 12:45pm - 2:15pm

WC01 Sourcing/Procurement and Supply Chain Management
WC03 Inventory Management II
WC04 Robust and Stochastic Network Optimization
WC06 Classic Scheduling II
WC07 Simulation and Optimization
WC08 Integer Optimization
WC09 Demand Learning and Model Uncertainty in Revenue Management
WC10 Topics in Finance
WC11 Advances in Learning and Dynamic Optimization
WC12 Stochastic Optimization in Energy
WC13 Applied Topics in Revenue and Yield Management
WC14 Stochastic Optimization in Short-Term Power Generation II
WC15 Decision Support Models and Sensitivity Analysis III
WC16 Applications in Open Pit Mining
WC17 Techniques in Decision Analysis
WC18 Topics in Production and Scheduling
WC19 Empirical Analysis in Economics
WC20 Global Optimization - Applications
WC21 Modeling and Optimization of Risk
WC22 Complementarity Problems: Theories and Applications
WC23 New OR Techniques for Homeland Security
WC24 Mixed Integer Programming
WC25 Revenue Management with Consumer Behavior Models
WC26 Outsourcing in IT
WC27 Managing Service Systems
WC28 Lifecycle Issues in Environmental Operations
WC29 Operations / Finance Interface
WC31 Health Systems Modeling and Decision Making
WC32 Research Supporting Sustainability
WC33 Statistical Decision Making and Quality Estimation in Energy Manufacturing Application
WC34 Technology Investment Decision Making in Hospitals
WC36 Joint Session DM/HAS: Data Mining and OR in Healthcare Problem and Clinical Decision Support
WC37 Statistical Process Control and Economic Design
WC38 Methodologies for VRP
WC39 Software and Platform Management
WC40 Investments in NPD Stages and Applications of Technologies
WC41 Corporate Level Strategy
WC42 Interface Between Information Systems and Marketing
WC43 Hybrid Models for Energy and the Environment
WC44 Optimization Methods and Applications
WC45 Inspection and Test
WC46 Corporate-level Organizational Issues
WC47 Applications of Location Routing Problems
WC48 Topics in Transportation
WC49 Joint Session I-Sim/MSOM: Operations Applications of Simulation
WC50 Applied Data Mining
WC51 Decision Support in the Petroleum Industry and General Transportation
WC53 Mathematical Modeling and Data Mining
WC55 Joint Session Analytics/CPMS: Panel Discussion: Educating Analytics Practiioners: M.S. Degrees in Analytics
WC56 Processes in Health Care
WC57 Airline Scheduling and Fleet Assignment
WC58 Disaster Relief Planning and Operations I
WC59 Management of Technological Innovation in the Service Sector
WC60 Approximation Algorithm and Online Learning in Optimization
WC61 Schedules and Timetables
WC62 Energy in Buildings
WC63 Multiobjective Programming
WC65 Procurement and Pricing
WC66 Logistics in Action
WC67 Systems Analysis
WC68 Simulation and Queuing in Supply Chain
WC69 Sustainability and Uncertainty in Competitive Supply Chains

Wednesday, 2:45pm - 4:15pm

WD01 Forecasting
WD02 Promotions
WD03 Stockouts, Backlogging and Lost Sales
WD07 Queueing Theory and Applications
WD08 Robust Optimization
WD09 Trends in Pricing in the Transportation and Hospitality Industries
WD11 Analysis, Applications and Computations with Many Server Systems
WD12 Stochastic Optimization in Transportation
WD14 Multi-stage Stochastic Programming Applied to Power Systems Scheduling
WD15 Data Visualizations for Improved Decision Making
WD16 Applications in Open Pit and Underground Mining
WD18 Project Management
WD19 Topics in Economics
WD21 Applied Stochastic Programming
WD22 Nonlinear Optimization: Theory and Applications
WD23 Topics in Disaster and Emergency Management
WD24 Topics in Bilevel Integer Programming
WD25 New Topics in Supply Chain Management
WD26 Topics in Outsourcing
WD27 Consumer Behavior in Operations and Supply Chain Management
WD28 Emergency Medical Service Systems
WD30 Information in the Supply Chain I
WD31 Partnering with Providers for Practical Implementation
WD33 Advances in Reliability and Risk Analysis
WD34 Joint Session HAS/Homeland Security: Modeling Radiological Events
WD39 E-Business
WD41 Topics in Strategy
WD42 Information Security and Risk Management
WD43 Mixed-integer Programming Problems in the Power Grid
WD44 Energy
WD45 Statistics and Quality Control I
WD46 Behavioral Operations
WD47 Integrated Models for Supply Chain and Logistics Planning
WD48 Single-mode Freight Transportation
WD49 Simulation Optimization
WD50 Progress in Data Mining Techniques

