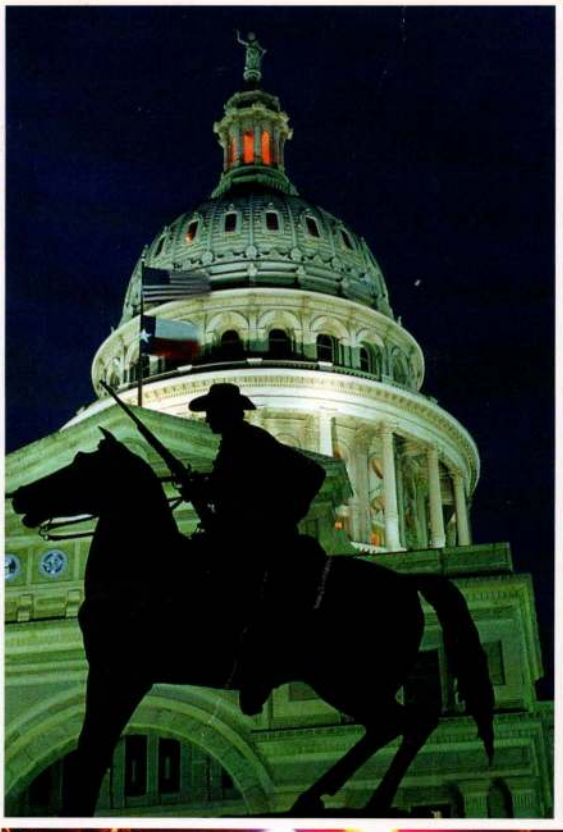
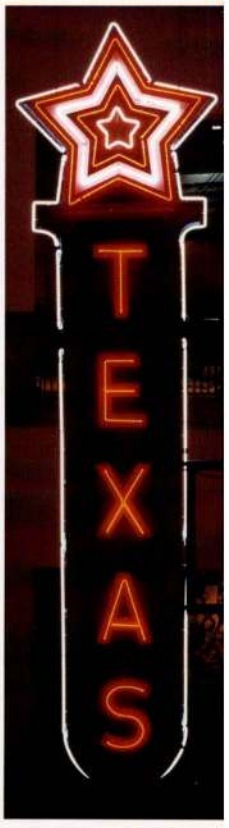
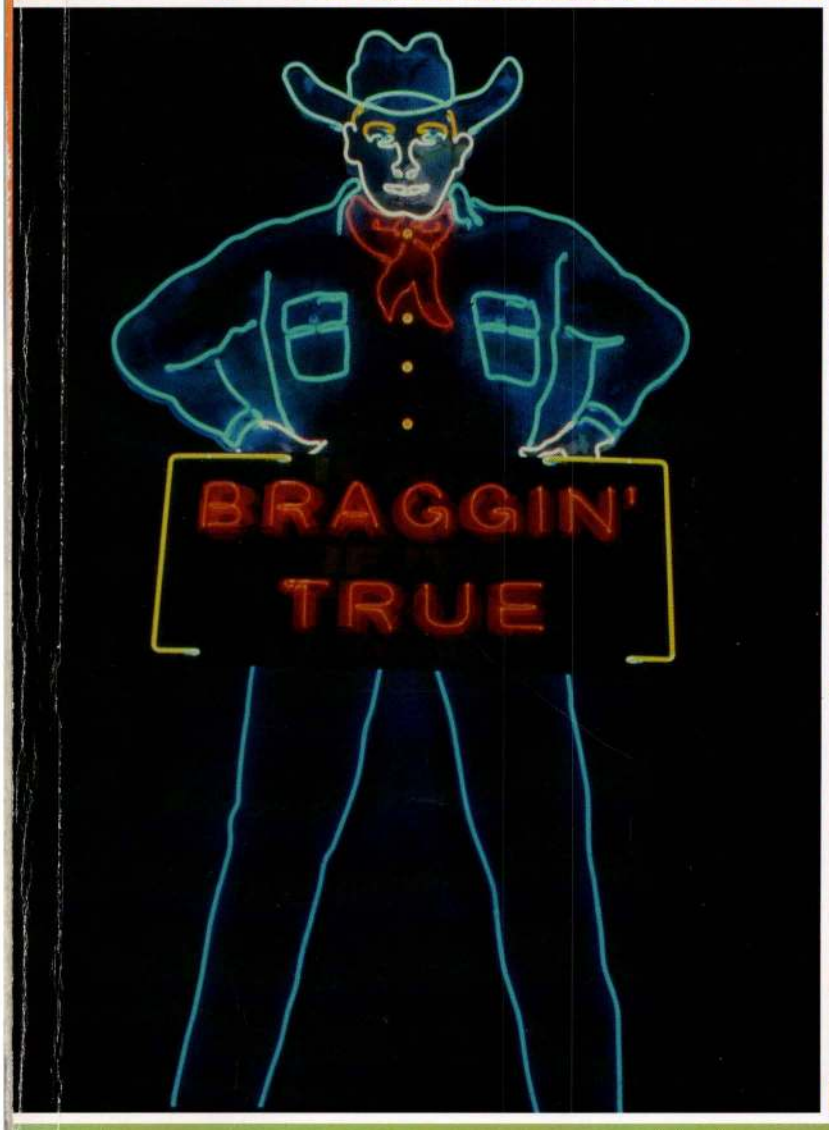
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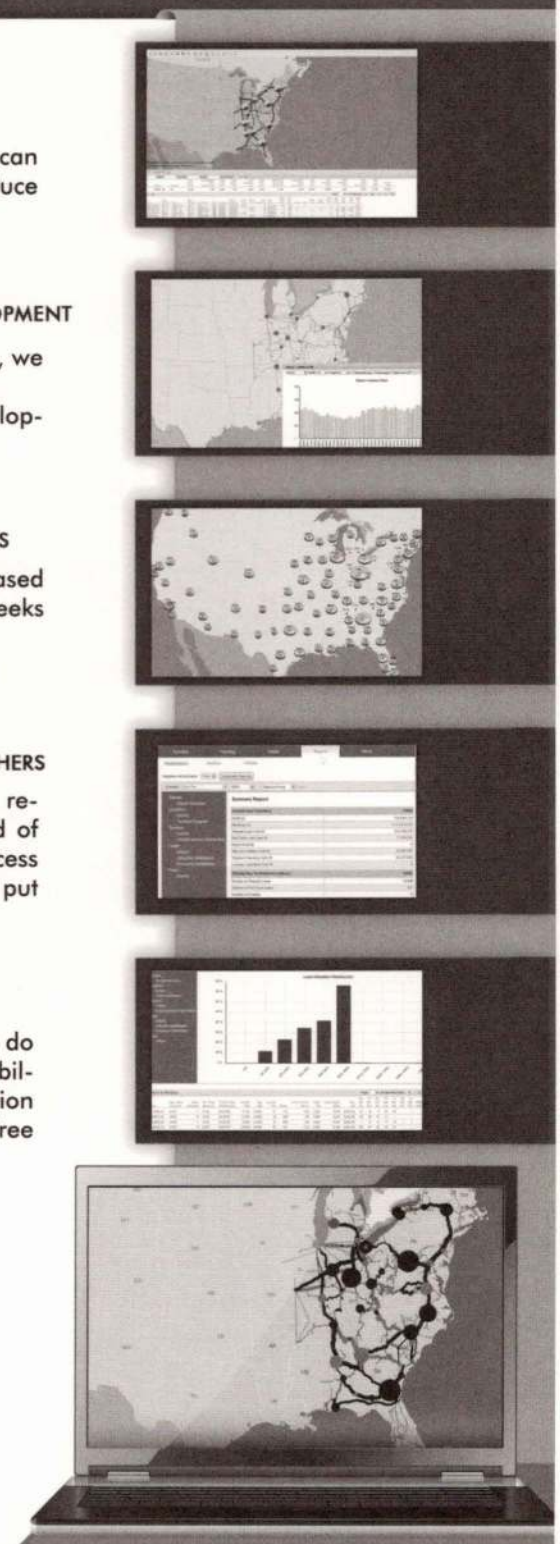
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Dear Friends of Operations Research and Management Science,

It is with great pleasure that I welcome you to Austin, one of the most exciting and livable cities in the U.S. We are a diverse community of entrepreneurs, technologists, artists and musicians, priding ourselves on being a bit more than out of the ordinary. In fact, we celebrate being "weird," as well as being a hub of creativity and progressive thinking.

From the early days of the Republic when the Texas Rangers brought law and order to the unruly, Austin's population has doubled every 20 or 30 years. Much of the recent growth has been a result of a technology boom that began more than four decades ago when Tracor Industries set up shop in northwest Austin. Others soon followed – IBM, Texas Instruments, 3M, Motorola, Advanced Micro Devices, Samsung, Dell. Today, we are national trend-setters in sustainable living, green construction, and alternative energy sources, not to mention being the focal point of Silicon Hills. The same entrepreneurial drive that led 19-year-old Michael Dell to launch a Fortune 500 company from his University of Texas dorm room has also made Austin a Mecca for all aspects of high-tech and the arts.

In the spirit of this year's conference theme – *Energizing the Future* – we have lined up an impressive array of plenary and keynote speakers. Heading the list is Joan Woodard, Executive Vice President Emeritus of Sandia Laboratories, who will speak on rethinking and re-engineering our energy systems. Charles Groat, Associate Director of the Energy Institute and former Director of the U.S. Geological Survey, will continue the discussion by surveying our energy future. Other speakers include Chung-Yee Lee, an expert in global supply chains, John Birge and Gerald Brown, leading thinkers in risk management, Edward Kaplan, an oft-quoted authority on national security and counterterrorism, John Weyant, an internationally recognized voice on climate and energy policy, Paul Jensen, an award winning software developer and educator, and Donna Warton, Vice President of Global Supply Chain Planning at Dell.

The highlight of the conference will be the General Reception on Tuesday evening to be held at the Austin Convention Center, the main venue for the meeting. The Convention Center is adjacent to the Hilton Hotel and ideally located in the heart of the downtown entertainment district. For the reception, we are planning a Wild West theme with live music, country-western dancing, and world-class armadillo races.

It goes without saying that it would not be possible for one person or even a handful to organize a conference of this size and scope. In addition to the invaluable help I received from Terry Cryan and her staff at INFORMS, I would like to acknowledge the tireless effort afforded by the members of the Organizing Committee. Special thanks goes to David Morton, Program Chair, Anant Balakrishnan and Natarajan Gautam, Invited Sessions Co-chairs, and John Hasenbein, Tutorials Chair. Moreover, I am grateful for the services of Elmira Popova, Erhan Kutanoglu, Kumar Muthuraman, Kevin Furman, Eric Bickel, and Ivilina Popova. For taking the lead in running the Interactive Sessions, I am indebted to co-chairs Maciek Nowak and Sila Çetinkaya. Finally, for the impossible job of coordinating 50+ students who will be providing support to the attendees on a session-by-session basis, I would like to recognize the two unflappable task masters Wesley Barnes and Jim Dyer, Arrangements Co-Chairs.

A second round of thanks goes to our Leadership sponsors – IBM, GAMS, and Microsoft – both for their financial support and continued advocacy for the profession. I am no less grateful to our Corporate and University sponsors, including RSG Media Systems, AIMMS, Gurobi Optimization, SAS, BNSF, UT-Austin, UT-Dallas, Texas A&M University, University of Southern California, University of Florida, Texas State University and Georgia Tech.

Enjoy the conference and make your stay an unforgettable time by taking advantage of the myriad activities that Austin has to offer.

Jonathan F. Bard

Jonathan F. Bard

NOTE:
Technical sessions are held at the Austin Convention Center and Hilton Austin. Check the Master Track Schedule on pages 50-57 for specific room locations.

KEY
H-Hilton
C-Convention Center

BADGES REQUIRED FOR TECHNICAL SESSIONS

INFORMS Annual Meeting 2010 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 50-57.

THANK YOU

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Tuesday Email Center

SAS

FRIDAY, NOVEMBER 5

7:30am-5:00pm	Teaching Effectiveness Colloquium	H – 602, 6th Fl.
6:00pm-8:00pm	Combined Colloquia	H – Salon A, 4th Fl.

SATURDAY, NOVEMBER 6

7:30am-4:30pm	Future Academician Colloquium	H – Salon A, 4th Fl.
7:30am-4:30pm	Future Practitioner Colloquium	H – 400, 4th Fl.
7:30am-4:30pm	Teaching Effectiveness Colloquium	H – 602, 6th Fl.
8:30am-6:00pm	DM-HI Workshop	H – 402 & 404, 4th Fl.
8:00am-5:00pm	CIST Conference	H – 408 & 410, 4th Fl.
9:00am-5:30pm	Vendor (Exhibitor) Workshops	C – See p. 20
2:00pm-7:00pm	Registration Opens	C – Exhibit Hall 3
5:00pm-6:00pm	INFORMS Membership Meeting	H – Salon B, 4th Fl.

SUNDAY, NOVEMBER 7

7:00am-5:00pm	Registration	C – Exhibit Hall 3
7:00am-5:00pm	Email Center, Free Internet	C – Exhibit Hall 3
8:00am-9:30am	Technical Sessions (SA)	Convention Center & Hilton
8:00am-5:00pm	CIST Conference	H – 408 & 410, 4th Fl.
9:30am-10:00am	Coffee Break	C – Ballroom Foyer, Level 4
10:00am-10:50am	Welcome/Plenary McCord Morse Lecture: Edward Kaplan	C – Ballroom G, Level 4
11:00am-12:30pm	Technical Sessions (SB)	Convention Center & Hilton
12:00pm-5:00pm	Exhibits, Job Fair	C – Exhibit Hall 3
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (SC)	Convention Center & Hilton
3:10pm-4:00pm	Keynote: John Weyant	C – Ballroom E, Level 4
3:10pm-4:00pm	Keynote: Edelman Reprise	C – Ballroom G, Level 4
4:00pm-4:30pm	Coffee Break	C – Exhibit Hall 3
4:30pm-6:00pm	Technical Sessions (SD)	Convention Center & Hilton
4:30pm-6:00pm	New Member Orientation	H – Salon C 4th Fl.
6:15pm-7:15pm	INFORMS Community Business Meetings	See p. 11
7:30pm-9:00pm	Welcome Reception-Exhibits Open	C – Exhibit Hall 3
8:30pm-9:45pm	Awards Ceremony & Dessert Reception *Reception open to ceremony attendees only, doors close at 8:45pm.*	C – Ballroom G, Level 4

MONDAY, NOVEMBER 8

7:00am-5:00pm	Registration	C – Exhibit Hall 3
7:00am-5:00pm	Email Center, Free Internet	C – Exhibit Hall 3
8:00am-9:30am	Technical Sessions (MA)	Convention Center & Hilton
9:00am-5:00pm	Exhibits, Job Placement	C – Exhibit Hall 3
9:30am-10:00am	Coffee Break	C – Exhibit Hall 3
10:00am-10:50am	Plenary: Joan Woodard	Ballroom G, Level 4
11:00am-12:30pm	Technical Sessions (MB)	Convention Center & Hilton
12:30pm-1:30pm	Interactive Session	C – Exhibit Hall 3
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (MC)	Convention Center & Hilton
3:10pm-4:00pm	Keynote: Charles Groat	C – Ballroom E, Level 4
3:10pm-4:00pm	Keynote: Perry Noakes	C – Ballroom G, Level 4
4:00pm-4:30pm	Coffee Break	C – Exhibit Hall 3
4:30pm-6:00pm	Technical Sessions (MD)	Convention Center & Hilton
6:15pm-7:15pm	INFORMS Community Business Meetings	See p. 11

TUESDAY, NOVEMBER 9

7:00am-5:00pm	Registration, Email Center, Free Internet	C – Exhibit Hall 3
8:00am-9:30am	Technical Sessions (TA)	Convention Center & Hilton
9:00am-5:00pm	Exhibits, Job Placement	C – Exhibit Hall 3
9:30am-10:00am	Coffee Break	C – Exhibit Hall 3
10:00am-10:50am	Plenary-OMEGA RHO: John Birge	Ballroom G, Level 4
11:00am-12:30pm	Technical Sessions (TB)	Convention Center & Hilton
12:30pm-1:30pm	Interactive Session	C – Exhibit Hall 3
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (TC)	Convention Center & Hilton
3:10pm-4:00pm	Keynote: Chung-Yee Lee	C – Ballroom E, Level 4
3:10pm-4:00pm	Keynote: Gerald Brown	C – Ballroom G, Level 4
4:00pm-4:30pm	Coffee Break	C – Exhibit Hall 3
4:30pm-6:00pm	Technical Sessions (TD)	Convention Center & Hilton
6:15pm-7:15pm	INFORMS Community Business Meetings	See p. 11
7:30pm-10:30pm	General Reception	C – Exhibit Hall 5

WEDNESDAY, NOVEMBER 10

7:00am-3:30pm	Registration, Email Center, Free Internet	C – Exhibit Hall 3
8:00am-9:30am	Technical Sessions (WA)	Convention Center & Hilton
9:00am-1:00pm	Exhibits	C – Exhibit Hall 3
9:00am-3:00pm	Job Placement	C – Exhibit Hall 3
9:30am-10:00am	Coffee Break	C – Exhibit Hall 3
10:00am-10:50am	Keynote: Paul Jensen	C – Ballroom G, Level 4
	Keynote: 2010 Wagner Presentation	C – Ballroom E, Level 4
11:00am-12:30pm	Technical Sessions (WB)	Convention Center & Hilton
12:30pm-1:30pm	Lunch Break (on your own)	
1:30pm-3:00pm	Technical Sessions (WC)	Convention Center & Hilton
3:00pm-3:30pm	Coffee Break	C – Ballroom D & Foyer, Level 4
3:30pm-5:00pm	Technical Sessions (WD)	Convention Center & Hilton

COFFEE BREAKS

All coffee breaks take place in the Convention Center.

Sunday	9:30am-10:00am	Ballroom Foyer, Level 4
	4:00pm-4:30pm	Exhibit Hall 3
Monday	9:30am-10:00am	Exhibit Hall 3
	4:00pm-4:30pm	Exhibit Hall 3
Tuesday	9:30am-10:00am	Exhibit Hall 3
	4:00pm-4:30pm	Exhibit Hall 3
Wednesday	9:30am-10:00am	Exhibit Hall 3
	3:00pm-3:30pm	Ballroom D & Foyer, Level 4

THANK YOU

Monday Afternoon Break
Tuesday Morning & Afternoon Breaks

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Sunday Afternoon Break

BNSF

Monday Morning Break

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Sunday Morning Break

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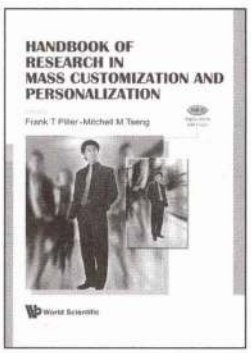
Wednesday Morning Break

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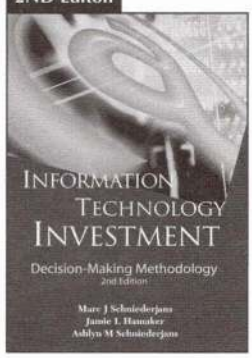
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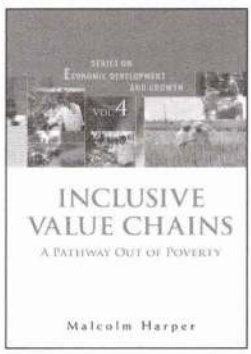
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2ND Editon



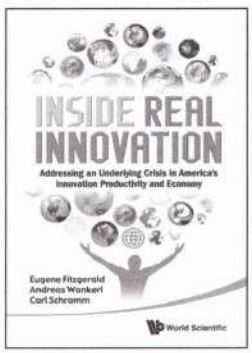
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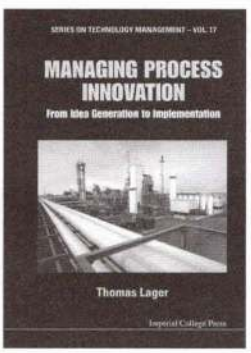
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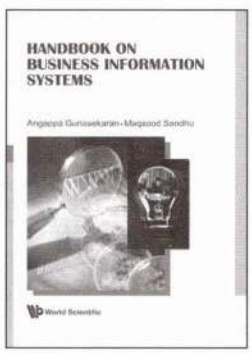
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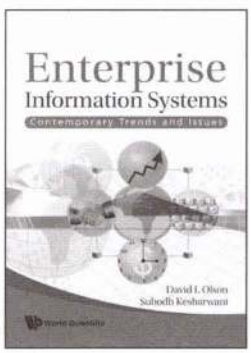
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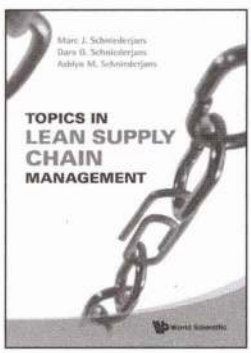
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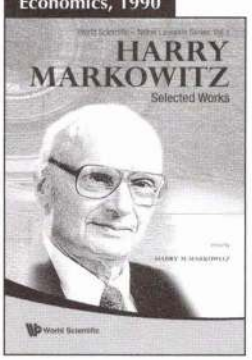
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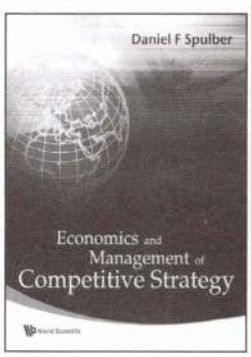
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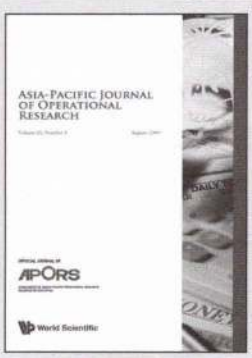
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FRIDAY, NOVEMBER 5

Teaching Effectiveness Colloquium	H – 602, 6th Fl.	7:30am-5:00pm
Combined Colloquium	H – Salon A, 4th Fl.	6:00pm-8:00pm

SATURDAY, NOVEMBER 6

Combined Colloquia		
Breakfast	H – Salon G, 6th Fl.	7:30am-8:00am
Lunch	H – Salon G, 6th Fl.	11:45am-1:15pm
Future Academician Colloquium	H – Salon A, 4th Fl.	8:00am-4:30pm
Future Practitioner Colloquium	H – 400, 4th Fl.	8:00am-4:30pm
Teaching Effectiveness Colloquium	H – 602, 6th Fl.	8:00am-4:30pm
Colloquia Dinner	Off-Site, Iron Cactus Restaurant	7:00pm-9:00pm
Meetings Committee	H – Suite 2637	7:30am-12:00pm
DM-HI Breakfast/Welcome	H – Salon B, 4th Fl.	7:30am-8:30am
DM-HI Workshop	H – 402 & 404, 4th Fl.	8:30am-6:00pm
CIST Conference	H – 408 & 410, 4th Fl.	8:00am-5:00pm
CIST Lunch/Speaker	H – Salon F, 6th Fl.	12:00pm-1:30pm
ISR Editors	H – 415, 4th Fl.	8:30am-3:00pm
Organization Science Competition	C – 13, Level 4	8:30am-5:00pm
INFORMS Executive Committee	H – 401, 4th Fl.	9:00am-11:30am
Vendor Workshops – Session I		
AIMMS (Paragon)	C – 16A, Level 4	9:00am-11:30am
AnyLogic North America	C – 12B, Level 4	9:00am-11:30am
Automatic Forecasting Systems	C – 14, Level 4	9:00am-11:30am
Forio Business Simulations	C – 16B, Level 4	9:00am-11:30am
Maximal Software	C – 15, Level 4	9:00am-11:30am
SAS Global Academic Program	C – 12A, Level 4	9:00am-11:30am
Vendor Workshops – Session II		
Decision Frameworks	C – 12A, Level 4	12:00pm-2:30pm
FICO	C – 12B, Level 4	12:00pm-2:30pm
Frontline Systems	C – 14, Level 4	12:00pm-2:30pm
Gurobi Optimization	C – 15, Level 4	12:00pm-2:30pm
JMP	C – 16A, Level 4	12:00pm-2:30pm
Salford Systems	C – 17A, Level 4	12:00pm-2:30pm
INFORMS Board Meeting	H – 406, 4th Fl.	12:00pm-5:00pm
Vendor Workshops – Session III		
American Optimal Decisions	C – 17A, Level 4	3:00pm-5:30pm
GAMS	C – 12B, Level 4	3:00pm-5:30pm
IBM-ILOG	C – 16B, Level 4	3:00pm-5:30pm
Innovative Scheduling	C – 15, Level 4	3:00pm-5:30pm
LINDO Systems	C – 16A, Level 4	3:00pm-5:30pm
Responsive Learning Technologies	C – 14, Level 4	3:00pm-5:30pm
SAS	C – 12A, Level 4	3:00pm-5:30pm
INFORMS Membership Meeting/Reception	H – Salon B, 4th Fl.	5:00pm-6:00pm
Roundtable Reception	H – 412, 4th Fl.	5:30pm-6:15pm
ISR Senior & Associate Editors	H – 415, 4th Fl.	6:00pm-7:30pm
Roundtable Meeting	H – Salon C, 4th Fl.	6:15pm-7:45pm
University of Texas at Dallas Reception	H – 400, 4th Fl.	6:00pm-9:00pm
Roundtable Dinner	H – 412, 4th Fl.	7:45pm-9:00pm

KEY
H-Hilton
C-Convention Center

For INFORMS Community business meetings, see page 11.

JOB PLACEMENT SERVICES

Job Fair
Sunday
12:00pm-5:00pm
Convention Center – Exhibit Hall 3
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 3
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
Monday – MC59, 1:30pm-3:00pm
Hilton – Salon A, 4th Floor

The Industry Job Search
Monday – MD59, 4:30pm-6:00pm
Hilton – Salon A, 4th Floor

SCHEDULE OF SPECIAL EVENTS

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. Please take advantage of the opportunities to recycle, reuse and reduce as much as you can.

The Austin Convention Center makes every effort to promote sustainable practices, including the use of LED lighting, an intelligent irrigation system, green cleaning products, and more. The goal is to help the City of Austin become carbon neutral by 2020.

Printed Program – approximately 38% 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 Austin. Reference copies of the program will be available at all Session Monitor desks and the Program Information booth (see maps on pages 48-49 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 and Hilton.

Sustainable Registration Materials – both the conference bag and badge holder are made from recycled materials. We hope you will reuse 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.

Recycling Daily – the Center provides clearly marked bins for recyclables. The Hilton sorts and separates all recyclables from its waste receptacles.

KEY
H-Hilton
C-Convention Center

SUNDAY, NOVEMBER 7

Roundtable Meeting	H – Salon E, 4th Fl.	7:00am-4:30pm
JPS Breakfast	H – Salon D, 4th Fl.	7:30am-9:00am
Guest Breakfast	H – Finn & Porter	8:00am-9:00am
INFORMS Board	H – 406, 4th Fl.	8:00am-3:30pm
CIST Conference	H – 408 & 410, 4th Fl.	8:00am-5:00pm
Plenary-McCord Morse: Edward Kaplan	C – Ballroom G, Level 4	10:00am-10:50am
Combined Colloquia Committee	H – 401, 4th Fl.	10:00am-11:00am
CIEADH	H – 402, 4th Fl.	10:00am-5:45pm
OMEGA RHO Lunch/Meeting	H – 401, 4th Fl.	11:00am-1:00pm
Junior Faculty Interest Group Lunch	H – Salon C, 4th Fl.	11:30am-1:00pm
OR Editors Lunch/Meeting	H – 412, 4th Fl.	12:00pm-2:00pm
Keynote: John Weyant	C – Ballroom E, Level 4	3:10pm-4:00pm
Keynote: Edelman Reprise	C – Ballroom G, Level 4	3:10pm-4:00pm
Roundtable/INFORMS Board	H – Salon E, 4th Fl.	4:30pm-5:30pm
New Member Orientation	H – Salon C, 4th Fl.	4:30pm-6:00pm
President's Reception Roundtable	H – 412, 4th Fl.	5:30pm-6:30pm
IOL Reception	H – 410, 4th Fl.	6:00pm-7:00pm
Welcome Reception-Exhibits Open	C – Exhibit Hall 3	7:30pm-9:00pm
Communities Meet-and-Greet	C – Exhibit Hall 3	7:30pm-9:00pm
International Members Meet-and-Greet	C – Exhibit Hall 3	7:30pm-9:00pm
Minority Issues Forum Reception	H – 406, 4th Fl.	8:00pm-9:00pm
Forrest-Fest/COIN-OR Reception	Iron Cactus Grill	8:00pm-10:00pm
Awards Ceremony & Dessert Reception	C – Ballroom G, Level 4	8:30pm-9:45pm

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

MONDAY, NOVEMBER 8

Board/Editors/Committee Chair Breakfast	H – 408, 4th Fl.	7:00am-8:00am
ACORD Breakfast/Meeting	H – 402, 4th Fl.	7:30am-9:00am
Guest Breakfast	H – Finn & Porter	8:00am-9:00am
Chapters/Fora Committee	H – 410, 4th Fl.	9:30am-10:30am
Section/Societies Committee	H – 400, 4th Fl.	9:30am-10:30am
Decision Analysis Editors	H – 412, 4th Fl.	9:30am-11:00am
Plenary-Joan Woodard	C – Ballroom G, Level 4	10:00am-10:50am
Education Committee	H – 402, 4th Fl.	10:00am-11:00am
COIN-OR Members & Users	C – 19B, Level 4	12:15pm-1:15pm
International Activities Committee	H – 410, 4th Fl.	12:30pm-1:30pm
Publications/Editors in Chief	H – 406, 4th Fl.	12:30pm-3:30pm
Service Science PhD Consortium	C – 18C, Level 4	12:30pm-1:30pm
Fellows Luncheon	H – Salon C, 4th Fl.	12:45pm-2:30pm
Subdivisions Council	H – Salon E, 4th Fl.	2:30pm-4:30pm
Keynote-Charles Groat	C – Ballroom E, Level 4	3:10pm-4:00pm
Keynote-Perry Noakes	C – Ballroom G, Level 4	3:10pm-4:00pm
Isolated Academics	H – 402, 4th Fl.	3:15pm-4:15pm
CPMS Isolated Practitioners Workshop	C – 17A, Level 4	6:15pm-7:15pm
Interfaces Editors	H – 401, 4th Fl.	6:15pm-7:15pm
Carnegie Mellon-Tepper Reception	H – 400, 4th Fl.	6:00pm-8:00pm
University of Texas at Austin Reception	H – 410, 4th Fl.	6:30pm-9:00pm
University of Florida ISE Reception	H – 412, 4th Fl.	6:30pm-8:00pm
IFORS 2011 Committee	C – 13A, Level 4	7:00pm-8:00pm
Tsinghau Univ.-Dept. of IE	H – 406, 4th Fl.	7:00pm-8:30pm
Texas A&M University Reception	H – 404, 4th Fl.	7:00pm-9:00pm
University of Michigan Reception	H – 408, 4th Fl.	7:00pm-9:00pm
Military Applications Reception	C – 14, Level 4	7:15pm-10:15pm
University of North Carolina Reception	H – Salon E, 4th Fl.	7:30pm-9:30pm
Wharton School Reception	H – 402, 4th Fl.	7:30pm-9:00pm
Student Reception & Focus Group	H – Salon C, 4th Fl.	7:30pm-9:00pm

TUESDAY, NOVEMBER 9

Chapters/Fora Officers Breakfast	H – Salon D, 4th Fl.	7:00am-8:00am
Transportation Science Editors	H – 401, 4th Fl.	7:30am-9:00am
Austin Area Math Teacher Workshop	Off-Site, UT Austin	8:00am-3:00pm
Student Chapter Officers	H – Salon D, 4th Fl.	8:00am-8:45am
Guest Breakfast	H – Finn & Porter	8:00am-9:00am
Meetings Committee	H – Suite 2637	8:30am-5:00pm
Plenary-Omega Rho: John Birge	C – Ballroom G, Level 4	10:00am-10:50am
Sections/Societies Officers Lunch	H – Salon D, 4th Fl.	12:00pm-1:30pm
JOC Editors Meeting/Lunch	H – Salon E, 4th Fl.	12:30pm-1:30pm
Women in OR/MS Lunch	H – Salon C, 4th Fl.	12:30pm-1:30pm
Edelman Committee	H – Salon E, 4th Fl.	3:00pm-5:30pm
Keynote-Chung-Yee Lee	C – Ballroom E, Level 4	3:10pm-4:00pm
Keynote-Gerald Brown	C – Ballroom G, Level 4	3:10pm-4:00pm
Future Organizing Committee Reception	H – Salon D, 4th Fl.	5:00pm-6:00pm
General Reception	C – Exhibit Hall 5	7:30pm-10:30pm

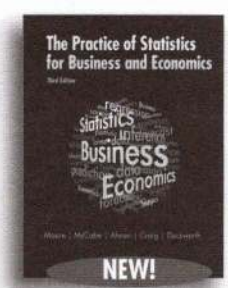


WEDNESDAY, NOVEMBER 10

Keynote-Paul Jensen	C – Ballroom G, Level 4	10:00am-10:50am
Keynote-2010 Wagner Presentation	C – Ballroom E, Level 4	10:00am-10:50am

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http://meetings.informs.org/Austin2010/

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 "#informs2010" to your tweets, and they will appear on the Annual Meeting homepage during the meeting. Also "follow" the official conference twitter feed, INFORMS2010, to make sure you receive important conference announcements.

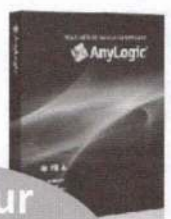
LinkedIn – Connect with other attendees on the Annual Meeting LinkedIn Group to discuss key topics. RSVP to the LinkedIN Meeting Event to let your colleagues know you are attending. Go to the Annual Meeting website homepage to find a link leading to the Annual Meeting LinkedIn group.

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.

eNews Daily – INFORMS will publish the third volume of its popular Annual Meeting eNews Daily in Austin. This official record of the Annual Meeting will be 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 will also be links to each issue on the Annual Meeting website.

Keep INFORMS Weird, Too – Based on the popular theme "Keep Austin Weird," INFORMS will let you know about fun things to do and see while visiting Austin. Keep an eye out for fun items in eNews Daily.

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* And, yes, we have the survey results to show you.

SUNDAY, NOVEMBER 7

Information Systems	H – ~~408, 4th Fl.~~	5:30pm-6:30pm
Aviation Applications	H – Salon G, 4th Fl.	6:15pm-7:15pm
Data Mining & Artificial Intelligence	C – 4A, Level 3	6:15pm-7:15pm
eBusiness	H – 415, 4th Fl.	6:15pm-7:15pm
Energy, Natural Resources & Environment	C – Ballroom D1, Level 4	6:15pm-7:15pm
Forum on Education (INFORM-ED)	C – 8B, Level 3	6:15pm-7:15pm
Location Analysis	C – 11A, Level 4	6:15pm-7:15pm
Manufacturing & Service Operations Mgt.	C – Ballroom E, Level 4	6:15pm-7:15pm
Military Applications Board	C – 12, Level 2	6:15pm-7:15pm
Minority Issues Forum	H – 404, 4th Fl.	6:15pm-7:15pm
Multiple Criteria Decision Making	C – 13B, Level 4	6:15pm-7:15pm
Optimization	C – 10B, Level 3	6:15pm-7:15pm
Railway Applications	H – Salon F, 6th Fl.	6:15pm-7:15pm
Revenue Management & Pricing	C – 17B, Level 4	6:15pm-7:15pm
Service Science	C – 18B, Level 4	6:15pm-7:15pm
Simulation	C – 1, Level 1	6:15pm-7:15pm
Telecommunications	C – 14, Level 2	6:15pm-7:15pm
Transportation Science & Logistics Board	H – Salon K, 6th Fl.	6:15pm-7:15pm
Decision Analysis Council	C – 13A, Level 4	6:15pm-7:30pm
Revenue Management & Pricing Board	C – 17B, Level 4	7:15pm-8:15pm

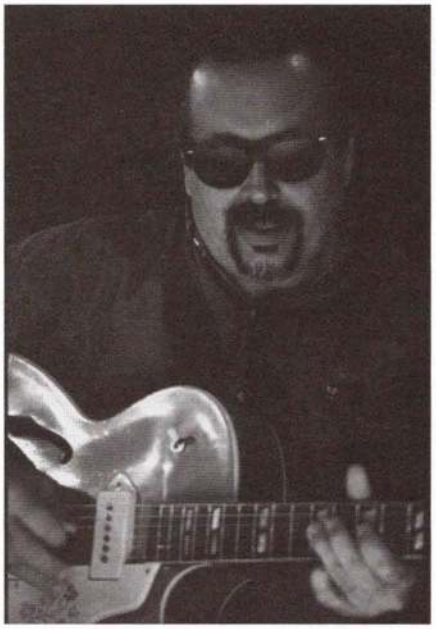
MONDAY, NOVEMBER 8

Public Programs, Services & Needs	C – Ballroom B, Level 1	12:30pm-1:30pm
Analytics Section Member Drive	H – 415, 4th Fl.	6:00pm-7:00pm
Decision Analysis	H – Salon B, 4th Fl.	6:00pm-7:15pm
Technology Management	C – 16, Level 2	6:00pm-7:15pm
Applied Probability	C – 8C, Level 3	6:15pm-7:15pm
Computing	C – 6A, Level 3	6:15pm-7:15pm
Financial Services	C – 3, Level 1	6:15pm-7:15pm
Health Applications	C – 1, Level 2	6:15pm-7:15pm
Military Applications	C – 14, Level 4	6:15pm-7:15pm
Quality, Statistics & Reliability	C – 5B, Level 3	6:15pm-7:15pm
Spreadsheet Productivity Research	C – 6, Level 2	6:15pm-7:15pm
Transportation Science & Logistics	H – Salon K, 6th Fl.	6:15pm-7:15pm
Women in OR/MS	C – 9C, Level 3	6:15pm-7:15pm
Behavioral Operations Management	C – 15, Level 4	7:15pm-8:15pm
Military Applications Reception	C – 14, Level 4	7:15pm-10:15pm

TUESDAY, NOVEMBER 9

CPMS Council	H – Salon E, 4th Fl.	7:00am-9:00am
SpORts	H – 404, 4th Fl.	6:00pm-7:00pm

KEY
H-Hilton
C-Convention Center



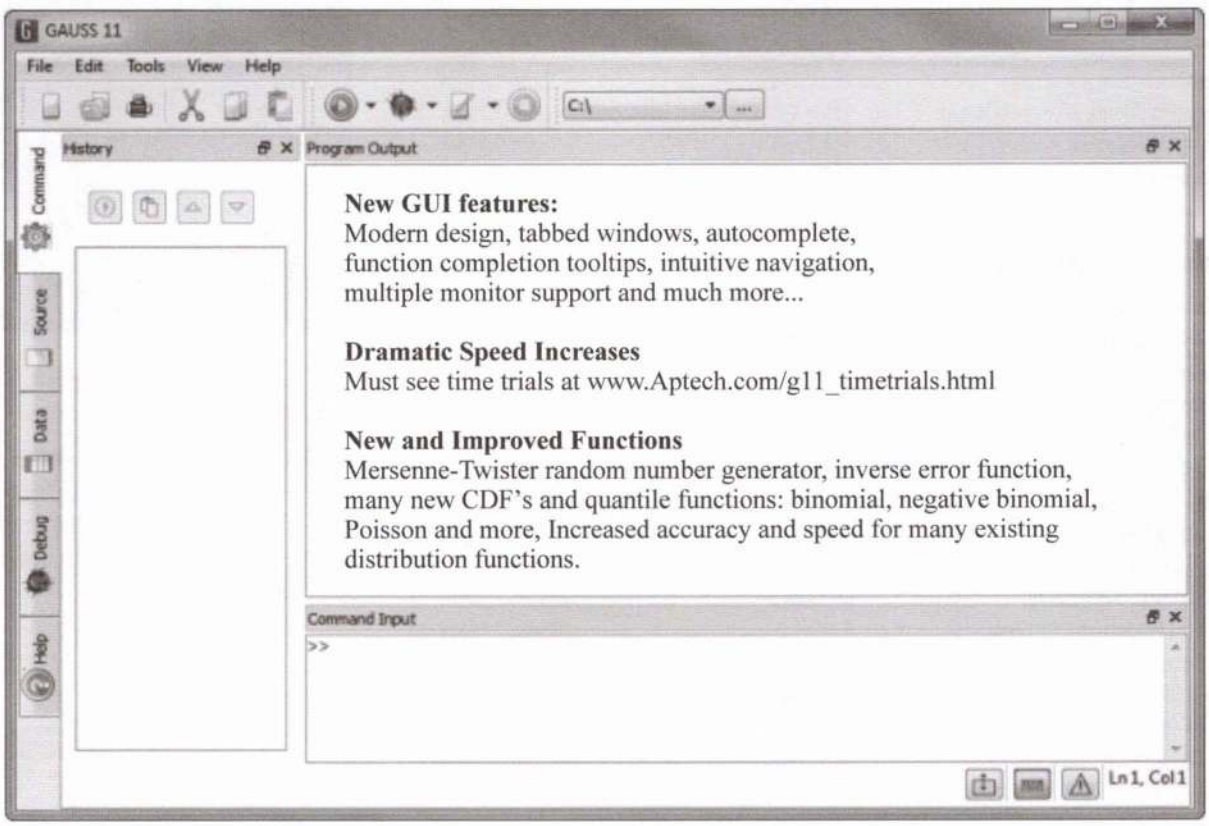
SPEAKERS BOOK STORE AT INFORMS BOOTH

The INFORMS Speakers Bookstore will feature recent publications written by a number of this year's INFORMS Annual Meeting presenters. Stop by INFORMS booth #46-47 in the exhibit hall to check out a wide selection of titles.

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SPEAKER GUIDELINES

Audio-Visual Services

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 data stick as a backup.

Speaker Ready Room

There will be a Speaker Ready Room available in the Convention Center, Exhibit Hall 3, 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, Exhibit Hall 3 (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 both the Convention Center and Hilton (see maps on pages 48-49 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).

EXHIBITS

Name badges must be worn for admittance to the Exhibit Hall, located in the Convention Center, Exhibit Hall 3, Level 1, during the following hours:

Sunday, Nov. 7	12:00pm-5:00pm 7:30pm-9:00pm* (Welcome Reception)
Monday, Nov. 8	9:00am-5:00pm
Tuesday, Nov. 9	9:00am-5:00pm
Wednesday, Nov. 10	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.

THANK YOU

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AIMMS 3

FREE INTERNET AT CONVENTION CENTER

Free wireless Internet and an email center are located in the Convention Center, Exhibit Hall 3, 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 during the following hours:

Sunday, Nov. 7	7:00am-5:00pm
Monday, Nov. 8	9:00am-5:00pm
Tuesday, Nov. 9	9:00am-5:00pm
Wednesday, Nov. 10	9:00am-1:00pm

In addition, free wireless Internet is available throughout the Convention Center, including in meeting rooms.

Hilton: there is no complimentary wireless available at the Hilton. Hotel guests can access the Internet for $13.95 for a 24-hour time frame.

BUSINESS CENTERS

Hilton: a UPS Store is located on the 1st floor. Hours are: Saturday-Sunday, 9:00am-5:00pm; Monday-Wednesday, 7:00am-7:00pm.

Convention Center: the Convention Center business center is open Monday-Wednesday, 8:00am-5:00pm. It is located just outside Exhibit Hall 3.

REGISTRATION

Badges Required for Technical Sessions

INFORMS Annual Meeting 2010 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, 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, Finn & Porter Restaurant, Main Lobby). 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 (#41-43 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

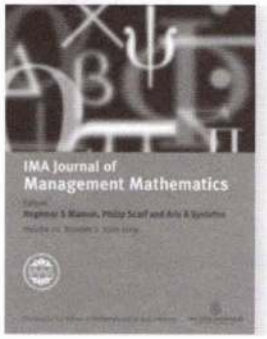
A luggage check area will be located in the Convention Center, Exhibit Hall 3. The luggage check will be open on Tuesday, 7:00am-6:15pm and Wednesday, 7:00am-5:00pm.

Austin Visitor Information

An Austin Visitor Center representative will have a desk in the Exhibit Hall near registration on Saturday, 2:00pm-6:00pm and on Sunday and Monday 9:00am-5:00pm. Stop by for information on what to see and do in Austin.

EXCELLENCE IN EVIDENCE

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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, Finn & Porter Restaurant, Main Lobby
Sunday-Tuesday, 8:00am-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

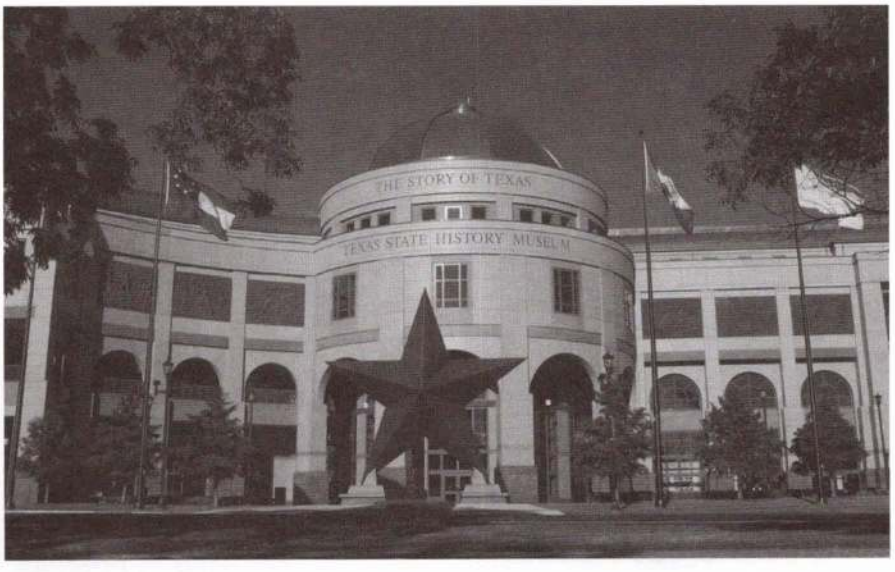
You may still be able to register for the following guest tours. Go to the INFORMS Registration Desk for information on availability. **Meet in the Hilton, North Lobby entrance (5th St.) for guest tour departures.** Buses will leave at the beginning time listed for each tour, and will return to the Hilton at the ending time listed.

Tour of Austin Art

Sunday, November 7
12:00pm-5:00pm $55 (lunch not included)
The tour visits three Austin area museums. First is the University of Texas Harry Ransom Humanities Research Center, a library, museum and archive, specializing in the collection of literary and cultural artifacts from the U.S. and Europe. Next is the University of Texas Blanton Museum of Art, home to a collection of over 17,000 works of art, recognized for its European Old Master paintings and Latin American art. Finally, the tour proceeds to the Umlauf Sculpture Garden and Museum, featuring more than 130 paintings, sculptures and drawings by Charles Umlauf and rotating exhibits from other artists.

Texas Legends & Lore Tour

Monday, November 8
9:00am-1:30pm $54 (lunch not included)
The first highlight of the tour is a visit to the impressive State Capitol Building with a dome of 309 feet, over fourteen feet higher than the U.S. Capitol. Next is a visit to the Lyndon Baines Johnson Library and Museum, featuring displays on the landmark Civil Rights Programs, the war in Vietnam and more. Finally, the Bob Bullock Texas State History Museum will take you on a journey through Texas history.



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 Hilton, North Lobby entrance (5th St.) for plant tour departures.** Buses will leave at the beginning time listed for each tour, and will return to the Hilton at the ending time listed.

AMD Lone Star Campus

Monday, November 8
9:00am-12:00pm $35
AMD's "Lone Star" campus, home to AMD's Austin business operations and the Austin design engineering center, was designed and constructed by a diverse team of internationally recognized architects, engineers, ecologists and sustainability experts. The site development plan was based on three key tenets: limit site impact, protect water quality and use innovative sustainable design. The tour will provide the opportunity to gain a greater understanding of AMD's LEED® Gold (Leadership in Energy and Environmental Design) campus including rainwater collection systems and native landscape design.

Freescale Semiconductor, ATMC

Tuesday, November 9
9:00am-11:00am $35
Freescale's Austin Technology and Manufacturing Center (ATMC) is a 200mm wafer fab specializing in automotive, consumer, industrial, networking and wireless applications. Prestigious brands like BMW, Whirlpool, Datang, Dolby, Logitech, Electrolux, Toshiba, Motorola and Pioneer are among their 18,000 customers. The guided window tour of the 135,000 square foot facility will provide a rare view into semiconductor manufacturing, accompanied with a corporate overview and in-depth examples on how Freescale ATMC utilizes operations research and management science in its everyday operations.

YOUR BADGE IS YOUR TICKET

Wear your badge for admission to these events; your meeting registration fee includes these 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 and continental breakfasts on Sunday, Monday and Tuesday.

SUNDAY

WELCOME RECEPTION & EXHIBITS

7:30pm-9:00pm
Convention Center
Exhibit Hall 3

INFORMS and the Austin Organizing Committee welcome you to the 2010 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. Soft drinks and water are complimentary, with a cash bar available for other beverages.

THANK YOU

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INFORMS AWARDS CEREMONY & DESSERT RECEPTION

8:30pm-9:45pm (Doors close at 8:45pm*)
Convention Center
Ballroom G, Level 4

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 take the escalators up to Level 4 for the Awards Ceremony. Following the ceremony, you'll have an opportunity to congratulate the awardees at a special dessert reception.

Please note: the 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
Edward H. Kaplan, Yale University

INFORMS Impact Award
Frontline Systems, Inc.
Fred W. Glover, OptTek Systems, Inc.

INFORMS President's Award
Jonathan P. Caulkins, Carnegie Mellon University

INFORMS Prize for the Teaching of ORMS Practice
Michael F. Gorman, University of Dayton

George Kimball Medal
James C. Bean, University of Oregon
Lawrence M. Wein, Stanford University

John von Neumann Theory Prize
Peter W. Glynn, Stanford University
Soren Asmussen, Aarhus University

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. In addition, the winners of the Bonder Scholarship for Applied Operations Research in Health Science and in Military Applications will be presented.