WD51 Alternative Dispatching Methods for Freight Transportation
WD52 Models and Algorithms for Facility Location
WD54 Joint Session Analytics/CPMS: Financial Risk Management in Practice
WD55 Joint Session Analytics/CPMS: Forecast Value Added Analysis
WD56 Therapy and Treatment Issues in Health Care
WD57 Optimization Models for Airline Crew Rostering and Crew Pairing
WD58 Topics in Homeland Security
WD59 Service Science and Network Science
WD60 Linear Optimization: Algorithms and Applications
WD61 Design Issues
WD62 Energy Storage
WD63 Multiobjective Optimization for Engineering Design
WD64 Strategy and Policy in Health Care
WD65 Operations Management I
WD66 Manufacturing Topics
WD67 Business Applications I
WD68 Green Supply Chain Management

Wednesday, 4:30pm - 6:00pm

WE01 Stochastic Processes
WE02 Structural Topics in Marketing
WE03 Procurement and Costing
WE07 Advances in Queueing Theory
WE08 Topics in Dynamic Programming
WE09 Model Selection and Mis-specification Issues in Revenue Management
WE11 The Skorokhod Problem and Stochastic Networks
WE14 Simulations in Energy Markets
WE19 Financial Engineering
WE20 Combinatorial Optimization
WE21 Applied Stochastic Programming in Finance and Energy
WE22 Continuous Optimization
WE23 Evacuations
WE24 Topics in Integer Programming
WE25 Supply Chain Management
WE26 Choice and Assortment Planning
WE28 Environmental Operations
WE30 Information in the Supply Chain II
WE31 Operational Technology for Patient Flow Improvement
WE33 Panel Discussion: Integrated Nanomanufacturing and Nanoinformatics Research
WE34 Multi-agent Models on Public Health
WE42 Topics in Information Systems Research
WE44 Energy Systems
WE45 Statistics and Quality Control II
WE47 Policy Analyses for Freight Transportation and Logistics
WE48 Multi-modal Issues in Freight Transportation
WE52 Applications of Facility Planning
WE54 Joint Session Analytics/CPMS: Consulting Firms Share Their Lessons Learned on how to Create Significant Impact with Optimization and Advanced Analytics at Their Client Organizations
WE57 Alternate Strategies for Aviation Systems Planning
WE58 Disaster Relief Planning and Operations II
WE59 Knowledgement Management in Service
WE61 Public Transportation
WE62 Closed Loop and Reverse Supply Chain
WE63 Multicriteria Decision Making
WE65 Operations Management II
WE67 Business Applications II
WE68 Remanufacturing and End-of-Life Issues
WE69 Green Innovation and Product Development