THANK YOU

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TUESDAY

GENERAL RECEPTION WILD WEST PARTY

7:30pm-10:30pm
Convention Center – Exhibit Hall 5

Take a trip to the Wild West! We'll be serving great food during the evening, featuring a barbecue buffet of baked potatoes, smoked brisket, chicken, baked beans, Texas toast and hot fruit cobbler. Vegetarian choices will also be included. Non-alcoholic beverages are complimentary; a cash bar will be available for other beverages

Entertainment throughout the evening will include:

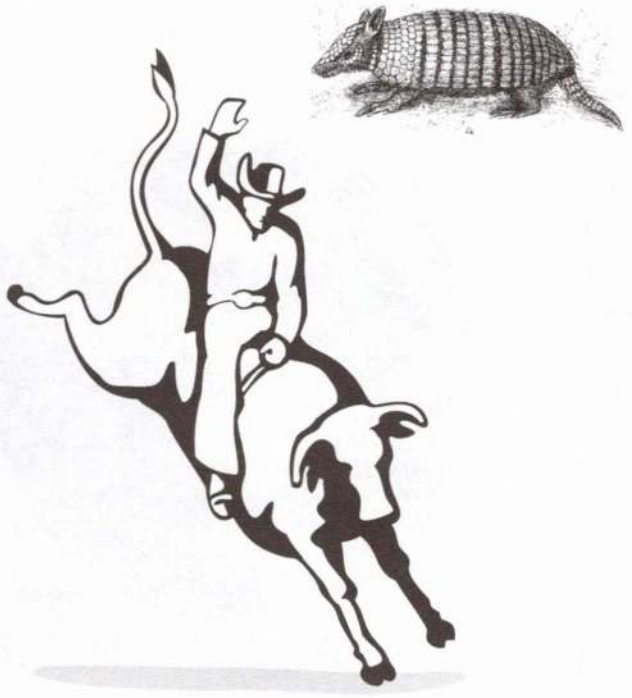
Texas Unlimited Band – this band specializes in both classic and current country western tunes, with a strong repertoire of rock songs, too.

Live Armadillo Races – place your bets! Become part of the action in this race among live, tame Texas critters with fun prizes for winners. You can also pose for pictures with the animals.

Old West Photo Booth – take home a memory of the Wild West at the Old West Photo Booth!

Mechanical Bull – see how long you can hold on! Test your skill on the bull, who has a well-padded, inflatable mat for a saddle.

Dance Like a Texan! – Sherry Reynolds, previously a competitor in international ballroom dancing and now an expert on the country circuit, will give lessons on different Texas dance styles.



INFORMS HEALTHCARE 2011

June 20-22, 2011 Montreal, Canada Hilton Bonaventure

A new INFORMS thematic conference on the **health sector** that brings together researchers and stakeholders to elaborate on current challenges.

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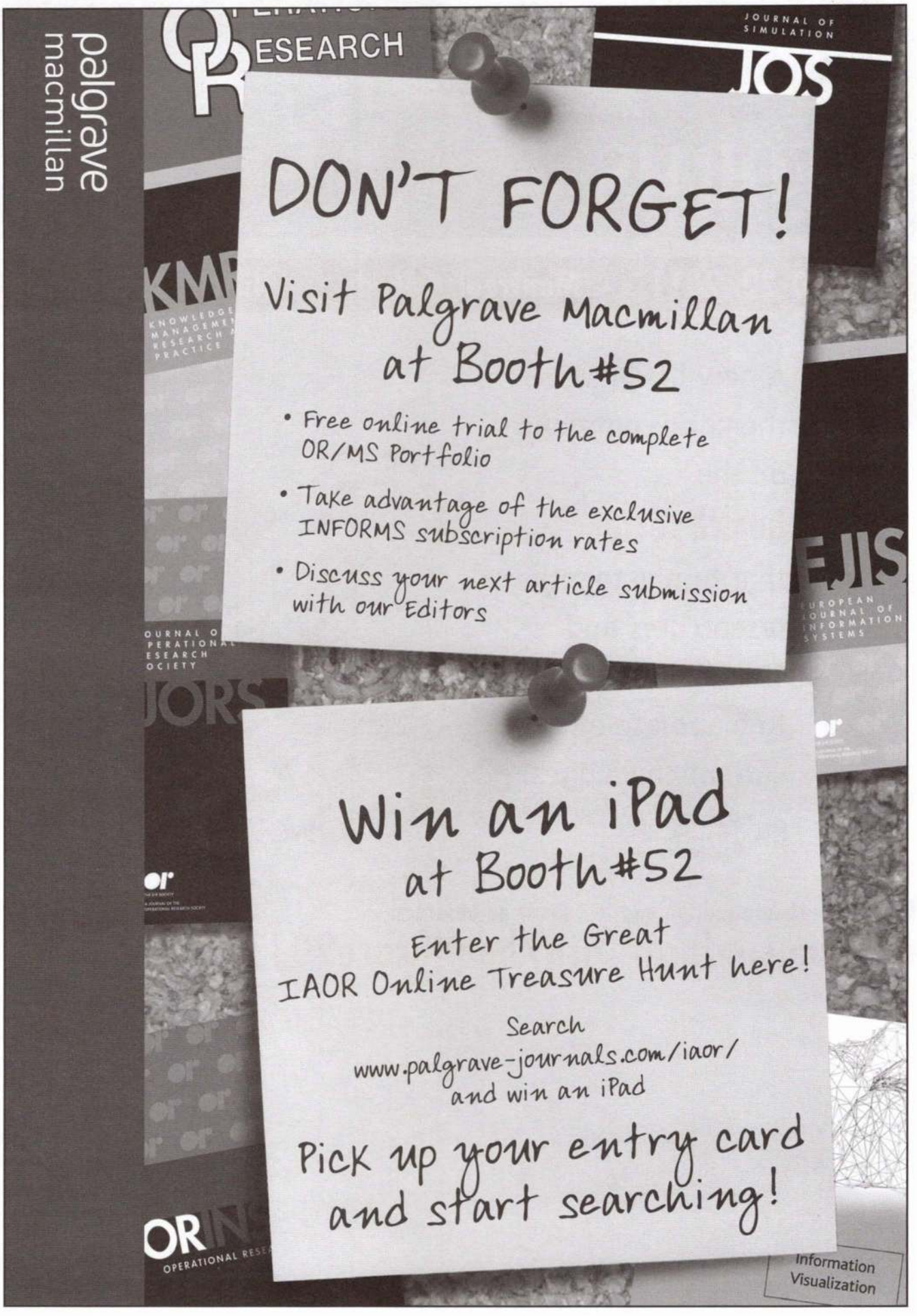
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SATURDAY, NOVEMBER 6

INFORMS Membership Meeting & Reception
5:00pm-6:00pm
Hilton – Salon B, 4th Floor
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 7

Junior Faculty Interest Group Luncheon
11:30am-1:00pm
Hilton – Salon C, 4th Floor
$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. A buffet lunch will be served.

Sponsored by Texas A&M University, Industrial Distribution Program; University of Alabama, College of Commerce and Business Administration; University of Arkansas, Dept. of Industrial Engineering

INFORMS Online Reception
6:00pm-7:00pm
Hilton – Room 410, 4th Floor
What's your online strategy for yourself or for your INFORMS community? How can INFORMS Online (IOL) help you advance that? Come and tell us over refreshments and drinks. We are your IOL team.

Communities Meet-and-Greet
7:30pm-9:00pm
Convention Center – Exhibit Hall 3
It's a big meeting - make it personal and come introduce yourself to the members of the many INFORMS communities! Sections, societies, fora, and geographical chapters will host tables during the Welcome Reception. You're invited to stop by, have a drink, enjoy some refreshments, chat about community events and meet new people who share your interests.

International Members Meet-and-Greet
7:30pm-9:00pm
Convention Center – Exhibit Hall 3
Are you traveling to Austin, Texas from outside the United States? The International Activities Committee (IAC) will host a table for international attendees during the Welcome Reception. You're invited to stop by and meet the members of the IAC, and the many INFORMS members who hail from around the globe!

Minority Issues Forum Reception
8:00pm-9:00pm
Hilton – 406, 4th Floor
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; Cornell University, O.R. and Information Engineering; Princeton University, O.R. and Financial Engineering; Rice University, Applied Mathematics; University of South Florida; University of Southern California, Viterbi School of Engineering; Dr. James E. Moore, University of Southern California

Forrest-Fest/COIN-OR 10th Reception
8:00pm-10:00pm
Iron Cactus Mexican Grill & Margarita Bar
Corner of Trinity & 6th Streets
This year marks the 10th anniversary of COIN-OR, and coincidentally, the "retirement" of John Forrest–the mastermind behind some of the most widely used open-source software packages for optimization in the world. Join the 10th year celebration and come congratulate John! Festivities will include the awarding of the 2010 COIN-OR Cup. See https://projects.coin-or.org/Events/wiki/JJHFCOIN10 for details.

NEW MEMBER WELCOME & ANNUAL MEETING ORIENTATION SESSION

Sunday, 4:30pm-6:00pm
Hilton – Salon C, 4th Floor

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 from key INFORMS leaders, a thorough orientation to navigating the meeting from Annual Meeting veterans, and a chance to relax and network with colleagues.

MONDAY, NOVEMBER 8

COIN-OR Members & Users Meeting - Bag Lunch
12:15pm-1:15pm
Convention Center – Room 19B, Level 4
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.

CPMS Isolated Practitioner Workshop & Reception
6:15pm-7:15pm
Convention Center – 17A, Level 4
CPMS, The Practice Section of INFORMS, sponsors this workshop on topics of interest to isolated practitioners, the "Lone Rangers" of OR/MS. This 27th workshop will address timely issues that affect isolated practitioners. All are welcome to participate. Wine and cheese will be served.

Student Reception & Focus Group
7:30pm-9:00pm
Hilton – Salon C, 4th Floor
All students registered for the meeting are encouraged to attend this special reception for an opportunity to socialize and network with other students. We invite you to participate in a Focus Group at the reception. INFORMS leaders want to know how they can serve you better - this is your chance to tell them.

Sponsored by GAMS Development Corporation



TUESDAY, NOVEMBER 9

Women in OR/MS Forum Luncheon
12:30pm-1:30pm
Hilton – Salon C, 4th Floor
$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 IBM; SAS; University of Pittsburgh, IE Dept.; Harvey Mudd College, Dept. of Math; Texas A&M University; Arizona State University; Northwestern University; Penn State University, IE Dept.; University of Texas-Arlington; Harlan Crowder Photography; Naval Postgraduate School Foundation; Mississippi State University.

DM-HI WORKSHOP

5th INFORMS Workshop on Data Mining and Health Informatics

Breakfast/Welcome Session
7:30am-8:30am – Hilton, Salon B, 4th Floor

Workshop
8:30am-6:00pm
Hilton, Rooms 402 & 404, 4th Floor

The Data Mining (DM), Artificial Intelligence (AI) and Health Applications (HA) sections of INFORMS are jointly organizing this workshop. The DM, AI and HA 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 HA. This workshop highlights the frontiers of fundamental and applied research in DM, AI and HA.

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VENDOR WORKSHOPS

All Vendor Workshops are located in the Convention Center, Level 4

9:00am - 11:30am

AIMMS-Paragon Decision Technology - Robust Optimization in the Face of Uncertainty
Room 16A

AnyLogic North America - How do you skin a simulated cat?
Room 12B

Automatic Forecasting Systems, Inc. - Autobox Automatic System
Room 14

Forio Business Simulations - Forio Simulate
Room 16B

Maximal Software, Inc. - Optimization Modeling with MPL and Python: Integrating Optimization in Real-World Business Applications
Room 15

SAS Global Academic Program
Room 12A

12:00pm - 2:30pm

Decision Frameworks, Inc. - Decision Framing for Project Management
Room 12A

FICO - Solving Super-Size Problems with FICO Xpress Optimization Suite
Room 12B

Frontline Systems, Inc. - Optimization and Simulation Models from Excel to Your Intranet or Web Server
Room 14

Gurobi Optimization - Introducing Gurobi 4.0: Quadratic Programming and More
Room 15

JMP Division, SAS Institute - Exploration, Visualization and Experimentation with JMP
Room 16A

Salford Systems - Data Mining Platform
Room 17A

3:00pm - 5:30pm

American Optimal Decisions - Portfolio Safeguard
Room 17A

GAMS Development Corp. - Using GAMS Modeling Tools
Room 12B

IBM - The IBM Advanced Analytics Forum Preconference Event
Room 16B

Innovative Scheduling, Inc. - Solving Complex Scheduling Problems through Decomposition and Network Flows
Room 15

LINDO Systems, Inc. - The Art of Modeling with LINGO and What's Best!
Room 16A

Responsive Learning Technologies, Inc. - Play Online Games for Operations Management and Supply Chain Courses
Room 14

SAS - Solving Business Problems with OPT-MODEL and SAS
Room 12A



Whether you work in industry, government or consulting, you'll find the best applications resources at the INFORMS Annual Meeting.

Reprise: 2010 Edelman Award-Winning Presentation: Indeval, S.A.

Sponsored by CPMS, The Practice Section of INFORMS
Sunday: Keynote, 3:10pm-4:00pm
Convention Center – Ballroom G, Level 4
The Edelman Prize recognizes analytics projects that had major impacts on their client organizations. Indeval, S.A. presents their work on a new operating and settlement system using operations research, which resulted in the strengthening of the Mexican financial infrastructure.

2010 Edelman Finalists, 2010 INFORMS Prize Winner, Practice of OR/MS

Sunday-Tuesday
Convention Center – Room 16B, Level 4
Track 17
Highlights of the practice of OR/MS sessions include presentations by Edelman Finalists Sasol, Deutsche Post DHL, Delaware River Basin Commission and Procter & Gamble. Jeppesen, the INFORMS Prize winner, will present their work on Monday (MB31-Room 5C, Level 3). Additional presentations feature O.R. in practice at Boeing, IBM, UPS, Dow Chemical and General Electric.

CPMS: The Practice Section of INFORMS

Sunday-Wednesday
Convention Center – Room 17A, Level 4
Track 18
Real-world applications are the focus of sessions organized by CPMS, the Practice Section of INFORMS. Included are presentations by speakers from Sears, IBM, Sandia National Labs and Ford. Practical application of O.R. in healthcare, transportation and manufacturing are featured.

Software Demonstrations

Sunday-Wednesday
Convention Center
See pages 35-37 for abstracts and schedule.
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.

Tutorials

Sunday-Wednesday
Convention Center
See pages 31-33 for abstracts and schedule.
These 90-minute sessions offer an in-depth look at current methodologies. Topics include fraud detection in online transactions, optimal control of queueing networks, online optimization, risk applications in commercial nuclear power, decentralized supply risk management, optimization in competitive electricity markets, mathematical approaches to infectious disease control, and more.

All attendees receive free access to the INFORMS 2010 TutORials in Operations Research online book concurrently with the Meeting! For access, go to http://www.informs.org/Journal/Tutorials-in-OR/2010-TutORials-in-Operations-Research-ONLINE and enter your INFORMS member username and password. If you do not know your username or password, you may request it at that link. You can order the 2010 book or previous volumes (CDs 2005-2009) through the TutORials website http://www.informs.org/Journal/Tutorials-in-OR. For more information, visit INFORMS booths 46-47.

Analytics: The Future of INFORMS?

Monday, 4:30pm-6:00pm
Hilton – Room 415, 4th Floor
Please join Anne Robinson, VP of Marketing, Communications and Outreach, and Jack Levis, VP of Practice, along with other INFORMS leaders to learn about the results of the recent Analytics Market Study and discuss how the results relate to the future of INFORMS. Stay afterwards to sign up for a new Analytics Section of INFORMS.

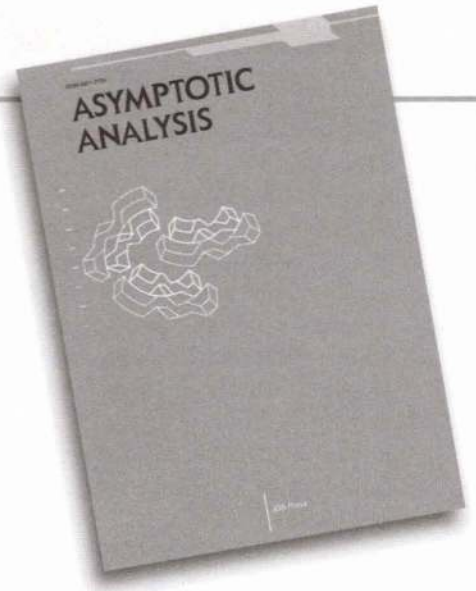
CPMS Isolated Practitioner Workshop & Reception

Monday, 6:15pm-7:15pm
Convention Center – Room 17A, Level 4
This special event is geared to the interests of isolated practitioners, the "Lone Rangers" of OR/MS. The 27th workshop in this series will address timely issues that affect the isolated practitioner community. All are welcome; wine and cheese will be served.

2010 Daniel H. Wagner Prize Competition

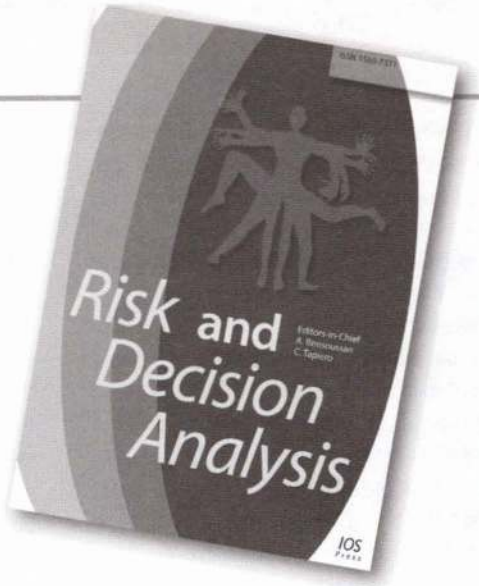
Sponsored by CPMS, The Practice Section of INFORMS
Tuesday
Convention Center – Ballroom G, Level 4
Track 7 (TB, TC, TD)
The Wagner Prize Competition recognizes the quality and coherence of analysis used in practice, with an emphasis on good writing, strong analytical content and verifiable practice success. 2010 competitors include GE Global Research (optimal product offers to bank customers), Blockbuster Distribution (scheduling model for order processing), Georgia Tech/CDC (vaccine scheduling tool), Kimberly-Clark Latin America (optimal scheduling system) and IBM Research (O.R. models for planning human capital supply chains). The winner will be announced and will reprise their presentation at the Wednesday morning keynote session (Ballroom E, Level 4).





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Asymptotic Analysis

Aims and Scope
The journal *Asymptotic Analysis* fulfills a twofold function. It aims at publishing original mathematical results in the asymptotic theory of problems affected by the presence of small or large parameters on the one hand, and at giving specific indications of their possible applications to different fields of natural sciences on the other hand. *Asymptotic Analysis* thus provides mathematicians with a concentrated source of newly acquired information which they may need in the analysis of asymptotic problems.

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Subscription Information
Asymptotic Analysis (ISSN 0921-7134) will be published in 5 volumes of 4 issues in 2011 (Volumes 71-75).
Institutional subscription (print and online):
€1660 / US$2275
Institutional subscription (online only):
€1470 / US$2000
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€250 / US$300

Risk and Decision Analysis

Aims and Scope
The interdisciplinary journal *Risk and Decision Analysis* emphasizes on convergence, synergies and risk. It will be a useful and high quality publication, bridging theory and practice. Problems considered for publication include industrial operations and services management, finance, insurance, energy, safety and security, healthcare, environment, and related areas, based on risk based techniques (statistics, probabilities), Bayesian statistics and learning, stochastic modeling, stochastic and optimal control.

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Subscription Information
Risk and Decision Analysis (ISSN 1569-7371) will be published in 1 volume of 4 issues in 2011 (Volume 2).
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Institutional subscription (online only): €355 / US$446
Individual subscription (online only): €100 / US$115

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2010 Combined Colloquia and Teaching Effectiveness Colloquium
Friday-Saturday
Hilton - schedule and room locations on page 7.
The Teaching Effectiveness Colloquium (TEC) is a two-day program beginning on Friday morning. The 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, SAS and University of North Carolina at Chapel Hill.

Organization Science: Dissertation Proposal Competition
Saturday, 8:30am-5:00pm
Convention Center – Room 13, Level 2
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 2010 – Conference on Information Systems and Technology
Saturday-Sunday
Hilton – Rooms 408 & 410, 4th Floor
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 University of Texas at Austin; University of Texas at Dallas; Carnegie Mellon University; Indian School of Business; Purdue University; University of Connecticut; University of Minnesota; University of Washington; and Georgia Institute of Technology.

Service Science Section Doctoral Consortium
Monday, 12:30pm-1:30pm
Convention Center – Room 18C, Level 4
The main objectives of the consortium are networking and information-sharing. The consortium will be an opportunity for PhD students to discuss their research and career plans with senior members of the service science community from industry and academia.

Sponsored by IBM Research.

Professional Issues – Special Panels
Sunday-Tuesday
Convention Center – Room 7, Level 2-Mezzanine
Track 46
These special sessions are of broad interest to the OR/MS Community. Topics include:
- Social Networking & O.R.
- O.R. in Engineering Schools
- INFORMS Journals
- Success as a Junior Faculty
- OR/MS in Business Schools
- Academic Administration & OR/MS
- Skills & Career Paths in Industry

In Honor of William W. Cooper
Sunday-Wednesday
Hilton – Salon H, 6th Floor
Track 71
William W. Cooper is a unique academic who has made significant contributions to a wide range of disciplines such as management science, economics, statistics, accounting and information systems. The presentations in this track will focus on Dr. Cooper's role as an outstanding mentor and teacher, and contemporary research following his seminal work in mathematical programming and data envelopment analysis.

John Forrest-Fest & COIN-OR 10th Anniversary
Sunday-Wednesday
Convention Center – Room 9C, Level 3
Track 40
This special cluster commemorates the 10th anniversary of COIN-OR, and the "retirement" of John Forrest, the lead author of some of the most widely used open-source software packages for optimization in the world. The Computational Infrastructure for Operations Research (COIN-OR) was launched by IBM Research in 2000 as an experiment to promote open-source tools, standards, distribution, licensing information and other infrastructure needed by O.R. software developers and users. In the ten years of its existence, COIN-OR has grown into an independent, active and important force in the O.R. world which now hosts and supports more than 40 projects, spanning much of computational O.R. John Forrest was instrumental in COIN-OR's success; this year he retired from IBM Research and as project manager of the COIN-OR Branch-and-Cut (CBC) library and the COIN-OR Linear Program (CLP) solver. All attendees are invited to join this duo-celebration and associated reception on Sunday night. For more details, see https://projects.coin-or.org/Events/wiki/JJHF-COIN10.

Austin Area Workshop on O.R. for High School Math Teachers
Tuesday
University of Texas at Austin

Two Sessions
Full Day: 8:00am-3:00pm
Deterministic and Probabilistic Real-World Decision Models

Evening: 4:30pm-7:30pm
Deterministic Real-World Decision Models

This workshop is based on a curriculum developed under NSF-funded Project MINDSET, (Mathematics Instruction using Decision Science and Engineering Tools). MINDSET is developing, implementing and evaluating a two-semester course for high school seniors based on the mathematics of operations research. The project team has already developed two semester-long texts, one in deterministic decision making and the other for probabilistic decision making. These texts are currently being used by hundreds of students in dozens of high schools in Michigan, North Carolina and San Diego, CA. The primary goal of this workshop is to provide high school teachers with an experience using sample operations research material from project MINDSET. The workshop leader is Kenneth Chelst, Wayne State University.

Sponsored by INFORMS, University of Texas at Austin, National Science Foundation, Wayne State University, North Carolina State University and University of North Carolina-Charlotte.

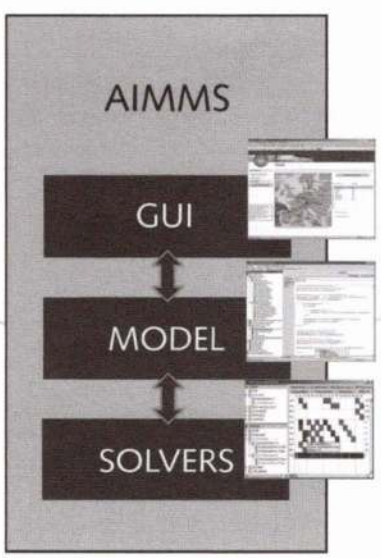
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SUNDAY

WELCOME & PHILIP MCCORD MORSE LECTURE

10:00am-10:50am
Center, Ballroom G, Level 4

Welcome

Susan L. Albin
President, INFORMS
Professor and Graduate Director
Rutgers University

Jonathan Bard
General Chair
INFORMS Annual Meeting Austin
Professor of Operations Research and Industrial Engineering, University of Texas at Austin

Philip McCord Morse Lecture

Intelligence Operations Research

Edward H. Kaplan
William N. and Marie A. Beach Professor of Management Sciences
Professor of Public Health, Professor of Engineering
Yale School of Management

The talk will address applications of operations research to intelligence problems in national security and counterterrorism. The phrase "intelligence operations research" can be interpreted in two different ways: as *intelligence operations* research, meaning studies to characterize and improve the operations of intelligence agencies themselves, and as intelligence *operations research*, meaning the application of operations research methods to specific substantive intelligence problems. After defining intelligence, Kaplan will review the intelligence production process (or the intelligence cycle) with reference to the intelligence community of the United States. He then considers the extent to which operations research has been deployed inside this intelligence community, and summarizes previous attempts to apply operations research methods to intelligence problems. He will close with some suggestions for future intelligence operations research studies.



Edward H. Kaplan has had his research reported on the front pages of the *New York Times* and the *Jerusalem Post*, editorialized in the *Wall Street Journal*, recognized by the *New York Times Magazine's Year in Ideas*, and discussed between the covers of other prominent news magazines. The author of more than 125 research articles, Kaplan received the Lanchester Prize and the Edelman Award, two top honors in the operations research field. An elected member of the National Academy of Engineering and the Institute of Medicine of the US National Academies, he has twice received the Lady Davis Visiting Professorship at the Hebrew University of Jerusalem, where he has investigated AIDS policy issues facing the State of Israel. Kaplan's current research focuses on the application of operations research to problems in counterterrorism and homeland security. He serves on the National Research Council's Committee on Behavioral and Social Science Research to Improve Intelligence Analysis for National Security, is a member of the Intelligence Community Associates Program, and co-directs the Daniel Rose Technion-Yale Initiative in Homeland Security and Counterterror Operations Research.

KEYNOTE

3:10pm-4:00pm
Center, Ballroom G, Level 4

Reprise of 2010 Edelman Award-Winning Presentation

Indeval Develops a New Operating and Settlement System Using Operations Research

Presenters:
Héctor Anaya-Doll, Arturo Palacios-Brun and Jaime A. Villaseñor, S.D. Indeval, S.A. de C.V.
Francisco Solís, Banco de México
Miguel de Lascurain, David F. Muñoz, Instituto Tecnólogico Autónoma de México

Co-authors:
Francisco J. Herrería Valdés, S.D. Indeval, S.A. de C.V.
Luis de los Santos Cayetano, Banco de México
Omar Romero Hernández, Instituto Tecnólogico Autónoma de México

Indeval, the Mexican Central Securities Depository for all financial securities, manages Dalí, the Securities Settlement System (SSS), which has as its core an O.R. engine. In 2005, Indeval, the Central Bank and ITAM started a project for the implementation of a safer, reliable and efficient SSS. Communication protocols, business rules and best market practices were revised, and a new settlement environment and solution was devised. Business Process Modeling Notation was used to redesign all business processes, and simulation to test the SSS. As a result, financial intermediaries save over US$ 150 million a year by not having to provide daily liquidity in the order of US$ 130 billion to settle over US$ 250 billion in daily securities transactions. However, the most important benefit of the implementation of O.R. in the new SSS is the enhancement and strengthening of the Mexican financial infrastructure. This could not have been accomplished without the novel O.R. application at the "heart" of the Mexican financial sector.

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 2010 finalists include the Delaware River Basin Commission, Deutsche Post DHL, New Brunswick Department of Transportation, Procter & Gamble and Sasol. In this keynote, the first-place Indeval team will reprise their winning presentation.

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***Tracking Costs of Time and Money: How Accounting Periods Affect Mental Accounting**
Robin L. Soster, Ashwani Monga, and William O. Bearden

KEYNOTE

3:10pm-4:00pm
Center, Ballroom E, Level 4

Climate and Energy Policy Analyses: Current Status and Future Directions

John P. Weyant
Professor of Management Science and Engineering
Stanford University

The talk will give an overview of the current generation of energy and climate change policy analyses, and make suggestions for future work. The alternative techno-economic input assumptions, policy architectures and policy instruments used in these analyses in searching for best practices, policy insights, and directions for improvement will be reviewed. State, federal and global issues/analyses will be described and results summarized. Idealized policy architectures provide useful benchmarks and are relatively easy to analyze, but are not very realistic given current and likely future institutional constraints. Projecting the impacts of increased expenditures on energy R&D and energy efficiency programs continue to be among the most popular proposals, but they present analysts with rather significant challenges in terms of basic understanding and data availability. Current and possible future approaches to the most difficult of these modeling challenges will be highlighted. The Energy Modeling Forum, National Academy of Sciences, Intergovernmental Panel on Climate Change, as well as relevant state and US government studies, are used to illustrate key approaches and insights.



John P. Weyant is also Director of the Energy Modeling Forum (EMF) and Deputy Director of the Precourt Institute for Energy Efficiency at Stanford University. He is a Senior Fellow of the Precourt Institute for Energy and the Freeman-Spolgi Institute for International Studies at Stanford. His current research focuses on analysis of global climate change policy options, energy efficiency analysis, energy technology assessment and models for strategic planning. Weyant has been a convening lead author, lead author and review editor for the Intergovernmental Panel on Climate Change. He has been active in the US debate on climate change policy through the Department of State, the Department of Energy and the Environmental Protection Agency. In California, he is a member of the California Air Resources Board's Economic and Technology Advancement Advisory Committee (ETAAC). Weyant was awarded the US Association for Energy Economics 2008 Adelmann-Frankel award for unique and innovative contributions to the field of energy economics. He was acknowledged in 2007 as a major contributor to the Nobel Peace prize awarded to the Intergovernmental Panel on Climate Change and in 2008 by Chairman Mary Nichols for contributions to California's ETAAC report.

MONDAY

PLENARY

10:00am-10:50am
Center, Ballroom G, Level 4

Re-think, Re-engineer, Re-energize

Joan B. Woodard
Executive Vice President Emeritus
Sandia National Laboratories

The energy systems that serve our needs today are an incredible set of interdependent, engineered systems that have enabled huge advances for mankind for over a century. We see a convergence of a number of significant forces and drivers that will cause a major redefinition of our energy systems. This redefinition will be very challenging, starting first with the challenge of understanding how the systems today operate and defining an adequate representation for analysis. The definition of the future systems is an enormous challenge of optimization over many variables: cost, reliable and secure supply, high quality supply, low environmental impact, reduced climatic impact, varying geographic distribution and many more. The creation of our desirable future systems will require the best of physics-based simulations, network modeling, economic optimization, competitive market dynamics analysis, and analysis of national and global social goods.



Joan Woodard served in various roles of national service, with progressively greater responsibility for over 35 years, including 15 years in executive leadership. Her most recent role was the Deputy Laboratories Director for all laboratories activities in support of US military technology; proliferation prevention; energy science, resources, conservation, and infrastructure assurance; and homeland security. She currently serves on the Intelligence Science Board, and has served on the Air Force Scientific Advisory Board, vice-chairing a major study on energy; the Congressional Commission to Assess the Vulnerabilities of the US Infrastructure to EMP; and the National Academy Study on S&T for Countering Terrorism. Woodard holds a PhD in Mechanical Engineering (Thermal Sciences) from the University of California Berkeley; a MS in Engineering Economic Systems from Stanford University; and a BS in Applied Mathematics from the Missouri University of Science & Technology (magna cum laude). She has been elected to the Phi Kappa Phi Honor Society.

KEYNOTE

3:10pm-4:00pm
Center, Ballroom E, Level 4

Part of Our Energy Future Will Look Like the Past

Charles G. Groat
John A. and Katherine G. Jackson Chair in Energy and Mineral Resources
Department of Geological Sciences
The University of Texas at Austin

Climate issues, concerns about resource availability (peak oil) and evolving alternative energy technologies have created the illusion that we are moving substantially away from carbon based fuels as future energy sources. While advances in implementing "clean energy" technologies have been impressive and important, on a global scale transportation and electricity generation will remain dominantly dependent on fossil fuels for at least several decades. The challenge is developing cost-effective technologies that allow their use in ways compatible with our greenhouse gas reduction and energy efficiency aspirations. In this vein, continued heavy coal use would be most acceptable with workable carbon capture and sequestration systems. The flood of natural gas supplies, most notably from shale sources, reduces resource availability to a negligible issue and provides an opportunity for electricity generation, and perhaps transportation, to be fueled with much lower carbon dioxide emissions. Nuclear energy is emerging as a more acceptable alternative with growth most dependent on control of capital costs. Policy and economic incentives to make our continued dependence on carbon-based fuels and nuclear energy occur on a base of the cleanest, safest technologies and most efficient systems, can support both a healthy economy and a cleaner environment.



Charles G. (Chip) Groat is also Director of the Center for International Energy and Environmental Policy, Associate Director of the Energy Institute, Director and Graduate Advisor of the Energy and Earth Resources Graduate Program, and Professor, LBJ School of Public Affairs at The University of Texas at Austin. He assumed these positions in June 2005 after serving six and a half years as Director of the US Geological Survey, having been appointed by President Clinton and retained by President Bush. Dr. Groat has been a member of the National Research Council Board on Earth Sciences and Resources and the Outer Continental Shelf Policy Board. He is a past President of the Association of American State Geologists and of the Energy Minerals Division and Division of Environmental Geosciences of the American Association of Petroleum Geologists. He holds degrees in geology from the University of Massachusetts (MS) and The University of Texas at Austin (PhD). His current interests focus on advancing the role of science and engineering in shaping policy and informing decisions, and on ways to increase the integration of the science disciplines as a means of improving the understanding of complex resource and environmental systems.

KEYNOTE

3:10pm-4:00pm
Center, Ballroom G, Level 4

Global Supply Chain Planning

Perry Noakes
Director of Global Business Excellence
Dell, Inc.

Over the past 50 years, the technology industry has revolutionized the way we work and live. Every 10-15 years, the industry has ushered in a new era that has fundamentally changed the competitive landscape and how we interact with technology. In its 26 years of existence, Dell has been a disruptive force in the industry. Dell changed the industry with a powerful idea: combine direct customer relationships, standards-based technology and a leading-edge supply chain to make technology hardware more accessible to more people and organizations. In order to continue our heritage as the "great equalizer" of the technology industry, Dell is undergoing a deep transformation. This transformation will take us from "the company that redefined value and expanded access to computing products" to "the company that is revolutionizing how technology works for people and organizations with simple, flexible, high-value solutions." We are transforming our core business – client computing (PCs, laptops, netbooks) – in service of our customers. We are creating multiple supply, build and delivery paths to match the changing ways customers buy technology today. We are getting better, faster and simpler, applying our expertise to develop flexible value-chain options that match the different needs of different customers. And we are providing product choice, customization and support consistent with what customers value most, always with great quality and at competitive prices.

Perry A. Noakes serves as Director of Global Business Excellence at Dell. Most recently he served as Director of Engineering and Quality for Dell Americas Operations, Director Server Storage Manufacturing and as Dell's chief quality officer. Prior to these roles he directed Dell's manufacturing operations in Austin and led the company's Americas supply chain management and manufacturing engineering teams. Mr. Noakes came to Dell in October 1999, from Motorola, Inc. During his 29-year career with Motorola, he served as corporate vice president for the company's communications enterprise. In addition, he also served as corporate vice president and general manager for Motorola's radio products group and vice president of the company's Asia operations in Singapore. Mr. Noakes holds a bachelor's degree in chemistry from Florida Atlantic University.

TUESDAY

OMEGA RHO DISTINGUISHED LECTURE

10:00am-10:50am
Center, Ballroom G, Level 4

ORMS and Risk Management Failures: What are we doing wrong?

John R. Birge
Jerry W. and Carol Lee Levin Professor of Operations Management
The University of Chicago

The events contributing to the global financial crisis and the Gulf of Mexico oil spill appear to represent cataclysmic failures of risk management within some of the most technologically capable organizations. In retrospect, even the most basic OR analysis should have avoided these disasters and their enduring consequences. Why then did these calamities occur and what is ORMS's responsibility? This talk will focus on some of these events in detail and offer possible explanations for ORMS's failure to avert them. We will then consider potential resolutions of the underlying causes of these failures and implications for ORMS's future development in practice and academic research.

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, John R. Birge will be inducted as the 44th Honorary Member of OMEGA RHO.



John R. Birge is the Jerry W. and Carol Lee Levin Professor of Operations Management at the University of Chicago, Booth School of Business. Previously, he was Dean of the McCormick School of Engineering and Applied Science and Professor of Industrial Engineering and Management Sciences at Northwestern University. He also served as Professor and Chair of Industrial and Operations Engineering and established the financial engineering program at the University of Michigan. He is former President of INFORMS and former Editor-in-Chief of *Mathematical Programming, Series B*. He has received many honors and awards including the IIE Medallion Award, the INFORMS Fellows Award, the Harold W. Kuhn Prize, and the George E. Kimball Medal. Birge's work considers the design and analysis of practical systems in which some outcomes are not completely known before decisions must be made. He has developed methods to determine optimal actions in these uncertain environments for applications such as asset and liability allocations, periodic scheduling of workers and machines, power and energy distribution, and allocation of public services. He received MS and PhD degrees from Stanford University in Operations Research and an A.B. in Mathematics from Princeton University.

KEYNOTE

3:10pm-4:00pm
Center, Ballroom G, Level 4

Rethinking Risk Assessment and Management for Homeland Security and Defense

Gerald G. Brown
Distinguished Professor of Operations Research
Naval Postgraduate School

The welfare of our society depends on effective assessment and management of risks to our most critical infrastructure systems. Currently fashionable probabilistic risk assessment estimates expected loss value, where the consequence of an "event" is measured in, e.g., economic replacement cost, or injuries or fatalities, as appropriate. Yet, recent examples – global financial crises, power failures, oil spills and floods – suggest we are better at building complex systems than we are at assessing potential damage from natural events or intentional actions. This presentation will describe how game theory and optimization can advise allocation of limited resources to mitigate worst-case disruptions; and how these techniques can be (and already are) used to enhance resilience of critical infrastructures and advise government, military, and private sector system operators.



Gerald G. Brown also serves as Executive Director of the Center for Infrastructure Defense at the Naval Postgraduate School, where he has taught and conducted research in optimization and optimization-based decision support since 1973, earning awards for both outstanding teaching and research. His military research has been applied by every uniformed service, in areas ranging from strategic nuclear targeting to capital planning. He has been awarded the Barchi, Rist, and Thomas prizes for military operations research, and been credited with guiding investments of more than a trillion dollars. He has designed and implemented decision support software used by the majority of the Fortune 50, in areas ranging from vehicle routing to supply chain optimization. His research appears in scores of open-literature publications and classified reports, some of which are seminal references. Brown is a member of the National Academy of Engineering, a recipient of the US Navy Distinguished Civilian Service Medal, an INFORMS Fellow, and a founding Director of Insight, Incorporated, the leading provider of strategic supply chain optimization tools to the private sector.

KEYNOTE

3:10pm-4:00pm
Center, Ballroom E, Level 4

Ocean Container Transport: Making Global Supply Chain Management Effective

Chung-Yee Lee
Head and Chair Professor, Department of Industrial Engineering & Logistics Management
The Hong Kong University of Science & Technology

As supply chains become more global, and as more operations are outsourcing and move offshore, ocean container transport now is a critical element of any such supply chain. In particular, due to the tightened security, increased congestion, and heightened pressure on energy usage and carbon emission, the immediate effect of transportation on supply chain has recently attracted much attention. Lee will first review the main characteristics of current ocean container supply chains and discuss some major trends that affect the operation of these supply chains. He will then present a number of problems and related research questions that have been understudied in the literature and yet appear to be challenging for both container shipping service providers and users. He will also suggest on how ORMS can play a role in such an emerging topic.



Chung-Yee Lee is the Founding and Current Director of the Logistics and Supply Chain Management Institute at the Hong Kong University of Science & Technology. He served as Department Head of Industrial Engineering and Logistics Management at HKUST for seven years. His research areas are in logistics and supply chain management, scheduling and inventory management. He has engaged in numerous research projects sponsored by industries in the U.S. and Hong Kong, and has published more than 100 papers in refereed journals. According to an article in the *Int. J. Prod. Eco.* (2009), which looked at all papers published in the 20 core journals during last 50 years in the field of production and operations management, he was ranked number six among all researchers worldwide in h-index. Lee received a MS degree in Management Sciences from National Chiao-Tung University. He also received a MS degree in Industrial Engineering from Northwestern University (1980) and PhD degree in Operations Research from Yale University (1984). He is a Fellow of the Institute of Industrial Engineers.

WEDNESDAY

KEYNOTE

10:00am-10:50am
Center, Ballroom G, Level 4

Small Computing for Operations Research Using Excel and VBA

Paul Jensen
Professor Emeritus
The University of Texas at Austin

Operations Research is riding the wave of large (and fast) computing. Problems that were computationally impossible a few years ago are standard fare for the advanced computers and computer codes of today. This talk suggests the alternative of small (and slow) computing implemented by programs written in Visual Basic for Applications and executed in Microsoft Excel. In compensation for the loss of speed, the add-ins are free, use the familiar interface of Excel, are available for a wide range of OR models, combine data and analysis in the same workbook, are easy to use and are capable of solving challenging problems. A website (www.ormm.net) provides extensive instructions and download links for add-in files and demonstration workbooks. The student or practitioner can formulate and solve meaningful problems without the expense of stand-alone programs and sophisticated computers. People from throughout the world visit the site and use the add-ins.



Paul Jensen earned his PhD in Operations Research in Industrial Engineering at Johns Hopkins University in 1967. He joined the faculty at the University of Texas where he taught with the operations research program in mechanical engineering, retiring in 2003 as the Cullen Professor Emeritus. His first major book co-authored with J. Wesley Barnes, *Network Flow Programming*, received the 1980 Book of the Year Award from the Institute of Industrial Engineers. In 1983 and 1985 he authored a pioneer package of operations research programs for microcomputers, Microsolve/Operations Research. *The Students' Guide to Operations Research* was published in 1986. The book *Operations Research Models and Methods* coauthored with Jonathan Bard was published in 2003. Jensen was the Contributed Papers Chairman for two national INFORMS meetings and General Chair for the Dallas Texas meeting in 1997. He served a three-year term on the Council of the Operations Research Society of America. He served as Vice President for Meetings of INFORMS from 2001 through 2004 and is an INFORMS Fellow. Jensen was awarded the 2007 INFORMS Prize for the Teaching of ORMS Practice.

KEYNOTE

10:00am-10:50am
Center, Ballroom E, Level 4

2010 Daniel H. Wagner Prize Presentation

The competition for the 2010 Daniel H. Wagner Prize for Excellence in Operations Research Practice resulted in five finalists, who submitted papers to the judging committee and who will present their results in three sessions on Tuesday. In this keynote, the winner of the competition will be announced and the authors will give a reprise of the winning presentation. The 2010 finalists include O.R. applications from IBM, Blockbuster, Kimberly-Clark Latin America, Bank BPH and the Center for Disease Control.

All tutorials are located in the Convention Center.

SUNDAY

■ SA06 - Ballroom E, Level 4
8:00am-9:30am
Provably Near-Optimal Approximation Algorithms for Operations Management Models
Retsef Levi, Massachusetts Institute of Technology

The session provides a survey of several recent results on the design and analysis of provably near-optimal approximation algorithms for operations management multistage stochastic optimization models. We will discuss cost-balancing based algorithms for core stochastic inventory control models, and linear programming based control for models concerned with the management of reusable resources.

■ SB06 - Ballroom E, Level 4
11:00am-12:30pm
Using Secondary Data in Operations Management (OM) Research: Overview and Research Opportunities
Vinod R. Singhal, Georgia Institute of Technology

This tutorial will provide an overview of how to use secondary data in OM research. It will discuss data sources that are available, the research methods and statistics for use with secondary data, and an approach for carrying out this research. Basics of the event study methodology will be discussed. An application that uses this approach will also be discussed.

■ SC06 - Ballroom E, Level 4
1:30pm-3:00pm
Introduction to Modeling and Generating Probabilistic Input Processes for Simulation
James Wilson and Julie Ivy, North Carolina State University; Michael E. Kuhl, Rochester Institute of Technology; Emily K. Lada, SAS Institute Inc.; Natalie M. Steiger, Maine Business School; Mary Ann Wagner, SAIC

We discuss modeling, fitting and generating the univariate probabilistic input processes that drive many discrete-event simulation experiments. We emphasize the generalized beta distribution family, the Johnson translation system of distributions, and the Bezier distribution family. Also discussed are techniques for modeling and simulating time-dependent arrival streams using nonhomogeneous Poisson processes. Public-domain software implementations and current applications are presented.

■ SD06 - Ballroom E, Level 4
4:30pm-6:00pm
Optimal Control of Queueing Networks
Michael Veatch, Gordon College

This talk addresses Markov decision process formulations of queueing network control problems. Manufacturing and service system models are used to illustrate some formulation approaches that facilitate computation. Software developed by the author to solve small examples is described. The structure of optimal policies is addressed through connections with fluid models and by reviewing some monotone control results.

MONDAY

■ MA06 - Ballroom E, Level 4
8:00am-9:30am
Online Optimization
Patrick Jaillet, Massachusetts Institute of Technology; Michael Wagner, Saint Mary's College of California

There are many situations in which present actions must be made and resources allocated with incomplete knowledge of the future. It is not clear in this setting how to measure the quality of a proposed decision strategy. One approach is to devise some probabilistic model of the future and act on this basis. Online optimization compares the performance of a strategy that operates with no knowledge of the future (on-line) with the performance of an optimal strategy that has complete knowledge of the future (off-line). In this tutorial, we give an overview of the state of the art of this approach relevant to operations research and management science.

■ MA07 - Ballroom F-G, Level 4
8:00am-9:30am
Optimization via Simulation over Discrete Decision Variables
Barry L. Nelson, Northwestern University

Both the simulation research and software communities have been interested in optimization via simulation (OvS), by which we mean maximizing or minimizing the expected value of some output of a stochastic simulation. Continuous-decision-variable OvS, and gradient estimation to support it, has been an active research area with significant advances. However, the decision variables in many operations research and management science simulations are more naturally discrete, even categorical. In this tutorial we describe some of the research directions and results available for discrete-decision-variable OvS, and provide some guidance for using the OvS heuristics that are built into simulation modeling software.

■ MB06 - Ballroom E, Level 4
11:00am-12:30pm
Risk Applications in Commercial Nuclear Power
Ernie Kee, South Texas Project Nuclear Operating Company

Broad categories of risk evaluated in commercial nuclear power production, nuclear safety and production losses, are summarized. Risk applications in nuclear safety and production losses categories are described. Preventive maintenance scheduling using risk metrics is detailed. Direct application and presentation of risk information to operations and maintenance planning personnel is described. Reliability and cost data analysis methods in use at a commercial nuclear power plant are summarized.

■ MB07 - Ballroom F-G, Level 4
11:00am-12:30pm
Constructing Multiattribute Utility Functions for Decision Analysis
Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign

A fundamental step in decision analysis is the accurate representation of the decision maker's preferences. When the decision situation is deterministic, each alternative leads to a single prospect (consequence). A prospect may be characterized by one or more attributes, such as health state and wealth. A value function that ranks the prospects is sufficient to rank order the decision alternatives in deterministic decision problems. When uncertainty is present, each alternative may result in a number of possible prospects, each characterized by a number of attributes. A von Neumann-Morgenstern utility function, defined over the domain of the attributes, is then required for each prospect we face. The best decision alternative is the one with the highest expected utility. This tutorial surveys a variety of methods for constructing multiattribute utility functions.

■ MC06 - Ballroom E, Level 4
1:30pm-3:00pm
Fraud Detection in Online Transactions
Carolina Barcenas, PayPal

With the advent of the Internet, e-commerce has seen significant growth of financial transactions and has connected sellers with potential buyers. Merchants can now do business with people living in countries all over the world. The additional freedom to conduct business quickly and globally gives rises to novel risks. "Bad" buyers hide amongst "good" buyers. Legitimate merchants and "scammers" all try to take advantage of the aforementioned new business paradigms. In this talk we will review some of the analytical techniques used to minimize the risk involved in online transactions. We will also review the modus operandi of online fraudsters and describe how we can combat them both with technology and mathematical analysis widely used in operations research and data mining.

■ MC07 - Ballroom F-G, Level 4
1:30pm-3:00pm
Mathematical Approaches to Infectious Disease Prediction and Control
Nedialko Dimitrov, Naval Postgraduate School; Lauren Meyers, University of Texas at Austin

Mathematics has long been an important tool for understanding and controlling the spread of infectious diseases. Here, we begin with an overview of compartmental models, the traditional approach to modeling infectious disease dynamics, and then introduce contact network epidemiology, a relatively new approach that applies bond percolation on random graphs to model the spread of infectious disease through heterogeneous populations. As we illustrate, these methods can be used to address public health challenges and have recently been coupled with powerful computational methods to optimize epidemic control strategies.

■ MD06 - Ballroom E, Level 4
4:30pm-6:00pm
The Separation, and Separation-Deviation Methodology for Group Decision Making and Aggregate Ranking
Dorit Hochbaum, University of California-Berkeley

The aggregate ranking problem is to obtain a ranking that is fair and representative of the individual decision makers' rankings. We argue here that using cardinal pairwise comparisons provides several advantages over score-wise or ordinal models. The aggregate group ranking problem is formalized as the separation model and separation-deviation model and linked to the inverse equal paths problem. The application of these models is described for scenarios including sports competitions, NSF review panels, choosing winning projects, determining countries credit risk, customer segmentation, web pages rankings and ranking academic papers in terms of citations. We compare and contrast the separation approach with PageRank and the principal eigenvector methods as well as other commonly used methods.

■ MD07 - Ballroom F-G, Level 4
4:30pm-6:00pm
Meaningless Statements in Epidemiology
Fred Roberts, Professor, Rutgers University

A statement involving scales of measurement is called meaningless if its truth or falsity can depend on the particular versions of scales that are used in the statement. Using examples from the study of diseases such as HIV, malaria and tuberculosis, we will give a variety of examples of meaningless and meaningful statements. We will briefly discuss the mathematical foundations of the theory of meaningfulness, discuss ways to average scores that lead to meaningful statements, and, time permitting, discuss the meaningfulness of statistical tests. Some of the specific topics to be discussed are: averaging judgments of cough severity or fatigue, finding a combined index of air pollution, evaluating alternative HIV treatments using averages of normalized scores, meaningfulness of solutions to optimization problems in epidemiology and behavioral responses to health events.