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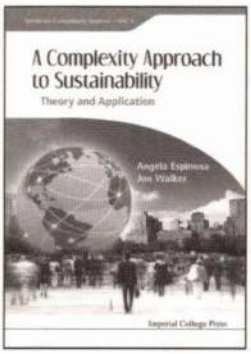
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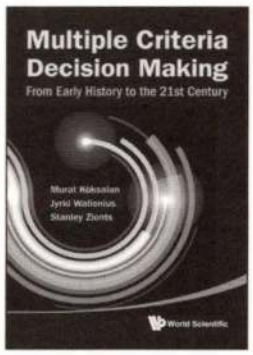
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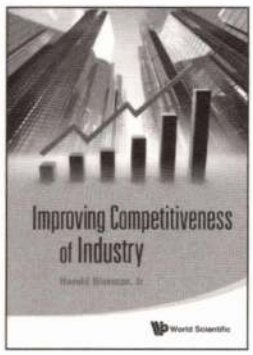
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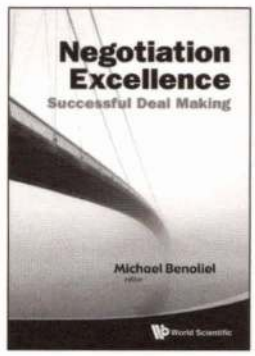
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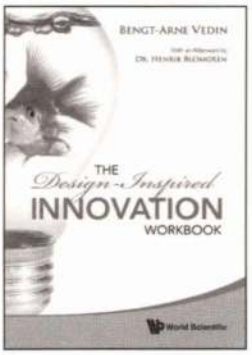
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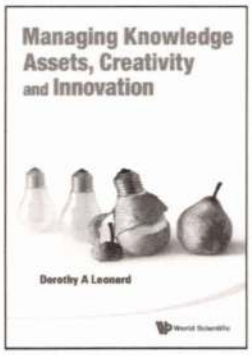
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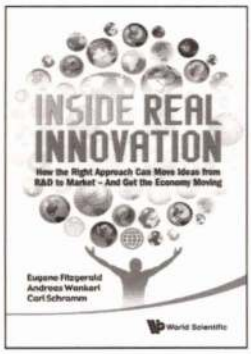
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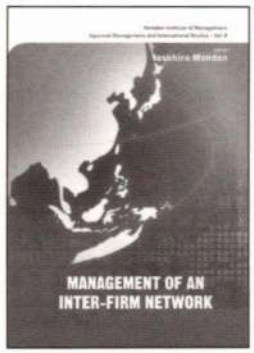
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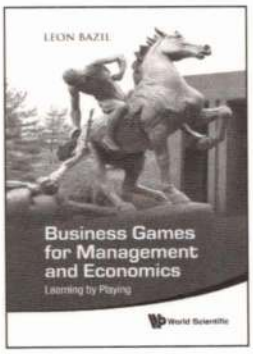
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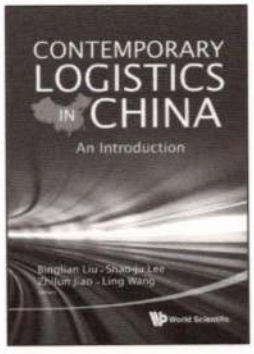
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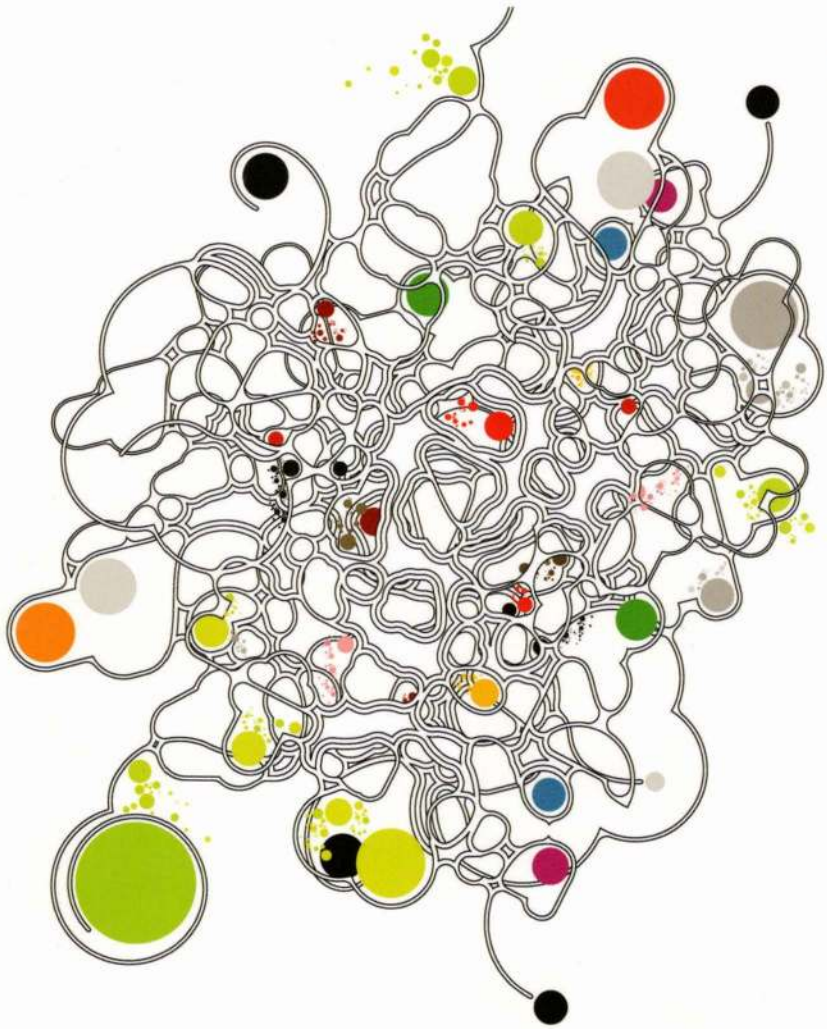
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