TUESDAY

■ TA06 - Ballroom E, Level 4
8:00am-9:30am
Dynamic Optimization with Applications to Dynamic Rate Queues
William A. Massey, Princeton University; Robert Hampshire, Carnegie Mellon University

This tutorial presents recent developments in the dynamic optimization of dynamic rate queues. These problems are motivated by the management of communications services and apply broadly to services involving the leasing of shared resources. First, we show how the time evolution of many fundamental dynamic rate queueing models are well approximated by low-dimensional dynamical systems. We then discuss the variational calculus methods for Lagrangians, Hamiltonians and Bellman value functions that give us a three century perspective on the dynamic optimization of dynamical systems. Finally, we apply these techniques to examples of dynamic rate queues that yield approximate policies for profit-optimal design, pricing or staffing.

■ TB06 - Ballroom E, Level 4
11:00am-12:30pm
Decentralized Supply Risk Management
Volodymyr Babich, Georgetown University; Goker Aydin, Indiana University; Damian Beil, University of Michigan; Zhibin Yang, University of Oregon

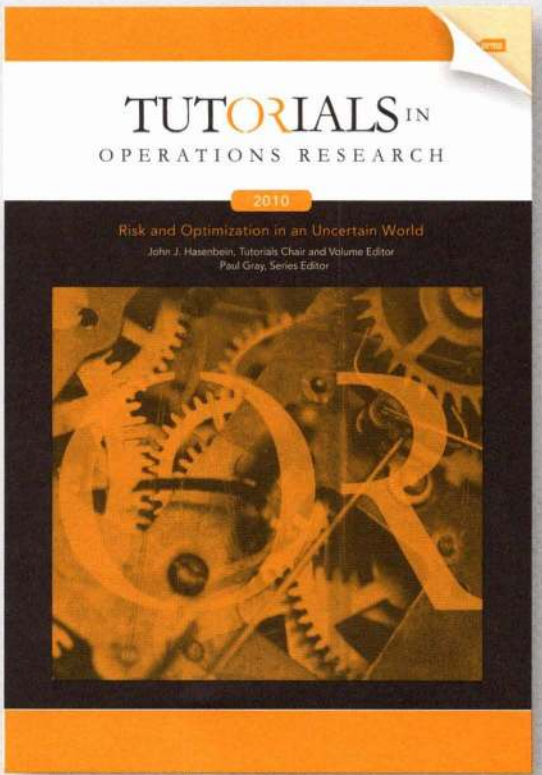
In a 2008 survey of 138 companies, 58% reported that they suffered financial losses within the last year due to a supply disruption. The tutorial will emphasize the challenges and opportunities in supply risk management arising from the decentralized nature of supply chains and highlight how supply risks influence the interactions among firms in supply networks, review insights into decentralized supply risk management from the extant academic research and point out important future research directions.

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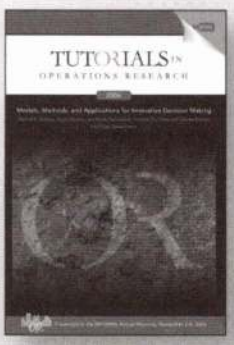
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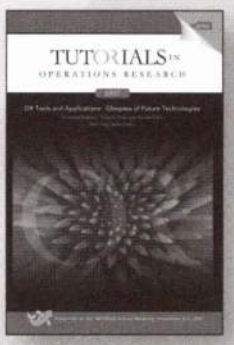
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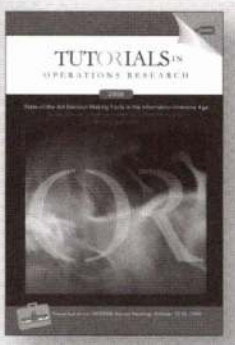
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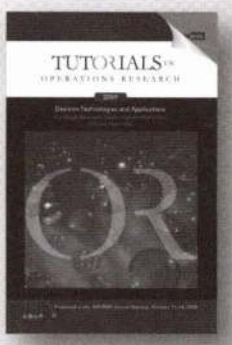
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■ TC06 - Ballroom E, Level 4
1:30pm-3:00pm
The Trojan Horse of Time-Risk Preference Representations
Matthew J. Sobel, Case Western Reserve University

Throughout the management sciences, individuals and organizations compare alternatives with consequences that are risky and unfold over time. This tutorial examines representations of preferences that are sensitive to timing and risk. It reviews the logical foundations of the two major contending representations and finds that each of them is self-contradictory. In particular, properties of preferences that are consistent with discounting are also consistent with risk neutrality. In this sense, discounting implies risk neutrality. Then the tutorial briefly examines the prospects of developing new representations that are logically consistent. The tutorial ends by applying the various representations to a model of a supply chain contract.

■ TD06 - Ballroom E, Level 4
4:30pm-6:00pm
Auctions in Supply Chains/Procurement
Damian Beil, University of Michigan

This tutorial introduces the basic ingredients of procurement auction research. After discussing the classic market-pricing logic of the open-descending auction, we demonstrate how simple modeling embellishments can extend the market-pricing auction logic to also capture key operational realities and tradeoffs encountered in procurement practice. This tutorial should be of value to anyone interested in studying competitive bidding in supply chains.

WEDNESDAY

■ WA06 - Ballroom E, Level 4
8:00am-9:30am
New Developments for Solving Real World Optimization Problems by Marrying Simulation and Optimization
Manuel Laguna, University of Colorado at Boulder; Jay April and Marco Better, OptTek Systems, Inc.

Companies invest billions of dollars each year in applications that can be handled by combining simulation and optimization. These notably include problems that involve uncertainty and complex nonlinearities, as in the areas of capital investment, workforce composition and management, energy resource and transmission planning, health care systems, financial portfolio optimization, production and inventory systems, security and emergency response planning. We identify latest advances and applications in these areas from combining simulation and optimization, together with opportunities for future applications.

■ WB06 - Ballroom E, Level 4
11:00am-12:30pm
Robust Vehicle Routing
Fernando Ordonez, University of Southern California

Vehicle routing problems in many industrial applications must take into account uncertain demand, traffic conditions and/or service times. In this tutorial we present recent work on the use of robust optimization for vehicle routing problems (VRP) under uncertainty. We outline different robust VRP models, depending on the formulation, source of the uncertainty, and correlation in the uncertainty. Furthermore, we discuss previous computational results that illustrate when such a robust model is convenient and when it is not. We show with results in two different applications that robust optimization is useful to find a routing plan when routes will be adapted to the outcome of the uncertainty.

■ WC06 - Ballroom E, Level 4
1:30pm-3:00pm
Searching and Hiding on Networks
J. Cole Smith, University of Florida

The problem of deploying and controlling a set of searchers on a network to locate a hidden target is referred to as a search game. There are countless variations of this game, depending on, e.g., whether or not the target is mobile, and the searchers' communication and control capabilities. This tutorial will examine classical results in this field, discuss contemporary search literature, and explore research directions in this field as driven by future security challenges.

■ WC48 - Room 9, Level 2-Mezzanine
1:30pm-3:00pm
The Role and Challenges for Optimization in Competitive Electricity Markets
Shmuel Oren, Professor, University of California-Berkeley, IEOR Department

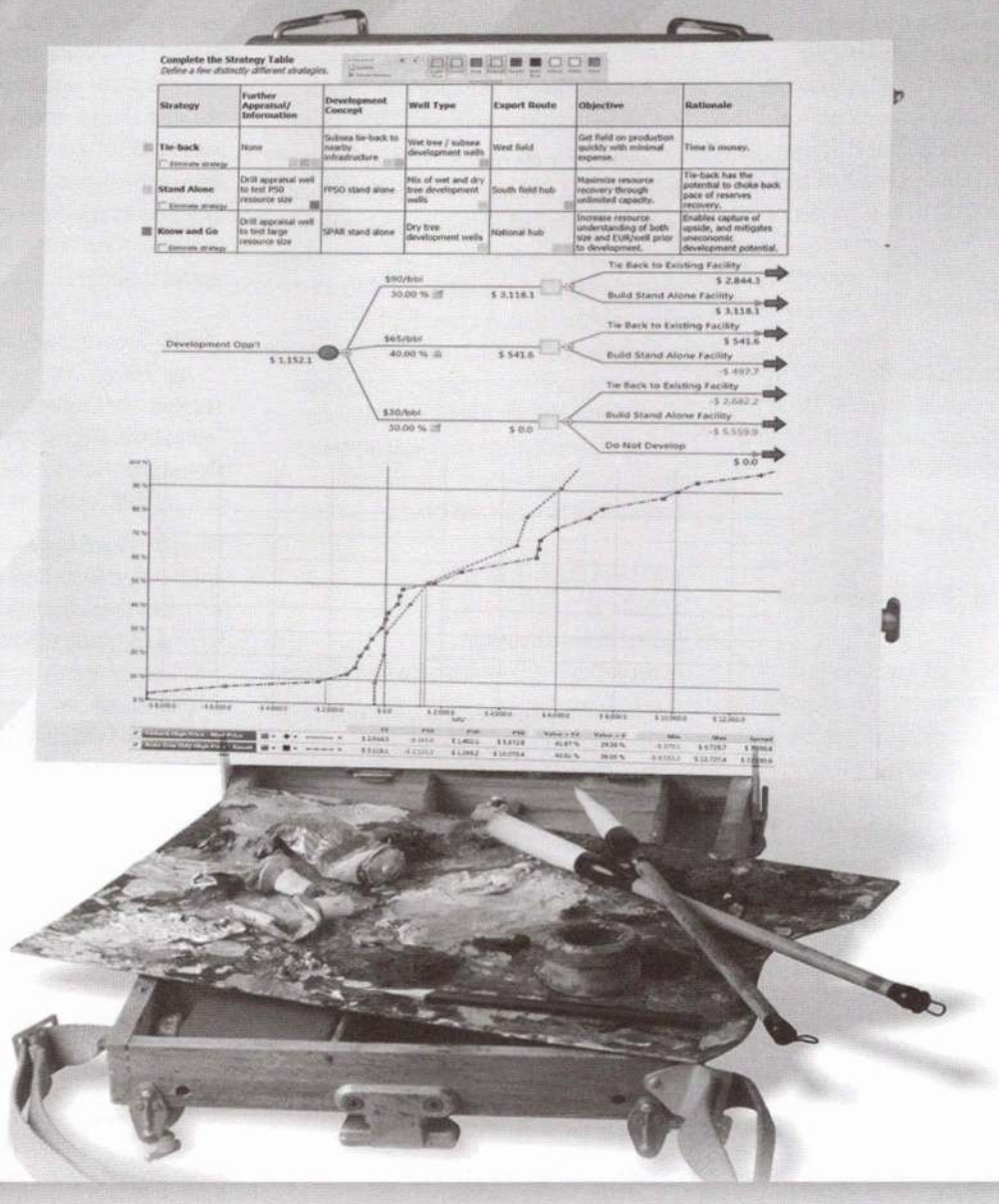
This tutorial will describe key challenges in designing and operating competitive electricity markets. It will review the basic components of electricity markets and alternative structural approaches adopted in different systems. We will discuss the underlying optimization problems being solved in scheduling, operating and simulating electricity markets. New computational challenges and research activities in this area will also be reviewed.

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SUNDAY, NOVEMBER 7

■ SA48 - Center, Room 9, Level 2
8:00am-8:45am
SAS Global Academic Program- Enterprise Guide Demonstration
Tom Bohannon, tom.bohannon@sas.com

This demonstration shows how one can use the menu driven tasks in SAS Enterprise Guide 4.2, the point and click interface to SAS, to perform common reporting and research tasks: querying, reporting and analyzing data. SAS Enterprise Guide provides a SAS graphical point-and-click interface that helps you exploit the power of SAS and publish dynamic results in a Microsoft Windows client application.

8:45am-9:30am
Automatic Forecasting Systems - Capabilities of Autobox
Tom Reilly, tomreilly@autobox.com

Autobox, launched in 1976, adjusts for outliers and adds variables to fix the data to where it should have been so that the model and forecast isn't skewed. Autobox adapts to changes like trends, level shifts and seasonal pulses. Autobox adjusts for lead/lag effects for causal variables like price, promotion, holidays, etc.

■ SB48 - Center, Room 9, Level 2
11:00am-11:45am
Salford Systems - Real-World Data Analysis
Mikhail Golovnya, golomi@salford-systems.com

This tutorial, intended for the modeler wanting to apply data mining methodology, will emphasize real-world data analysis. The main concepts behind three well-known data mining algorithms will be discussed: CART®, MARS®, TreeNet®. Additionally, the course will discuss what is novel in the software, cover implementation, and show where the software fits in terms of other data mining software.

11:45am-12:30pm
GAMS Development Corp. - Application Prototyping with GAMS
Steve Dirkse, sdirkse@gams.com

GAMS Development will demonstrate how an application can be built using GAMS. We'll use 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.

■ SC48 - Center, Room 9, Level 2
1:30pm–2:15pm
JMP Division, SAS - Dynamic Visualization with JMP
Mia Stephens, mia.stephens@jmp.com

JMP is data analysis and visualization software from the SAS Institute. Intuitive, interactive and graphical, JMP lets you focus on the insight your data can provide. JMP provides a complete array of statistical procedures, from basic to advanced, and produces integrated and dynamic visual output. We will demonstrate popular JMP tools for data visualization, including Tabulate, Graph Builder®, Bubble Plots, the data filter and new mapping tools.

2:15pm-3:00pm
Innovative Scheduling - Practical Solutions to Real-World Logistics Problems
Ravindra K. Ahuja, ravi@innovativescheduling.com

In this tutorial, we will share with the audience our experiences of building successful solutions to complex real-world O.R. problems. We will describe several business problems, their modeling, algorithmic development and packaging into decision support systems. We will explain the difficulties encountered, how we addressed them, and the lessons we learned. We will also describe our approach for building optimization-based decision support systems in the rapid development mode.

■ SC51 - Center, Room 12, Level 2
1:30pm-2:15pm
Microsoft - Presenting Microsoft Solver Foundation 3.0
Nathan Brixius, nathan.brixius@microsoft.com

Microsoft Technical Computing's Solver Foundation is a .Net runtime for mathematical programming, modeling and optimization. The latest release broadens the range of models that can be created, solved and analyzed using Solver Foundation Services (SFS) and OML to include linear and mixed-integer nonlinear problems. A demo and technology roadmap will be presented.

2:15pm-3:00pm
AnyLogic - AnyLogic in Brief
Andrei Borshchev, andrei@xjtek.com

AnyLogic is the one tool that recognizes the value of different approaches. With AnyLogic you can build models in multiple techniques or even combine them to create hybrid models that are truer to your system than those created with single-purpose tools. This workshop provides background, demos and an overview of the tool, as well as an insight into future features.

■ SD48 - Center, Room 9, Level 2
4:30pm-5:15pm
AMPL Optimization LLC - New and Forthcoming Developments in the AMPL Modeling Language and System
Robert Fourer, 4er@ampl.com
David M. Gay, dmgay@sandia.gov

We describe recent and ongoing projects to extend and enhance AMPL to facilitate both formulation and implementation of optimization models. Extensions to AMPL's language will allow for more natural description of discrete models and stochastic data. New solver interfaces will make nontraditional solvers more accessible for practical modeling. A new callable interface to the AMPL system will facilitate business deployment.

5:15pm-6:00pm
Ziena Optimization, Inc. - New Developments in the KNITRO 7.0 Optimization Solver
Richard Waltz, waltz@ziena.com

This demonstration will highlight areas of improvement in the new version 7.0 release of the KNITRO optimization solver. Benchmark results will be presented showing significant performance gains for large-scale models. The demo will also provide an overview of how to effectively use KNITRO in a variety of environments and applications.

MONDAY, NOVEMBER 8

■ MA48 - Center, Room 9, Level 2
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.

■ MA59 - Hilton, Salon A, 4th Floor
8:00am-8:45am
Forio Business Simulations
Michael Bean, mbean@forio.com

During the session, Michael Bean will demonstrate how to create web simulations and use free drag-and-drop tools to create data visualizations for exploring what-if scenarios. He will discuss commonly occurring web simulation design challenges and potential solutions, and show examples of web simulations that have been used by thousands of users. He will also provide a series of guidelines for creating simulations online.

8:45am-9:30pm
Conrady Applied Science - Probabilistic Structural Equations and Causal Inference with BayesiaLab 5.0
Lionel Jouffe, jouffe@bayesia.com

Probabilistic Structural Equation Models (PSEM) based on machine-learned Bayesian Networks provide an efficient alternative to traditional Structural Equation Models (SEM). With BayesiaLab 5.0, PSEMs can be created through a series of semi-automatic clustering steps, which allows analysts to perform driver analysis extremely quickly, reducing research time from "months to minutes." As an extension, an intervention function is available, which formally implements Pearl's Do-Calculus for policy analysis.

■ MB48 - Center, Room 9, Level 2
11:00am-11:45am
Gurobi Optimization - Gurobi QP Optimizer
Edward Rothberg, rothberg@gurobi.com

The new Gurobi Optimizer 4.0 includes QP simplex, QP barrier and MIQP optimizers. The barrier and MIQP optimizers are parallel, and make efficient use of multiple cores. This tutorial will discuss some of the algorithmic issues associated with handling quadratic objectives in a math programming solver. We'll also look at a few QP formulation issues, and consider some of the tradeoffs associated with introducing quadratic terms into your models.

11:45am-12:30pm
AIMMS® (Paragon) - Robust Optimization in Action
Peter Nieuwesteeg, p.nieuwesteeg@aimms.com; Ming Fang, m.fang@aimms.com

There are different approaches to handle uncertainty in your model. We will show robust optimization as one of them. We start with a short introduction in AIMMS, where we show how you can use it to build, solve and visualize your optimization problems. After that, we will demonstrate robust optimization as a way of handling uncertainty, without the need to rewrite your AIMMS application. We will show how easy, yet powerful, this is and what it can do to improve your model results.

■ MC48 - Center, Room 9, Level 2
1:30pm-2:15pm
LINDO Systems, Inc. - Latest Optimization Modeling Software from LINDO Systems
Mark Wiley, mwiley@lindo.com

LINDO Systems will demonstrate the latest enhancements to LINDO API, LINGO and What'sBest – their popular linear, integer, quadratic, general nonlinear and global optimization tools. Improvements include capabilities for solving extremely large LPs. Heuristics for quickly finding excellent solutions to integer and nonlinear programs. Automatic exploitation of quadratic expressions, second order cone and nonconvex quadratic expressions in the global solver.

2:15pm-3:00pm
Imagine That - ExtendSim-Power Tools for Simulation
Dave Krahl, davek@extendsim.com

Experience for yourself the ease of use, flexibility and power of a professional simulation tool – ExtendSim. Use custom interactive model interfaces and hierarchical submodels to rapidly explore simulation concepts and design options. Realize why ExtendSim is the tool to watch in the simulation industry. Don't miss this demo!

■ MD48 - Center, Room 9, Level 2
4:30pm-5:15pm
American Optimal Decisions - Portfolio Safeguard by AORDA
Gaia Serraino, serraino@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 (linear, quadratic, maximum, StDev, variance, probability, VaR, CVaR, cardinality, fixed-charge, etc.) See real-life case studies in Windows Shell and MATLAB at www.aorda.com/aod/psg.action.

5:15pm-6:00pm
Lumina Decision Systems, Inc. - Analytica: What it does that spreadsheets can't
Surya Swamy, surya@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.

TUESDAY, NOVEMBER 9

■ TA48 - Center, Room 9, Level 2
8:00am-8:45am
Decision Frameworks - Don't Square the Circle
Jeremy Walker, jeremy@decisionframeworks.com

Do you find your teams trying to square a circle? Are they focused on solving the right problem? Come see the value of proper decision framing combined with practical decision analysis. View the latest framing tools and techniques in DTrio integrated with TreeTop's state-of-the-art decision trees, tornados and cumulative probabilities curves. Quality decision making – derived, not divined.

8:45am-9:30am
statistics.com - Data Mining In Excel
Peter Bruce, pbruce@statistics.com

The demo will illustrate common data mining classification and prediction techniques using XLMiner, a comprehensive data mining add-in for Excel that offers neural nets, trees, naive Bayes, logistic and linear regression, discriminant analysis (as well as clustering and association rules). The role of partitioning the data into training and validation samples will be discussed.

■ TB48 - Center, Room 9, Level 2
11:00am-11:45am
Frontline Systems, Inc. - Beyond the Excel Solver: Teaching and Practicing Management Science
Daniel H. Fylstra, dfylstra@frontsys.com

Learn how you can use Frontline's Risk Solver Platform for management science education and practice, with new textbook editions by Ragsdale and Powell & Baker. Save classroom time with one easily learned package for linear and nonlinear optimization, risk analysis and Monte Carlo simulation, sensitivity analysis and decision trees, while smoothly handling old and new versions of Windows and Excel.

11:45am-12:30pm
Maximal Software - Why is Maximal now giving away free development copies of MPL for Windows and MPL for Python?
Bjarni Kristjansson, bjarni@maximalsoftware.com

We at Maximal have now decided to fundamentally change how we sell our software, by greatly reducing how much you pay for development copies of MPL, in many cases bringing the actual cost down to zero. We will explain several new programs: "Pay Maintenance Only," "Subscription-Based Pricing," "Free Development Copies of MPL" and "Free Software for Academics." In the second part of the tutorial, we will introduce "MPL for Python," a new scripting and library interface for the MPL Modeling Language that takes full advantage of the many powerful features of Python.

■ TB62 - Hilton, Room 402, 4th Floor
11:00am-11:45am
The MathWorks - Discrete Event Simulation with SimEvents
Anuja Apte, anuja.apte@mathworks.com

SimEvents is the discrete event simulator in MathWorks product family. This presentation will cover: (1) introduction to SimEvents - the integration of MATLAB, Simulink and other MathWorks tools in a typical SimEvents workflow; (2) process simulation with SimEvents - product demonstrations that illustrate the use of SimEvents for process simulation to analyze bottlenecks, processing delays and resource requirements.

11:45am-12:30pm
ac2 Solutions - Supply Chain Management for Service Operations: Workforce Management and Performance Optimization using ac2 AWO Portal
Turgut Aykin, taykin@ac2solutions.com

Advanced Workforce Optimization (AWO) Portal by ac2 Solutions offers (1) advanced forecasting models for multiple seasonal patterns found in service systems such call centers, hospitals, and back offices; (2) ILP-based schedule optimization (work/off days, daily shift and break times) for centers with 10 to 20,000+ agents and complex scheduling rules in both skills-based and non-skills based environments; (3) strategic planning; and (4) performance optimization using real-time re-optimization and re-forecasting, scorecards, dashboards and agent adherence. We will take an in-depth look at the various capabilities offered and how they are used in call centers to manage workforce and optimize performance.

■ TC48 - Center, Room 9, Level 2
1:30pm-2:15pm
IBM ILOG - IBM ILOG CPLEX Optimization Studio: Complete Optimization Development Toolkit
John Gregory, jgregor@us.ibm.com

IBM ILOG CPLEX Optimization Studio now completely supports the rapid development and deployment of both mathematical programming and constraint programming models from a powerful IDE using the OPL language, programmatic APIs, or other 3rd party modeling interfaces. In this tutorial we will discuss the latest enhancements, while exploring the end-to-end model development capabilities supported in this single package, along with the various deployment options from CPLEX Optimization Studio, or the optional IBM ILOG ODM Enterprise.

2:15pm-3:00pm
Responsive Learning Technologies, Inc. - Online Games to Teach Operations and Supply Chain Management
Sam Wood, wood@responsive.net

Participate in a demonstration of online games that are used in operations management courses and supply chain management courses in hundreds of undergraduate and MBA-level programs to teach topics like capacity management, lead time management, inventory control, and supply chain design and logistics.

■ TD48 - Center, Room 9, Level 2
4:30pm-5:15pm
SAS - Building and Solving Optimization Models with SAS
Ed Hughes, Ed.Hughes@sas.com
Rob Pratt, Rob.Pratt@sas.com

OPTMODEL from SAS enables you to build and solve optimization models (including LP, MILP, QP, and NLP) and supports a range of standard and customized algorithms. We'll demonstrate modeling and solving a business problem using OPTMODEL in conjunction with SAS data, analytic, and reporting capabilities. We'll also illustrate how you can deploy this solution in a web-based interface with SAS.

5:15pm-6:00pm
Oracle - Crystal Ball
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. Crystal Ball is used in universities and schools worldwide to teach financial risk analysis, valuation, engineering, portfolio allocation, cost estimation, and project management. Join us for an overview of Crystal Ball and our teaching resources.

WEDNESDAY, NOVEMBER 10

■ WA48 - Center, Room 9, Level 2
8:00am-8:45am
FICO - Building Optimization Applications in 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. See 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.

8:45am-9:30pm
Palisade Corporation - DecisionTools Suite Software Introduction
Thompson Terry, tterry@palisde.com

Palisade's DecisionTools Suite includes seven software packages that can be used by a wide variety of departments and individuals within any organization to better assess risk and make well-informed decisions. See how all the components of the Suite can be used together to assess the likelihood of success of a new product launch, determine critical variables to limit risk exposure, optimize the inclusion of the new product into existing manufacturing facilities, and plan for the expansion of both production and distribution networks.

■ WB48 - Center, Room 9, Level 2
11:00am-11:45am
Cambio Technologies - Broadening the Operational Reach of Analytics
Frank Bria, frank.bria@cambiotechnologies.com

One of the more stubborn challenges for analytics-driven companies is bridging the gap between analytic output and operational input, and conversely the gap between operational results and analytic input–the classic divide that exists between the traditionally back-office analytics, and front-of-the-house operations. This session will take a look at how analytics can be made into a near-real-time process that's tightly coupled to the business operations, and will include a deeper dive into a real-world case study where data, models, optimization and operational decisioning have been seamlessly integrated.

MONDAY & TUESDAY

12:30pm-1:30pm
Convention Center – Exhibit Hall 3

Researchers, practitioners and students share their ORMS projects in these sessions presented as poster displays, laptop demonstrations and other creative formats. Authors will be on hand to present their work during the 12:30pm-1:30pm lunch periods on Monday and Tuesday in the Exhibit Hall.

A first-place award of $750 will be presented at each Interactive session. Several panels of distinguished ORMS professionals will review and judge the presentations. Judges include:

Monday Judges: E. Andrew Boyd; Pelin Pekgun, Georgia Tech; Matthew Bailey, Bucknell Univ.; Jean-Paul Watson, Sandia National Laboratories; Homarjun Agrahari, BNSF; Irvin J. Lustig, IBM; Anne G. Robinson, Cisco; Robert Inman, General Motors; Ranganath Nuggehalli, UPS; Teodor Gabriel Crainic, Univ. of Quebec Montreal; Ana Muriel, Univ. of Massachusetts; Barrett Thomas, Univ. of Iowa.

Tuesday Judges: Ronald G. Askin, Arizona State Univ.; Amy Cohn, Univ. of Michigan; Mark S. Daskin, Univ. of Michigan; Jeffrey D. Camm, Univ. of Cincinnati; Michael Fry, Univ. of Cincinnati; Cem Saydam, Univ. of North Carolina at Charlotte; Scott Mason, Clemson Univ.; Nesim K. Erkip, Bilkent Univ.; James J. Cochran, Lousiana Tech Univ.; Ronald L. Rardin, Univ. of Arkansas; Cerry M. Klein, Univ. of Missouri; Sheldon H. Jacobson, UIUC.

The Interactive Sessions are organized and chaired by Maciek A. Nowak, Loyola University Chicago, and Sila Çetinkaya, Texas A&M University.

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MONDAY

Union & Nonunion Employment: Factors that Could Influence the Development of Burnout
Rachel Costello, Walden Univ.

Fuzzy PSO Process
Stephany Coffman-Wolph, Western Michigan Univ.

O.R. at Oracle Retail: SC & Revenue Management Applications
Andrew Vakhutinsky, Oracle Retail Science Group

Achieving Desired Sensitivity out of Outer-Linearized Clearing Functions
Ali Kefeli, North Carolina State Univ.

Interactive Narrative Asthma Program: Usability Testing of Okay with Asthma v.2.0
Xueping Li, Univ. of Tennessee

Promotion Strategies & Backward Information Sharing in a SC
Hung Do, Purdue Univ.

Competitive Facility Location Problem
Mona Asudegi, Univ. of Maryland

Multi-Valued Subsets for Binary Partitions in Generalized Iterative Dichotomizer 3
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Foad Hassanmirzaei, Richard Ivey School of Business

Spatial Information Theoretical Approach to Locating Sensors in Transportation Security Applications
Jeffrey Taylor, Univ. of Utah

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Haochun Zhang, Univ. of Louisiana at Lafayette

Spatial Queue-Based Dynamic Flow Simulation & Rapid Response Model for Congestion Mitigation
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How Healthcare Can Benefit from Modeling & Analysis
Michael Hosking, NCSU

Use of Dynamic Simulation to Examine Interventions that Improve Access to Colorectal Cancer Care
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Impact of Staffing & Capacity Flexibility on Quality & Financial Outcomes in Hospitals
Adelina Gnanlet, California State Univ.

Serial SC Coordination Problem Under Centralized/Decentralized Decision Making
In-Jae Jeong, Hanyang Univ.

Mixed Integer Nonlinear Program for Electric Generation Expansion
Mehrdad Pirnia, Univ. of Waterloo

Minimum Cut Tree Games
Anne Schwahn, Univ. of Kaiserslautern

Stochastic Approach to Search & Target Acquisition
Steven Yuhaski, Jr, Natick Soldier Research

Risk Identification & Modeling in IT Service Management Projects
Winnie Cheng, IBM T.J. Watson Research Center

Research Project-Regional Evacuation: Planning, Control & Adaption
Katharina Gerhardt, Univ. of Kaiserslautern

Periodic Location Routing Inventory Problem
S. Reza Sajjadi, North Dakota State Univ.

Identifying the Leading Indicators of Software Development Cost Overruns
Victor Modic, U.S. Air Force

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Ehsan Jafari Shirazi, West Virginia Univ.

Market Making in Mean Reversion Price Models
Tanmoy Chakraborty, Univ. of Pennsylvania

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Travel-Time Model for Order Batching & Picking in a Synchronized Zone Order Picking System
Li Pan, Univ. of Hong Kong

Foreign Direct Investment & Convergence: Nonparametric Production Frontier Approach
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Information Based Tree Search
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Map Segmentation Problems for Geographic Resource Allocation
John Carlsson, Univ. of Minnesota

Mutating Turing Machines
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Open-Ended Projects for an Undergraduate O.R. Class in a Math Department
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Pricing & Production Optimization in the Presence of Market Uncertainty
Vijay Narayanan, Georgia Tech

Recovery Strategies for Returnable Transport Items
Ruth Carrasco-Gallego, Technical Univ. of Madrid

Risk-Based Technology Assessment for Capital Equipment Decisions in Small Firms
Samuel Merriweather, Texas A&M Univ.

Subsidies vs. Diversification: Strategies for Supplier Disruption Management
Luz Caudillo-Fuentes, Univ. of Michigan

Dilemma of Information Security: Building or Buying?
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Topology Design & Capacity Assignment on a Network with Guarantees on Robustness & QoS
Emmanuelle Wallach, Pennsylvania State Univ.

Underground Re-Scheduling for Maximizing the Use of Regenerative-Braking Energy
Maite Pena-Alcaraz, MIT

Forecasting PHEV Sales & Recharging Activities
Brittni Gutierr, Iowa State Univ.

Designing Optimal Yard Layouts for Container Terminals
Leena Suhl, Univ. of Paderborn

Indoor Location Analytics: Applying Web Analytics to Location-based Services
Sun K. Kim, Keio Univ.

Differential Equations Modeling of Patients Dynamics in Emergency Rooms
Jerome Ndayishimiye, Univ. at Buffalo

Hybrid Defense Resource Allocations in the face of Partially Strategic Attacker
Xiaojun Shan, Univ. at Buffalo

Measuring Partnership Efficacy in Haitian Disaster Recovery
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Modeling & Mitigating the Effects of SC Disruption on War Games
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Dual-RAMP Algorithm for Resource Constrained Project Scheduling
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Grey System Approach for EOQ & EPQ Models
Serpil EROL, Gazi Univ.

Valuing Pricing of Genetically Modified Traits Using Monte-Carlo Simulation
Suamdhur Shakya, North Dakota State Univ.

Embedding Classical TSP Neighborhoods in a Single Ejection Chain Framework
Dorabela Gamboa, Polytechnic of Porto

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Danielle Araujo, IEAV/DCTA

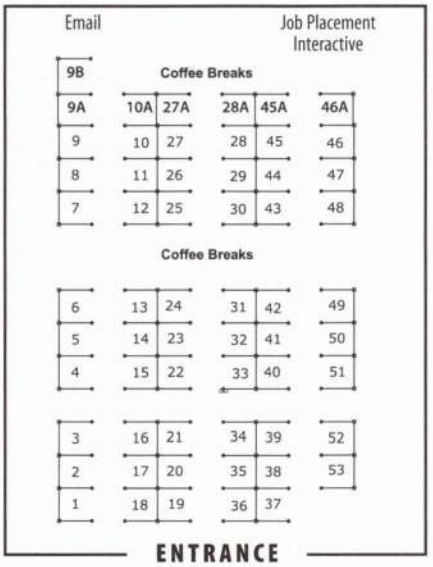
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Optimal Production Control & Labor Management in Lean Manufacturing
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Exhibit Hall 3



Exhibits Open

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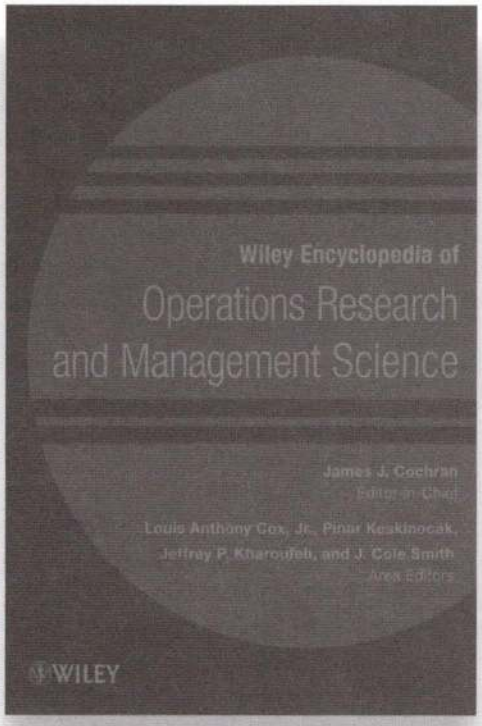
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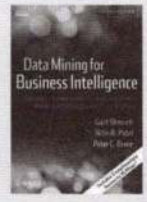
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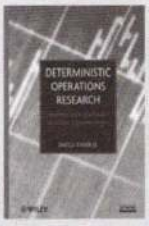


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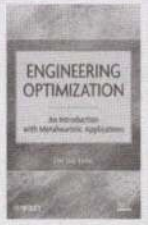


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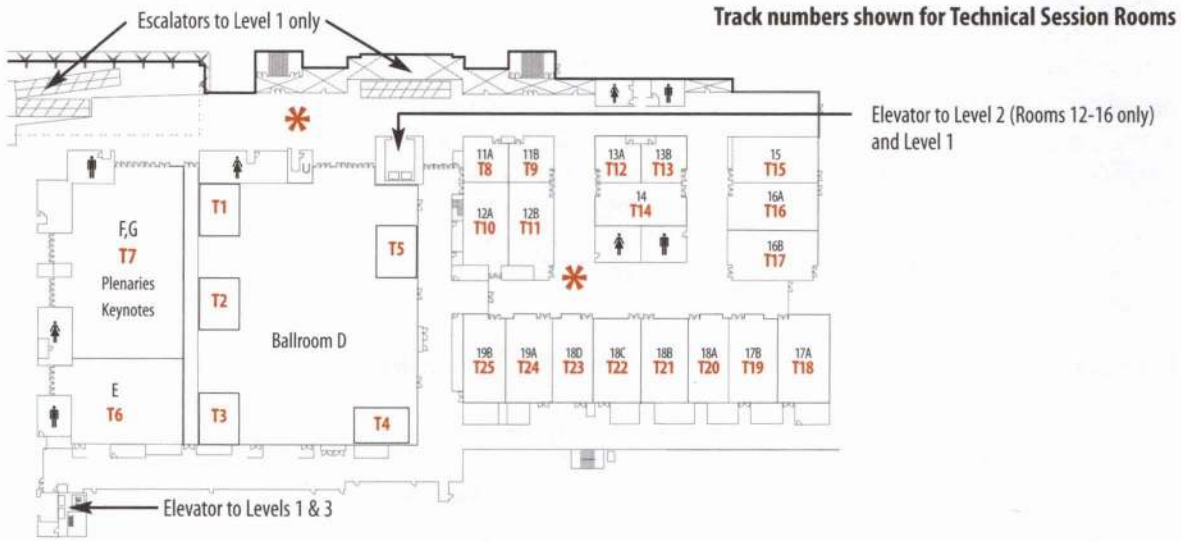
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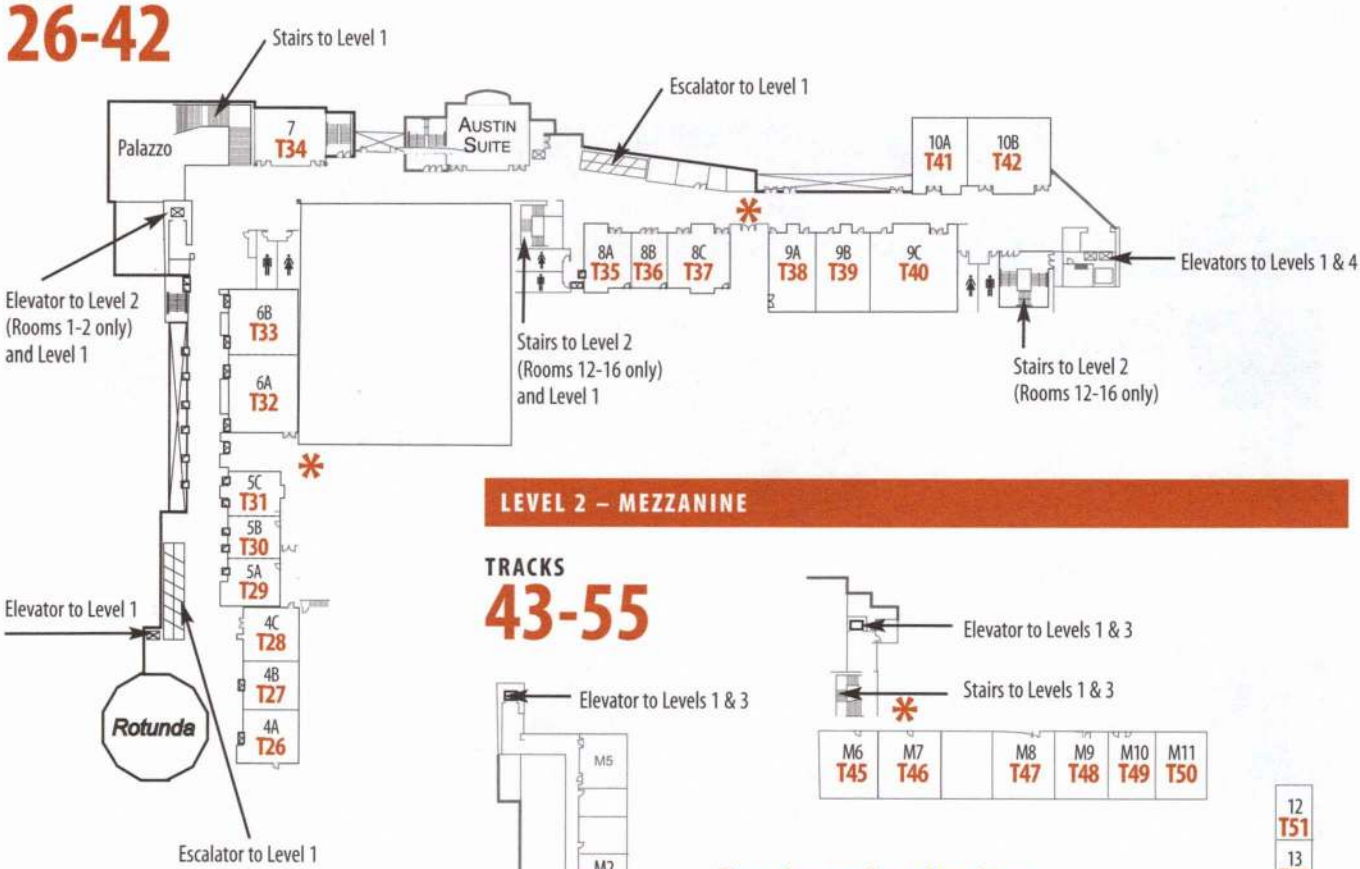
TRACKS 1-25

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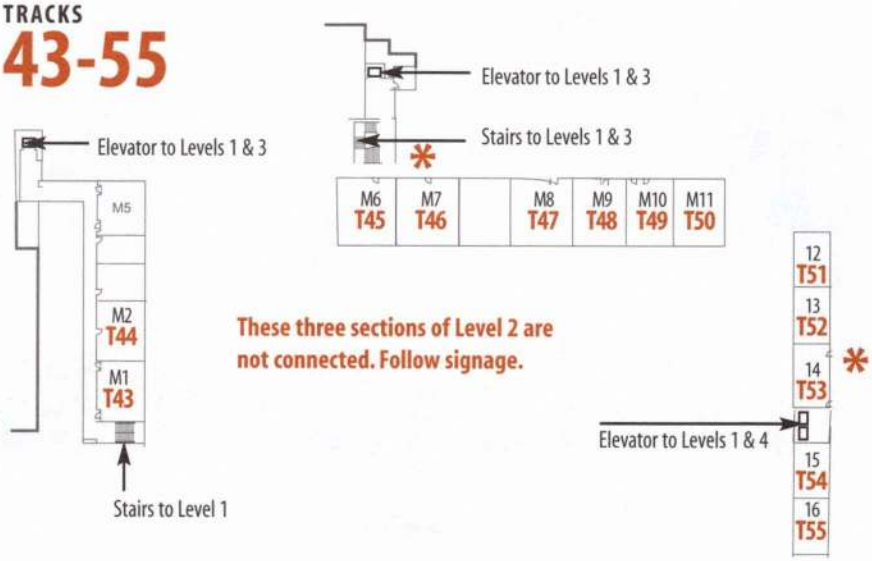
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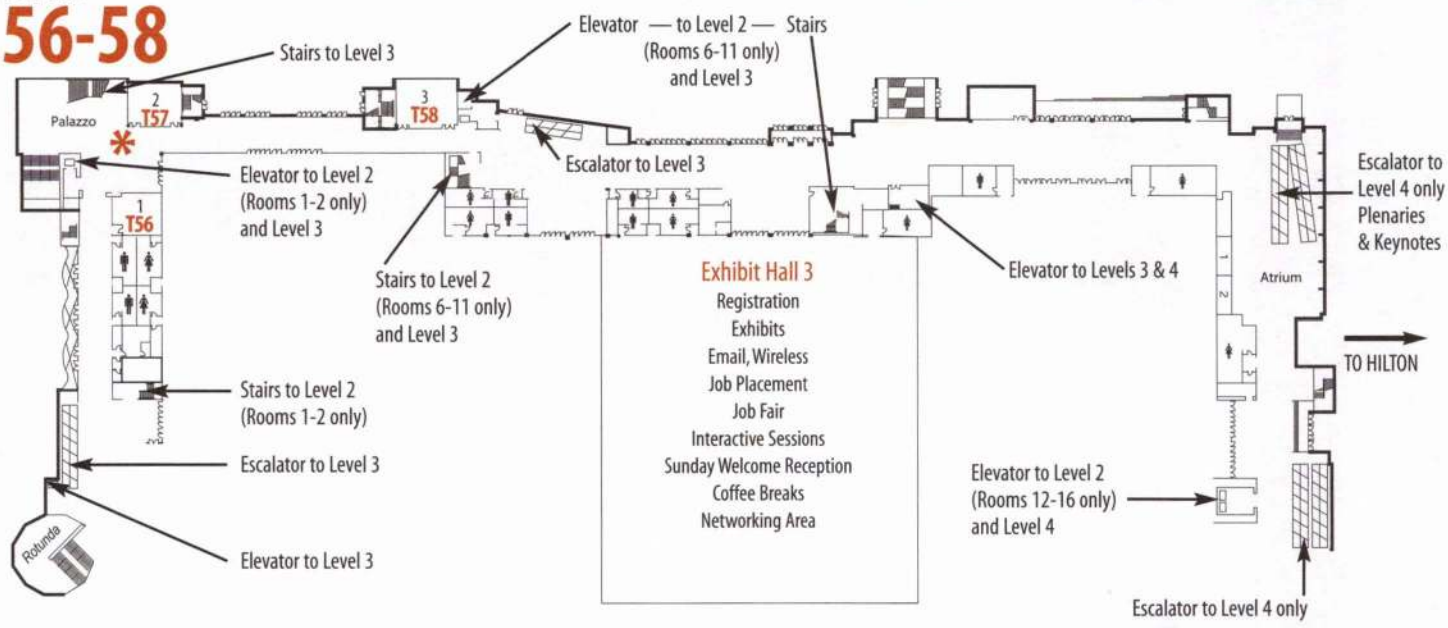
TRACKS 43-55



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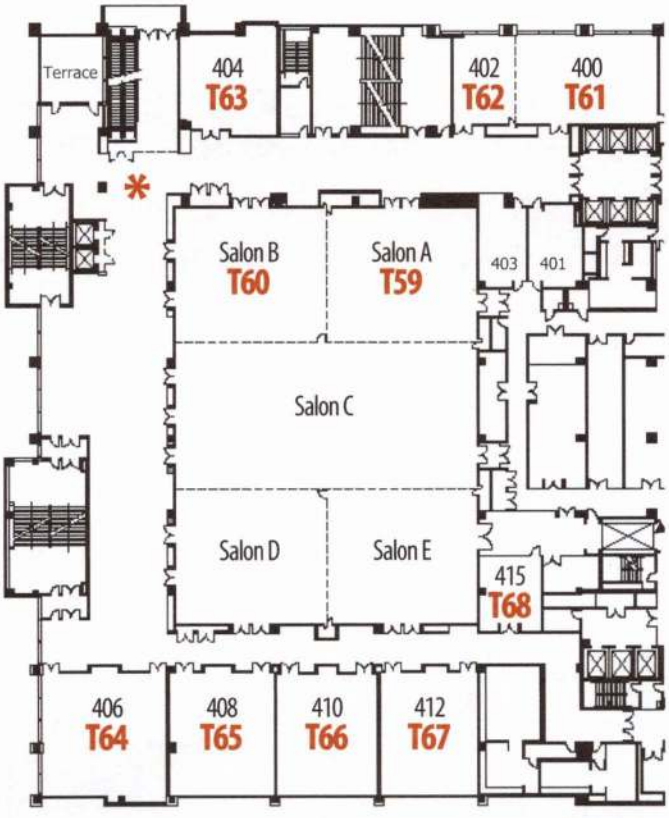
TRACKS
56-58

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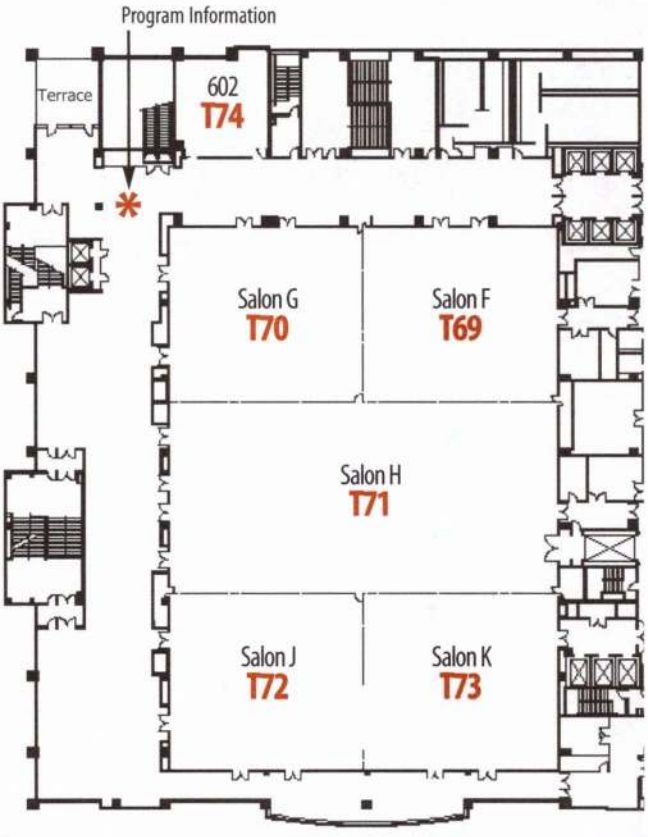
HILTON 4TH FLOOR

TRACKS
59-68



HILTON 6TH FLOOR

TRACKS
69-74



MASTER TRACK SCHEDULE – SUNDAY

C-Convention Center H-Hilton

Track	Room	SA 8:00-9:30	Plenary 10:00–10:50	SB 11:00-12:30	SC 1:30-3:00	Keynotes 3:10-4:00	SD 4:30-6:00
1	C - Ballroom D1, Level 4	ENRE - Energy		ENRE - Energy	ENRE - Energy		ENRE - Energy
2	C - Ballroom D2, Level 4	ENRE - Energy		ENRE - Energy	ENRE - Energy		Energy: Modeling the Interface
3	C - Ballroom D3, Level 4	ENRE - Mining		ENRE - Mining	ENRE - Mining		ENRE - Mining
4	C - Ballroom D4, Level 4	Clean Energy		Clean Energy	Clean Energy		Clean Energy
5	C - Ballroom D5, Level 4	SpORts		SpORts	SpORts		Sports & Entertainment
6	C - Ballroom E, Level 4	Tutorials		Tutorials	Tutorials		Tutorials
7	C - Ballroom F-G, Level 4	Junior Faculty Interest Group		JFIG	JFIG		JFIG
8	C - Room 11A, Level 4	Location Analysis		Location Analysis	Location Analysis		Location Analysis
9	C - Room 11B, Level 4	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
10	C - Room 12A, Level 4	Mfg. & Service Operations Mgt.	**Welcome & Philip**	MSOM	MSOM	**Keynote**	MSOM
11	C - Room 12B, Level 4	Mfg. & Service Operations Mgt.	**McCord Morse**	MSOM	MSOM	**John Weyant**	MSOM
12	C - Room 13A, Level 4	MSOM - Supply Chain	**Lecture**	MSOM - Supply Chain	MSOM - Supply Chain	**Climate Energy Policy**	MSOM - Supply Chain
13	C - Room 13B, Level 4	MSOM - Supply Chain	**Edward Kaplan**	MSOM - Supply Chain	MSOM - Supply Chain	**Analyses**	MSOM - Supply Chain
14	C - Room 14, Level 4	MSOM - Service Mgt.	**Intelligence**	MSOM - Service Mgt.	Women in OR/MS	**C-Ballroom E, Level 4**	Supply Chain Mgt.
15	C - Room 15, Level 4	Behavioral Operations Mgt.	**Operations Research**	Behavioral Operations Mgt.	Behavioral Operations Mgt.		Behavioral Operations Mgt.
16	C - Room 16A, Level 4	Semiconductor Mfg.	**Ballroom G, Level 4**	Semiconductor Mfg.	Semiconductor Mfg.		Semiconductor Mfg.
17	C - Room 16B, Level 4	Practice of OR/MS		Practice of OR/MS	Practice of OR/MS		Practice of OR/MS
18	C - Room 17A, Level 4	CPMS, The Practice Section		CPMS-Practice	CPMS-Practice		CPMS-Practice
19	C - Room 17B, Level 4	Revenue Mgt. & Pricing		Revenue Mgt.	Revenue Mgt.		Revenue Mgt.
20	C - Room 18A, Level 4	Revenue Mgt. & Pricing		Revenue Mgt.	Revenue Mgt.		Revenue Mgt.
21	C - Room 18B, Level 4	Service Science		Service Science	Service Science		Service Science
22	C - Room 18C, Level 4	Service Science		Service Science	Service Science	**Keynote**	Service Science
23	C - Room 18D, Level 4	Service Science		Service Science	Service Science	**Edelman Reprise**	Service Science
24	C - Room 19A, Level 4	Public Programs, Service & Needs		Public Programs	Public Programs	**2010 Edelman Winner**	Public Programs
25	C - Room 19B, Level 4	Public Programs, Service & Needs		Public Programs	Public Programs	**Indeval**	Public Programs
26	C - Room 4A, Level 3	Data Mining		Data Mining	Data Mining	**Indeval Develops New**	Data Mining
27	C - Room 4B, Level 3	Computing		Computing	Nicholson Student Paper Prize	**Operating & Settlement**	Nicholson Student Paper Prize
28	C - Room 4C, Level 3	Quality, Statistics & Reliability		QSR	QSR	**System Using OR**	QSR
29	C - Room 5A, Level 3	Quality, Statistics & Reliability		QSR	QSR	**C-Ballroom G, Level 4**	QSR
30	C - Room 5B, Level 3	Quality, Statistics & Reliability		QSR	QSR		QSR
31	C - Room 5C, Level 3	Data Mining		Data Mining	Data Mining		Data Mining
32	C - Room 6A, Level 3	Computing		Computing	Computing		Computing
33	C - Room 6B, Level 3	Computing		Computing	Computing		Computing
34	C - Room 7, Level 3	Computing		Computing	Computing		Computing
35	C - Room 8A, Level 3	Applied Probability		Applied Probability	Applied Probability		Applied Probability
36	C - Room 8B, Level 3	INFORM-ED		INFORM-ED	INFORM-ED		INFORM-ED

SUNDAY – *continued*

Track	Room	SA 8:00-9:30	Plenary 10:00–10:50	SB 11:00-12:30	SC 1:30-3:00	Keynotes 3:10-4:00	SD 4:30-6:00
37	C - Room 8C. Level 3	Applied Probability		Applied Probability	Applied Probability		Applied Probability
38	C - Room 9A, Level 3	Opt.-Global		Opt.-Global	Opt.-Global		Opt.-Global
39	C - Room 9B, Level 3	Opt.-Integer Prog.		Opt.-Integer Prog.	Opt.-Prizes		Opt.-Integer Prog.
40	C - Room 9C, Level 3	John Forrest-fest | COIN-OR 10th		John Forrest-fest | COIN-OR 10th	John Forrest-fest | COIN-OR 10th		John Forrest-fest | COIN-OR 10th
41	C - Room 10A, Level 3	Opt.-Nonlinear Prog.		Opt.-Nonlinear Prog.	Opt.-Nonlinear Prog.		Opt.-Nonlinear Prog.
42	C - Room 10B, Level 3	Opt.-Stochastic Prog.		Opt.-Stochastic Prog.	Opt.-Stochastic Prog.		Opt.-Stochastic Prog.
43	C - Room 1, Level 2	Health Applications		Health Applications	Health Applications		Health Applications
44	C - Room 2, Level 2	Health Applications		Health Applications	Health Applications		Health Applications
45	C - Room 6, Level 2	Health Applications		Health Applications	Health Applications		Health Applications
46	C - Room 7, Level 2	Invited Panel: Professional Issues		Applied Probability	Panel: Professional Issues		Undergraduate OR Prize
47	C - Room 8, Level 2	Comp. Biology & Bioinformatics		Comp. Biology & Bioinformatics	Comp. Biology & Bioinformatics		Comp. Biology & Bioinformatics
48	C - Room 9, Level 2	SAS Global & Autobox		Salford & GAMS	JMP & Innovative Sched.		AMPL & Ziena
49	C -Room 10, Level 2	Information Systems		Information Systems	Information Systems		Information Systems
50	C -Room 11, Level 2	Information Systems		Information Systems	Information Systems		Information Systems
51	C -Room 12, Level 2	Military Applications		Military Applications	Microsoft & AnyLogic		Computing
52	C -Room 13, Level 2	Military Applications		Military Applications	Military Applications		Military Applications
53	C -Room 14, Level 2	New Trends/Wireless Networks		New Trends/Wireless Networks	New Trends/Wireless Networks		Telecommunications
54	C -Room 15, Level 2	Tech. Mgt./New Product Dev.		Tech. Mgt./New Product	Tech. Mgt./New Product		Tech. Mgt./New Product
55	C -Room 16, Level 2	Tech. Mgt./New Product Dev.		Tech. Mgt./New Product	Tech. Mgt./New Product		New Product Development
56	C - Room 1, Level 1	Simulation		Simulation	Simulation		Simulation
57	C - Room 2, Level 1	Risk Mgt.		Risk Mgt.	Risk Mgt.		Risk Mgt.
58	C - Room 3, Level 1	Quantitative Finance		Quantitative Finance	Quantitative Finance		Quantitative Finance
59	H - Salon A, 4th Fl.	Combinatorial Optimization		Combinatorial Optimization	Doing Good with Good OR		Doing Good with Good OR
60	H - Salon B, 4th Fl.	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
61	H - Room 400, 4th Fl.	No Session		No Session	No Session		No Session
62	H - Room 402, 4th Fl.	No Session		No Session	No Session		No Session
63	H - Room 404, 4th Fl.	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
64	H - Room 406, 4th Fl.	No Session		No Session	No Session		No Session
65	H - Room 408, 4th Fl.	No Session		No Session	No Session		No Session
66	H - Room 410, 4th Fl.	No Session		No Session	No Session		No Session
67	H - Room 412, 4th Fl.	No Session		No Session	No Session		No Session
68	H - Room 415, 4th Fl.	eBusiness		eBusiness	eBusiness		eBusiness
69	H - Salon F, 6th Fl.	Railway Applications		Railway Applications	Railway Applications		Railway Applications
70	H - Salon G, 6th Fl.	Aviation Applications		Aviation Applications	Aviation Applications		Aviation Applications
71	H - Salon H, 6th Fl.	Transportation		In Honor of Bill Cooper	In Honor of Bill Cooper		In Honor of Bill Cooper
72	H - Salon J, 6th Fl.	Transportation Science & Logistics		TSL	TSL		TSL
73	H - Salon K, 6th Fl.	Transportation Science & Logistics		TSL	TSL		TSL
74	H - Room 602, 6th Fl.	Transportation Science & Logistics		TSL	TSL		TSL

THEME SESSIONS HIGHLIGHTED IN GREY

MASTER TRACK SCHEDULE – MONDAY

C-Convention Center H-Hilton

Interactive Session 12:30pm-1:30pm, Exhibit Hall 3

Track	Room	MA 8:00-9:30	Plenary 10:00–10:50	MB 11:00-12:30	MC 1:30-3:00	Keynotes 3:10-4:00	MD 4:30-6:00
1	C - Ballroom D1, Level 4	ENRE-Energy		ENRE-Energy	ENRE-Energy		ENRE-Energy
2	C - Ballroom D2, Level 4	Energy: Modeling the Interface		Energy: Modeling the Interface	Energy: Modeling the Interface		Energy: Modeling the Interface
3	C - Ballroom D3, Level 4	ENRE-Forestry		ENRE-Forestry	ENRE-Forestry		ENRE-Forestry
4	C - Ballroom D4, Level 4	Clean Energy		Clean Energy	Electrical Energy Systems		Electrical Energy Systems
5	C - Ballroom D5, Level 4	Auctions & Game Theory	**Plenary**	Auctions & Game Theory	Auctions/Mechanism	**Keynote**	Auctions/Mechanism
6	C - Ballroom E, Level 4	Tutorials	**Joan Woodard**	Tutorials	Tutorials	**Charles Groat**	Tutorials
7	C - Ballroom F-G, Level 4	Tutorials	**Re-think,**	Tutorials	Tutorials	**Part of Our Energy**	Tutorials
8	C - Room 11A, Level 4	Location Analysis	**Re-engineer,**	Location Analysis	Location Analysis	**Future Will Look**	Location Analysis
9	C - Room 11B, Level 4	Mfg. & Service Operations Mgt.	**Re-energize**	MSOM	MSOM	**Like the Past**	MSOM
10	C - Room 12A, Level 4	Mfg. & Service Operations Mgt.	**C-Ballroom G, Level 4**	MSOM	MSOM	**C-Ballroom E, Level 4**	MSOM
11	C - Room 12B, Level 4	Mfg. & Service Operations Mgt.		MSOM	MSOM		MSOM
12	C - Room 13A, Level 4	MSOM-Supply Chain		MSOM-Supply Chain	MSOM-Supply Chain		MSOM-Supply Chain
13	C - Room 13B, Level 4	MSOM-Supply Chain		MSOM-Supply Chain	MSOM-Supply Chain		MSOM-Services Mgt.
14	C - Room 14, Level 4	Supply Chain Mgt.		Women in OR/MS	Supply Chain Mgt.		Supply Chain Mgt.
15	C - Room 15, Level 4	Behavioral Operations Mgt.		Behavioral Operations Mgt.	Behavioral Operations Mgt.		Behavioral Operations Mgt.
16	C - Room 16A, Level 4	Semiconductor Mgt.		Semiconductor Industry	Production & Scheduling		Production and Scheduling
17	C - Room 16B, Level 4	Practice of OR/MS		Practice of OR/MS	Practice of OR/MS		Practice of OR/MS
18	C - Room 17A, Level 4	CPMS, The Practice Section		CPMS-Practice	CPMS-Practice		CPMS-Practice
19	C - Room 17B, Level 4	Revenue Mgt. & Pricing		Revenue Mgt.	Revenue Mgt.		Revenue Mgt.
20	C - Room 18A, Level 4	Revenue Mgt. & Pricing		Revenue Mgt.	Revenue Mgt.		Revenue Mgt.
21	C - Room 18B, Level 4	Service Science		Service Science	Service Science		Service Science
22	C - Room 18C, Level 4	Service Science		Service Science	Service Science	**Keynote**	Service Science
23	C - Room 18D, Level 4	Service Science		Service Science	Service Science	**Perry Noakes**	Service Science
24	C - Room 19A, Level 4	Public Programs, Service & Needs		Public Programs	Public Programs	**Global Supply Chain**	Public Programs
25	C - Room 19B, Level 4	Public Programs, Service & Needs		Public Programs	Public Policy	**Planning at Dell**	Public Policy
26	C - Room 4A, Level 3	Data Mining		Data Mining	Data Mining	**C-Ballroom G, Level 4**	Data Mining
27	C - Room 4B, Level 3	Combinatorial Opt.		Organization Science	Organization Science		Organization Science
28	C - Room 4C, Level 3	Quality, Statistics & Reliability		QSR	QSR		QSR
29	C - Room 5A, Level 3	Quality, Statistics & Reliability		QSR	QSR		QSR
30	C - Room 5B, Level 3	Quality, Statistics & Reliability		Bayesian Models	Bayesian Models		Bayesian Models
31	C - Room 5C, Level 3	Data Mining		Practice of OR/MS	Data Mining		Data Mining
32	C - Room 6A, Level 3	Computing		Computing	Computing		Computing
33	C - Room 6B, Level 3	Computing		Computing	Opt./Computational Opt.		Computing
34	C - Room 7, Level 3	Computing		Computing	Computing		Computing
35	C - Room 8A, Level 3	Applied Probability		Applied Probability	IOL Technical		Applied Probability
36	C - Room 8B, Level 3	INFORM-ED		INFORM-ED	INFORM-ED		INFORM-ED

MONDAY – *continued*

Track	Room	MA 8:00-9:30	Plenary 10:00–10:50	MB 11:00-12:30	MC 1:30-3:00	Keynotes 3:10-4:00	MD 4:30-6:00
37	C - Room 8C. Level 3	Applied Probability		Applied Probability	Applied Probability		Applied Probability
38	C - Room 9A, Level 3	Opt.-Global		Opt.-Global	Opt.-Global		e-Marketing
39	C - Room 9B, Level 3	Opt.-Integer Prog.		Opt.-Integer Prog.	Opt.-Integer Prog.		Opt.-Integer Prog.
40	C - Room 9C, Level 3	John Forrest-fest | COIN-OR 10th		John Forrest-fest | COIN-OR 10th	John Forrest-fest | COIN-OR 10th		John Forrest-fest | COIN-OR 10th
41	C - Room 10A, Level 3	Opt.-Nonlinear Prog.		Opt.-Nonlinear Prog.	Opt.-Nonlinear Prog.		Opt.-Nonlinear Prog.
42	C - Room 10B, Level 3	Opt.-Stochastic Prog.		Opt.-Stochastic Prog.	Opt.-Stochastic Prog.		Opt.-Stochastic Prog.
43	C - Room 1, Level 2	Health Applications		Health Applications	Health Applications		Health Applications
44	C - Room 2, Level 2	Health Applications		Health Applications	Health Applications		Health Applications
45	C - Room 6, Level 2	Health Applications		Health Applications	Health Applications		Health Applications
46	C - Room 7, Level 2	Panel: Professional Issues		Undergraduate OR Prize	Undergraduate OR Prize		Undergraduate OR Prize
47	C - Room 8, Level 2	Comp. Biology & Bioinformatics		Complex Systems	Complex Systems		Complex Systems
48	C - Room 9, Level 2	Syncopation & LINKS		Gurobi & AIMMS	LINDO & Imagine That		AORDA & Lumina
49	C -Room 10, Level 2	Information Systems		Information Systems	Information Systems		Information Systems
50	C -Room 11, Level 2	Information Systems		Information Systems	Cloud Computing		Cloud Computing
51	C -Room 12, Level 2	Military Applications		Military Applications	Military Applications		Military Applications
52	C -Room 13, Level 2	Homeland Security & Defense		Homeland Security & Defense	Homeland Security & Defense		Homeland Security & Defense
53	C -Room 14, Level 2	Telecommunications		Telecommunications	Telecommunications		Telecommunications
54	C -Room 15, Level 2	Tech. Mgt./New Product Dev.		Tech. Mgt./New Product	Tech. Mgt./New Product		Tech. Mgt./New Product
55	C -Room 16, Level 2	Tech. Mgt./New Product Dev.		Tech. Mgt./New Product	Tech. Mgt./New Product		Tech. Mgt.
56	C - Room 1, Level 1	Simulation		Simulation	Simulation		Simulation
57	C - Room 2, Level 1	Risk Mgt.		Risk Mgt.	Financial Services		Financial Services
58	C - Room 3, Level 1	Quantitative Finance		Quantitative Finance	Quantitative Finance		Quantitative Finance
59	H - Salon A, 4th Fl.	Forio & Conrady		George B. Dantzig Prize	Job Placement Services		Job Placement Services
60	H - Salon B, 4th Fl.	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
61	H - Room 400, 4th Fl.	No Session		No Session	No Session		No Session
62	H - Room 402, 4th Fl.	No Session		No Session	No Session		No Session
63	H - Room 404, 4th Fl.	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
64	H - Room 406, 4th Fl.	No Session		No Session	No Session		No Session
65	H - Room 408, 4th Fl.	No Session		No Session	No Session		No Session
66	H - Room 410, 4th Fl.	No Session		No Session	No Session		No Session
67	H - Room 412, 4th Fl.	No Session		No Session	No Session		No Session
68	H - Room 415, 4th Fl.	eBusiness		eBusiness	eBusiness		Analytics: Future of INFORMS?
69	H - Salon F, 6th Fl.	Railway Applications		Railway Applications	Railway Applications		Railway Applications
70	H - Salon G, 6th Fl.	Aviation Applications		Aviation Applications	Aviation Applications		Aviation Applications
71	H - Salon H, 6th Fl.	In Honor of Bill Cooper		In Honor of Bill Cooper	In Honor of Bill Cooper		In Honor of Bill Cooper
72	H - Salon J, 6th Fl.	Transport. Science & Logistics		TSL	TSL		TSL
73	H - Salon K, 6th Fl.	Transport. Science & Logistics		TSL	TSL		TSL
74	H - Room 602, 6th Fl.	Transport. Science & Logistics		TSL	TSL		TSL

THEME SESSIONS HIGHLIGHTED IN GREY

MASTER TRACK SCHEDULE – TUESDAY

C-Convention Center H-Hilton

Interactive Session 12:30pm-1:30pm, Exhibit Hall 3

Track	Room	TA 8:00-9:30	Plenary 10:00–10:50	TB 11:00-12:30	TC 1:30-3:00	Keynotes 3:10-4:00	TD 4:30-6:00
1	C - Ballroom D1, Level 4	ENRE-Energy		ENRE-Energy	ENRE-Energy		ENRE-Energy
2	C - Ballroom D2, Level 4	Energy: Modeling the Interface		Energy: Modeling the Interface	Energy: Modeling the Interface		Energy: Modeling the Interface
3	C - Ballroom D3, Level 4	ENRE-Forestry		ENRE-Forestry	ENRE-Forestry		No Session
4	C - Ballroom D4, Level 4	Electrical Energy Systems		Electrical Energy Systems	Electrical Energy Systems		Electrical Energy Systems
5	C - Ballroom D5, Level 4	Game Theory	**Plenary**	Game Theory	Queueing Models	**Keynote**	Queueing Models
6	C - Ballroom E, Level 4	Tutorials	**OMEGA RHO**	Tutorials	Tutorials	**Chung-Yee Lee**	Tutorials
7	C - Ballroom F-G, Level 4	Junior Faculty Interest Group	**Distinguished Lecture**	Daniel H. Wagner Prize	Daniel H. Wagner Prize	**Making Global Supply**	Daniel H. Wagner Prize
8	C - Room 11A, Level 4	Location Analysis	**John Birge**	Location Analysis	Location Analysis	**Chain Mgt. Effective**	Location Analysis
9	C - Room 11B, Level 4	Mfg. & Service Operations Mgt.	**ORMS and Risk Mgt.**	MSOM	MSOM	**C-Ballroom E, Level 4**	MSOM
10	C - Room 12A, Level 4	Mfg. & Service Operations Mgt.	**Failures**	MSOM	MSOM		MSOM
11	C - Room 12B, Level 4	Mfg. & Service Operations Mgt.	**C-Ballroom G, Level 4**	MSOM	MSOM		MSOM
12	C - Room 13A, Level 4	MSOM-Supply Chain		MSOM-Supply Chain	MSOM-Supply Chain		MSOM-Supply Chain
13	C - Room 13B, Level 4	MSOM-Service Mgt.		MSOM-Service Mgt.	MSOM-Service Mgt.		MSOM-Service Mgt.
14	C - Room 14, Level 4	Supply Chain Mgt.		Women in OR/MS	Supply Chain Mgt.		Supply Chain Mgt.
15	C - Room 15, Level 4	Behavioral Operations Mgt.		Behavioral Operations	Computer Science-Applications		Computer Science-Applications
16	C - Room 16A, Level 4	Production & Scheduling		Scheduling	Scheduling		Manufacturing
17	C - Room 16B, Level 4	Practice of OR/MS		OR/MS in India	OR/MS in India		OR/MS in India
18	C - Room 17A, Level 4	CPMS, The Practice Section		CPMS-Practice	CPMS-Practice		Computing
19	C - Room 17B, Level 4	Revenue Mgt. & Pricing		Revenue Mgt.	Revenue Mgt.		Revenue Mgt.
20	C - Room 18A, Level 4	Revenue Mgt. & Pricing		Revenue Mgt.	Revenue Mgt.		Revenue Mgt.
21	C - Room 18B, Level 4	Service Science		Service Science	Service Science		Service Science
22	C - Room 18C, Level 4	Service Science		Service Science	Service Science	**Keynote**	Service Science
23	C - Room 18D, Level 4	Service Science		Media Planning & Opt.	Media Planning & Opt.	**Gerald Brown**	Media Planning & Opt.
24	C - Room 19A, Level 4	Public Programs, Service & Needs		Public Programs	Public Programs	**Rethinking Risk**	Public Programs
25	C - Room 19B, Level 4	Public Policy		Public Policy	Traffic Mgt.	**Assessment & Mgt. for**	Transportation
26	C - Room 4A, Level 3	Data Mining		Data Mining	Data Mining	**Homeland Security &**	No Session
27	C - Room 4B, Level 3	Organization Science		Integer Programming	Integer Programming	**Defense**	Large Scale Optimization
28	C - Room 4C, Level 3	Quality, Statistics & Reliability		QSR	QSR	**C-Ballroom G, Level 4**	QSR
29	C - Room 5A, Level 3	Quality, Statistics & Reliability		QSR	QSR		QSR
30	C - Room 5B, Level 3	Quality, Statistics & Reliability		QSR	Reliability		Reliability
31	C - Room 5C, Level 3	Data Mining		Data Mining	Data Mining		Data Mining
32	C - Room 6A, Level 3	Computing		Computing	Computing		Computing
33	C - Room 6B, Level 3	Computing		Computing	Computing		Computing
34	C - Room 7, Level 3	Computing		Computing	Computing		Computing
35	C - Room 8A, Level 3	Applied Probability		Applied Probability	Applied Probability		Applied Probability
36	C - Room 8B, Level 3	INFORM-ED		INFORM-ED	INFORM-ED		INFORM-ED

TUESDAY – *continued*

Track	Room	TA 8:00-9:30	Plenary 10:00–10:50	TB 11:00-12:30	TC 1:30-3:00	Keynotes 3:10-4:00	TD 4:30-6:00
37	C - Room 8C, Level 3	Applied Probability		Applied Probability	Applied Probability		Applied Probability
38	C - Room 9A, Level 3	Opt.-Linear Prog. & Compl.		Opt.-Linear Prog. & Comp.	Opt.-Linear Prog. & Comp.		Opti.-Linear Prog. & Comp
39	C - Room 9B, Level 3	Optimization-Integer Prog.		Opt.-Integer Prog.	Opt.-Integer Prog.		Opt.-Integer Prog.
40	C - Room 9C, Level 3	John Forrest-fest | COIN-OR 10th		John Forrest-fest | COIN-OR 10th	John Forrest-fest | COIN-OR 10th		John Forrest-fest | COIN-OR 10th
41	C - Room 10A, Level 3	Nonlinear Programming		Nonlinear Programming	Opt.-Networks		Opti.-Networks
42	C - Room 10B, Level 3	Opt.-Stochastic Prog.		Opt.-Stochastic Prog.	Opt.-Stochastic Prog.		Opt.-Stochastic Prog.
43	C - Room 1, Level 2	Health Applications		Health Applications	Health Applications		Health Applications
44	C - Room 2, Level 2	Health Applications		Health Applications	Health Applications		Health Applications
45	C - Room 6, Level 2	Health Applications		Health Applications	Health Applications		Health Applications
46	C - Room 7, Level 2	Panel: Professional Issues		Panel: Professional Issues	Panel: Professional Issues		Panel: Professional Issues
47	C - Room 8, Level 2	Complex Systems		Complex Systems	Topics in Project Mgt.		Topics in Project Mgt.
48	C - Room 9, Level 2	Dec. Frameworks & statistics		Frontline & Maximal	IBM & Responsive Learn.		SAS & Oracle
49	C -Room 10, Level 2	Information Systems		Information Systems	Information Systems		Information Systems
50	C -Room 11, Level 2	Cloud Computing		Cloud Computing	Cloud Computing		Cloud Computing
51	C -Room 12, Level 2	Military Applications		Military Applications	Military Applications		Military Applications
52	C -Room 13, Level 2	Homeland Security & Defense		Homeland Security & Defense	Homeland Security & Defense		Homeland Security & Defense
53	C -Room 14, Level 2	Marketing Science		Marketing Science	Marketing Science		Marketing Science
54	C -Room 15, Level 2	Tech. Mgt./New Product Dev.		Tech. Mgt./New Product	Tech. Mgt./New Product		Tech. Mgt./New Product
55	C -Room 16, Level 2	Tech. Mgt./New Product Dev.		Tech. Mgt./New Product	Tech. Mgt./New Product		Tech. Mgt./New Product
56	C - Room 1, Level 1	Simulation		Simulation	Simulation		Simulation
57	C - Room 2, Level 1	Financial Services		Financial Services	Financial Services		Financial Services
58	C - Room 3, Level 1	Quantitative Finance		Quantitative Finance	Quantitative Finance		Quantitative Finance
59	H - Salon A, 4th Fl.	Analytic Hierarchy Process		Research & Development	Decision Support Systems		Decision Support Systems
60	H - Salon B, 4th Fl.	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
61	H - Room 400, 4th Fl.	Operations Mgt.		Operations Mgt.	Operations Mgt.		Operations Mgt.
62	H - Room 402, 4th Fl.	Aviation Applications		MathWorks & ac2 Solutions	Aviation Applications		Aviation Applications
63	H - Room 404, 4th Fl.	Decision Analysis		Decision Analysis	Decision Analysis		Decision Analysis
64	H - Room 406, 4th Fl.	Health Care		Health Care	Health Care		Health Care
65	H - Room 408, 4th Fl.	Inventory Mgt.		Inventory Mgt.	Inventory Mgt.		Inventory Mgt.
66	H - Room 410, 4th Fl.	Logistics		Logistics	Supply Chain		Supply Chain
67	H - Room 412, 4th Fl.	Economics		Economics	Economics		Revenue-Yield Mgt.
68	H - Room 415, 4th Fl.	eBusiness		eBusiness	eBusiness/ Commerce		Business Process
69	H - Salon F, 6th Fl.	Railway Applications		Railway Applications	Railway Applications		Transportation
70	H - Salon G, 6th Fl.	Aviation Applications		Aviation Applications	Aviation Applications		Aviation Applications
71	H - Salon H, 6th Fl.	In Honor of Bill Cooper		In Honor of Bill Cooper	In Honor of Bill Cooper		In Honor of Bill Cooper
72	H - Salon J, 6th Fl.	Transport. Science & Logistics		TSL	TSL		TSL
73	H - Salon K, 6th Fl.	Transport. Science & Logistics		TSL	TSL		TSL
74	H - Room 602, 6th Fl.	Transport. Science & Logistics		TSL	TSL		TSL

THEME SESSIONS HIGHLIGHTED IN GREY

MASTER TRACK SCHEDULE – WEDNESDAY

C-Convention Center H-Hilton

Track	Room	WA 8:00-9:30	Keynotes 10:00–10:50	WB 11:00-12:30	WC 1:30-3:00	WD 3:30-5:00
1	C - Ballroom D1, Level 4	ENRE-Energy		ENRE-Energy	ENRE-Energy	ENRE-Energy
2	C - Ballroom D2, Level 4	Energy: Modeling the Interface		Energy: Modeling the Interface	Energy	Energy
3	C - Ballroom D3, Level 4	ENRE-Forestry		ENRE-Forestry	Environmental Operations	Multiple Criteria Decision Making
4	C - Ballroom D4, Level 4	Decision Analysis		Decision Analysis	Sustainability	Sustainability
5	C - Ballroom D5, Level 4	Multicriteria Decision Making	Keynote	Stochastic Optimization	Dynamic Programming	Dynamic Programming
6	C - Ballroom E, Level 4	Tutorials	2010 Daniel H. Wagner	Tutorials	Tutorials	No Session
7	C - Ballroom F-G, Level 4	Supply Chain Optimization	Prize Presentation	Supply Chain	Supply Chain Optimization	Supply Chain
8	C - Room 11A, Level 4	Location Analysis	C-Ballroom E, Level 4	Location Analysis	Facility Location	Facility Location
9	C - Room 11B, Level 4	Manufacturing & Service Operations Mgt.		MSOM	MSOM	MSOM
10	C - Room 12A, Level 4	Manufacturing & Service Operations Mgt.		MSOM	MSOM	MSOM
11	C - Room 12B, Level 4	Manufacturing & Service Operations Mgt.		MSOM	MSOM	MSOM
12	C - Room 13A, Level 4	MSOM-Supply Chain		MSOM-Supply Chain	MSOM-Supply Chain	MSOM-Supply Chain
13	C - Room 13B, Level 4	MSOM-Service Mgt.		MSOM-Service Mgt.	MSOM-Service Mgt.	No Session
14	C - Room 14, Level 4	Supply Chain Mgt.		Supply Chain Mgt.	Supply Chain Mgt.	No Session
15	C - Room 15, Level 4	Continuous Optimization		Convex Optimization	Organization Theory	Organization Theory
16	C - Room 16A, Level 4	Manufacturing		Remanufacturing	Flexible Manufacturing	Managing Product Variety
17	C - Room 16B, Level 4	OR/MS in India		Decision Making	Supply Chain	Manufacturing
18	C - Room 17A, Level 4	CPMS, The Practice Section		CPMS-Practice	Industry Applications	Business Applications
19	C - Room 17B, Level 4	Revenue Mgt. & Pricing		Revenue Mgt. & Pricing	Revenue Mgt. & Pricing	Revenue Mgt. & Pricing
20	C - Room 18A, Level 4	Revenue Mgt. & Pricing		Pricing & Revenue Mgt.	Pricing & Revenue Mgt.	Pricing & Revenue Mgt.
21	C - Room 18B, Level 4	Service Science		Service Science	Service Science	No Session
22	C - Room 18C, Level 4	No Session	Keynote	Service Science	Service Science	Service System
23	C - Room 18D, Level 4	Service Science	Paul Jensen	Service Science	Service Science	Retail Management
24	C - Room 19A, Level 4	Public Programs, Service & Needs	Small Computing for	Public Programs	Public Programs	Public Programs
25	C - Room 19B, Level 4	Transportation-Intelligent Systems	OR Using Excel	Transportation	Transportation	Transportation
26	C - Room 4A, Level 3	Data Mining	& VBA	Data Mining	Data Mining	No Session
27	C - Room 4B, Level 3	Linear Programming	C-Ballroom G, Level 4	Network Optimization	Network Optimization	Networks and Graphs
28	C - Room 4C, Level 3	Quality, Statistics & Reliability		QSR	QSR	QSR
29	C - Room 5A, Level 3	Quality, Statistics & Reliability		QSR	QSR	QSR
30	C - Room 5B, Level 3	Reliability		Statistics/Quality Control	Statistics/Quality Control	Statistics/Quality Control
31	C - Room 5C, Level 3	Forecasting		Forecasting	Health Care	Quality Mgt.
32	C - Room 6A, Level 3	Computing		Computing	Computing	No Session
33	C - Room 6B, Level 3	Computing		Computing	Computing	Computing
34	C - Room 7, Level 3	Computing		Computing	Computing	No Session
35	C - Room 8A, Level 3	Applied Probability		Applied Probability	Applied Probability	Applied Probability
36	C - Room 8B, Level 3	INFORM-ED		Education	Education	Quality Mgt.

WEDNESDAY – *continued*

Track	Room	WA 8:00-9:30	Keynotes 10:00–10:50	WB 11:00-12:30	WC 1:30-3:00	WD 3:30-5:00
37	C - Room 8C, Level 3	Applied Probability		Applied Probability	Applied Probability	Stochastic Processes
38	C - Room 9A, Level 3	Opt.-Linear Prog. & Comp.		Opt.-Linear Prog. & Comp.y	Opt.-Linear Prog. & Comp.	Opt.-Linear Prog. & Comp.
39	C - Room 9B, Level 3	Opt.-Integer Programming		Opt.-Integer Programming	Opt.-Integer Programming	Opt.-Integer Programming
40	C - Room 9C, Level 3	John Forrest-fest | COIN-OR 10th		John Forrest-fest | COIN-OR 10th	Decision Analysis	Robust Optimization
41	C - Room 10A, Level 3	Vehicle Routing		Vehicle Routing	Metaheuristics	Metaheuristics
42	C - Room 10B, Level 3	Opt.-Computational & Software		Opt.-Computational & Software	Opt.-Computational & Software	Opt.-Computational & Software
43	C - Room 1, Level 2	No Session		No Session	No Session	No Session
44	C - Room 2, Level 2	Health Applications		Health Applications	Health Applications	Health Applications
45	C - Room 6, Level 2	Health Applications		Health Applications	Health Applications	Health Care
46	C - Room 7, Level 2	No Session		Health Applications	Health Applications	Health Applications
47	C - Room 8, Level 2	Topics in Project Mgt.		Topics in Project Mgt.	Topics in Project Mgt.	Project Mgt.
48	C - Room 9, Level 2	FICO & Palisade		Cambio Technologies	Tutorials	No Session
49	C -Room 10, Level 2	Information Systems		Information System	Information Systems	No Session
50	C -Room 11, Level 2	Cloud Computing		Information System	Information Systems	Information Systems
51	C -Room 12, Level 2	Military Applications		Military Applications	Military Applications	No Session
52	C -Room 13, Level 2	Homeland Security & Defense		Homeland Security & Defense	Homeland Security	No Session
53	C -Room 14, Level 2	Marketing		Operations/Marketing	Operations/Marketing	Operations/Finance Interface
54	C -Room 15, Level 2	Technology Mgt./New Product Dev.		Technology Mgt./New Product	Technology Mgt./New Product	Technology Mgt./New Product
55	C -Room 16, Level 2	Technology Mgt./New Product Dev.		Technology Mgt./New Product	Technology Mgt./New Product	Technology Mgt./New Product
56	C - Room 1, Level 1	Simulation		Simulation	Simulation and Optimization	Simulation and Optimization
57	C - Room 2, Level 1	Financial Services		Financial Services	Risk Analysis	Portfolio Analysis
58	C - Room 3, Level 1	Finance-Risk Mgt.		Finance-Theory & Empirics	Financial Engineering	Financial Engineering
59	H - Salon A, 4th Fl.	No Session		No Session	No Session	No Session
60	H - Salon B, 4th Fl.	No Session		No Session	No Session	No Session
61	H - Room 400, 4th Fl.	Operations Mgt.		Operations Mgt.	Operations Mgt.	Supply Chain
62	H - Room 402, 4th Fl.	Aviation Applications		Aviation Applications	Transportation	No Session
63	H - Room 404, 4th Fl.	Decision Analysis		Decision Analysis	Decision Analysis	Decision Analysis
64	H - Room 406, 4th Fl.	Health Care		Health Care	Health Care	Health Care
65	H - Room 408, 4th Fl.	Inventory Mgt.		Inventory Mgt.	Inventory Mgt.	Supply Chain
66	H - Room 410, 4th Fl.	Transportation		Facilities Planning & Design	Applications of O.R.	No Session
67	H - Room 412, 4th Fl.	Simulation		Simulation	Simulation	Transportation
68	H - Room 415, 4th Fl.	Innovation/Entrepreneurship		Innovation/Entrepreneurship	Strategy/Strategic Planning	Strategy/Strategic Planning
69	H - Salon F, 6th Fl.	Transportation		Transport. Science & Logistics	TSL	TSL
70	H - Salon G, 6th Fl.	Aviation Applications		Aviation Applications	Aviation Applications	Aviation Applications
71	H - Salon H, 6th Fl.	In Honor of Bill Cooper		In Honor of Bill Cooper	In Honor of Bill Cooper	No Session
72	H - Salon J, 6th Fl.	Transportation Science & Logistics Society		TSL	TSL	TSL
73	H - Salon K, 6th Fl.	Transportation Science & Logistics Society		TSL	TSL	TSL
74	H - Room 602, 6th Fl.	Transportation Science & Logistics Society		TSL	TSL	TSL

THEME SESSIONS HIGHLIGHTED IN GREY

SPONSORED CLUSTER CHAIRS

Applied Probability
Huseyin Topaloglu
Cornell University

Rene A. Caldentey
New York University

Aviation Applications
Gizem Keysan
United Airlines

Behavioral Operations Management
Elena Katok
Pennsylvania State University

Enno Siemsen
University of Minnesota

Computing
J. Robert Vanderbei
Princeton University

CPMS, Practice Section of INFORMS
Bjarni Kristjansson
Maximal Software

Data Mining
Seoung Bum Kim
Korea University

Decision Analysis
James C. Felli
Eli Lilly & Company

Casey Lichtendahl
University of Virginia

eBusiness
Daewon Sun
University of Notre Dame

Byung Cho Kim
Virginia Tech

ENERGY, NATURAL RESOURCES & THE ENVIRONMENT

Energy
Vishnu Nanduri
University of Wisconsin-Milwaukee

Forestry
Robert G. Haight
U.S. Forest Service Northern Research Station

Mining
Alexandra Newman
Colorado School of Mines

Financial Services
Aparna Gupta
Rensselaer Polytechnic Institute

Health Applications
Oguzhan Alagoz
University of Wisconsin-Madison

INFORM-ED
Matthew Bailey
Bucknell University

Information Systems
Gedas Adomavicius
University of Minnesota

Junior Faculty Interest Group
Burcu Keskin
University of Alabama

Location Analysis
Z. Max Shen
University of California-Berkeley

MANUFACTURING & SERVICE OPERATIONS MANAGEMENT
Fuqiang Zhang
Washington State University St. Louis

Guilliame Roels
University of California-Los Angeles

Service Management
Philipp Afeche
University of Toronto

Supply Chain
Sila Çetinkaya
Texas A&M University

Marketing Science
Frenkel Ter Hofstede
University of Texas at Austin

Raghunath Rao
University of Texas

Military Applications
Greg H. Parlier
Institute for Defense Analyses

Minority Issues
Robert Hampshire
Carnegie Mellon University

Multiple Criteria Decision Making
Murat Köksalan
Middle East Technical University

OPTIMIZATION

Computational Optimization & Software
Steven P. Dirkse
GAMS Development Corp.

Global Optimization
Kevin C. Furman
ExxonMobil

Integer Programming
Oktay Gunluk
IBM Research

Linear Programming & Complementarity
Miguel F. Anjos
University of Waterloo

Networks
Mauricio Resende
AT&T Labs Research

Nonlinear Programming
Uday Shanbhag
University of Illinois at Urbana-Champaign

Prizes
Nick Sahinidis
Carnegie Mellon University

Stochastic Programming
Lewis Ntaimo
Texas A&M University

Organization Science
Joseph P. Broschak
University of Arizona

Public Programs, Service & Needs
Ozlem Ergun
Georgia Institute of Technology

Michael J. Racer
University of Memphis

Quality, Statistics & Reliability
Roshan Vengazhiyil
Georgia Institute of Technology

Railway Applications
Homarjun Agrahari
BNSF Railway

Revenue Management & Pricing
Wei Ke
Novantas

Maarten Oosten
SAS Institute

Darius Walczak
PROS

Service Science
Grace Lin
WRO & Columbia University

Simulation
Peter J. Haas
IBM Almaden Research Center

SpORts
J. Eric Bickel
University of Texas at Austin

Technology Management/New Product Development
Janice E. Carrillo
University of Florida

Nile W. Hatch
Brigham Young University

Juliana Hsuan
Copenhagen Business School

Leonardo P. Santiago
Federal University of Minas Gerais

Telecommunications
Jun Shu
Pennsylvania State University

Abdullah Konak
Pennsylvania State University

Transportation Science & Logistics
Lei Zhang
University of Maryland

Women in OR/MS
Sadan Kulturel-Konak
Pennsylvania State Berks

Auctions & Game Theory
Vijay Krishna
Penn State University

Isa Emin Hafalir
Carnegie Mellon University

Bayesian Models
Robert McCulloch
University of Texas at Austin

Clean Energy
Feng Pan
Los Alamos National Laboratory

Cloud Computing
Cathy Xia
Ohio State University

Li Zhang
IBM Research

Complex Systems
Soundar Kumara
Pennsylvania State University

Abhijit Deshmukh
Texas A&M University

Computational Biology & Bioinformatics
Russell Schwartz
Carnegie Mellon University

Daniel H. Wagner Prize for Excellence in Operations Research
Allen Butler
Daniel H. Wagner Associates

Doing Good with Good O.R. Student Competition
James J. Cochran
Louisiana Tech University

John W. Fowler
Arizona State University

Electrical Energy Systems
Ross Baldick
University of Texas

Energy: Modeling the Interface Between Markets & Operations
Nicola Secomandi
Carnegie Mellon University

George B. Dantzig Dissertation Prize
Julie Swann
Georgia Institute of Technology

Homeland Security & Defense
R. Kevin Wood
Naval Postgraduate School

INFORMS Online
Gary Bennett
INFORMS

In Honor of Bill Cooper
Rajiv Banker
Temple University

Timothy W. Ruefli
University of Texas

Lawrence M. Seiford
University of Michigan

Invited Panels on Professional Issues
Michael A. Trick
Carnegie Mellon University

Job Placement Services
Bala Shetty
Texas A & M University

John Forrest-Fest | COIN-OR 10th (Joint with Computing)
Robin Lougee
IBM Research

Alan J. King
IBM Research

Media Planning & Optimization
Sridhar Seshadri
University of Texas

New Trends in Wireless Networks: Large-Scale Systems Perspective
Sanjay Shakkottai
University of Texas at Austin

Devavrat Shah
MIT

Nicholson Student Paper Prize
Sigrun Andradottir
Georgia Institute of Technology

ORMS in India
M. Rammohan Rao
Indian School of Business

Practice of ORMS
Srinivas Bollapragada
GE Global Research Center

Public Policy
Stefanos Zenios
Stanford University

Quantitative Finance
Stathis Tompaidis
University of Texas

Risk Management
John R. Birge
University of Chicago

Semiconductor Manufacturing
John W. Fowler
Arizona State University

Topics in Project Management
Timothy J. Lowe
University of Iowa

Richard E. Wendell
University of Pittsburgh

Undergraduate O.R. Research Prize
Susan E. Martonosi
Harvey Mudd College



INFORMS MEETINGS

2011

April 10-12
INFORMS Conference on Business Analytics and Operations Research
Applying Science to the Art of Business
Chicago Marriott Downtown
Chicago, Illinois
Chair: David Leonhardi, Boeing Commercial Airplane Group
http://meetings.informs.org/Practice2011

June 20-22
INFORMS Healthcare 2011
Hilton Bonaventure
Montreal, Canada
Chair: Vedat Verter, McGill University
http://meetings2.informs.org/healthcare2011/

November 13-16
INFORMS Annual Meeting 2011 Charlotte
Charlotte Convention Center
Charlotte, North Carolina
Chair: Cem Saydam, Univ. of North Carolina at Charlotte
http://meetings.informs.org/charlotte2011

July 10-15
IFORS Triennial 2011
Melbourne Convention Center
Melbourne, Australia
Chair: Patrick Tobin, Australian Catholic Univ.
www.ifors2011.org/

2012

April 15-17
INFORMS Practice Conference:
Applying Science to the Art of Business
Hyatt Regency Huntington Beach
Huntington Beach, California

June/July - Dates to be announced
INFORMS International Beijing
In conjunction with the Operations Research Society of China
Beijing, China
Chair: Jian Chen, Tsinghua Univ.
jchen@mail.tsinghua.edu.cn

October 14-17
INFORMS Annual Meeting 2012 Phoenix
Phoenix Convention Center
Phoenix, Arizona
Chair: Ronald Askin, Arizona State Univ.
ron.askin@asu.edu

2013

Dates to be announced
INFORMS Practice Conference:
Applying Science to the Art of Business

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

INFORMS COMMUNITIES

2010

December 5-8
Winter Simulation Conference 2010
Baltimore Marriott Waterfront
Baltimore, Maryland
Chair: Joseph Hugan, V-Sim, Inc.
www.wintersim.org

2011

January 9-11
INFORMS Computing Society Conference
Monterey Marriott
Monterey, California
Chair: Robert Dell, Naval Postgraduate School
www.informs.org/Community/Conferences/ICS2011

February 10-13
INFORMS Organization Science Winter Conference
Sheraton Steamboat Resort
Steamboat Springs, Colorado
Chair: Dan Levinthal
dlev@wharton.upenn.edu

June 9-11
INFORMS Marketing Science Conference
InterContinental Houston
Houston, Texas
Co-Chairs: Randy Batsell, Sharad Borle, AmitPazgal-Rice University
business.rice.edu/marketingscience2011.aspx

June 22-24
INFORMS Revenue Management and Pricing Conference
Columbia University
New York, New York
Co-Chairs: Guillermo Gallego, Robert Phillips, Columbia University
ggallego@ieor.columbia.edu

July 6-8
INFORMS Applied Probability Society Conference
Royal Inst. of Technology (KTH)
Stockholm Sweden
Chair: Henrik Hult, Royal Inst. of Technology (KTH)
www.informs.org/Community/Conferences/APS2011

December 11-14
Winter Simulation Conference 2011
Arizona Grand
Phoenix, Arizona
Chair: K. Preston White, Jr.
kpwhite@virginia.edu

How to Navigate the Technical Sessions

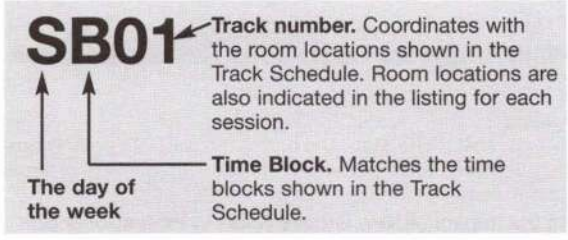
There are three primary resources to help you understand and navigate the Technical Sessions:

- 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 Session Chair, Author, and Session indices provide cross-reference assistance (pages 456-496).
- The Track Schedule is on pages 50-57. This is an overview of the tracks (general topic areas) and when/where they are scheduled.

Quickest Way to Find Your Own Session

Use the Author Index (pages 460-485) — the session code for your presentation(s) will be shown along with the track number. You can also refer to the full session listing for the room location of your session(s).

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 - 1:30pm – 3:00pm
D - 3:30pm - 5:00pm

Room Locations/Tracks

All tracks and technical sessions will be held in the Austin Convention Center and the Hilton Austin. Room numbers are shown on the Track Schedule and in the technical session listing.

Sunday, 8:00am - 9:30am

■ SA01

C - Ballroom D1, Level 4

Simulation Modeling in Energy Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Augusto Ruperez Micola, Assistant Professor, Universitat Pompeu Fabra, Barcelona, Spain, augusto.ruperezmicola@gmail.com

1 - A Decentralized Mechanism for Market Coupling
Alfredo Garcìa, Associate Professor, University of Virginia, 151 Engineer's Way, P.O. Box 400747, Charlottesville, VA, United States of America, ag7s@virginia.edu, Mingyi Hong, Himanshu Gupta

Several electricity markets in Europe have been integrated through a procedure known as "market coupling" which combines electricity trading with the allocation of cross-border transmission capacity. We analyze a decentralized mechanism for market coupling in which TSOs procure cross-border transmission capacity on behalf of their own markets while maintaining control of internal trading.

2 - A Multi-agent Energy Trading Competition
Wolfgang Ketter, Assistant Professor, Erasmus University, Rotterdam School of Management, Department of Decision and Information Science, Rotterdam, Netherlands, wketter@rsm.nl, John Collins, Carsten Block

We present the design of an open,competitive simulation approach that will produce robust research results on the structure and operation of retail power markets as well as on automating market interaction by means of competitively tested and benchmarked agents. These results will yield policy guidance that can significantly reduce the risk of instituting competitive energy markets at the retail level.

3 - Test of LSE's Strategic Behavior in a Two Settlement Market
Huan Zhao, Iowa State University, 419 S Walnut Avenue, Ames, IA, 50010, United States of America, hzhao@iastate.edu, Abhishek Somani

In most of the restructured power markets, a centralized power pool is operated in both day-ahead and real-time market. This day-ahead market is supposed to increase the system reliability. In reality, strategic LSE could utilize this two settlement system to reduce its procurement cost. In this study, we plan to utilize an agent-based model AMES to test LSE's bidding strategy between the two markets. This work includes the modification of DCOPF and change of LSE's learning algorithm.

4 - Wind Power, Load Volatility and Spot Electricity Prices
Augusto Ruperez Micola, Assistant Professor, Universitat Pompeu Fabra, Barcelona, Spain, augusto.ruperezmicola@gmail.com, Albert Banal-Estanol

We analyse whether supply side load volatility influences prices with a focus on the effects of wind power generation on electricity markets. We address three inter-related questions: Does wind volatility have an influence on spot electricity prices? Do demand volumes influence the results? Does asset ownership influence them? We model the market using simulations in which agents behave following parametrisations of the Experience-Weighted Attractions (EWA) algorithm.

■ SA02

C - Ballroom D2, Level 4

Real Options in the Energy Sector

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Afzal Siddiqui, University College London, Department of Statistical Science, London, United Kingdom, afzal@stats.ucl.ac.uk

1 - Capacity Switching Options Under Rivalry and Uncertainty
Ryuta Takashima, Chiba Institute of Technology, 2-17-1 Tsudanuma, Narashino-shi, Chiba, 275-0016, Japan, takashima@sun.it-chiba.ac.jp, Afzal Siddiqui

Generators can invest in either a small or a large plant. The former project offers the subsequent option to upgrade capacity. We contrast the direct and sequential investment strategies for a monopolist in order to extract the option value of flexibility. Next, we allow for a symmetric duopoly that can again adopt capacity in either direct or sequential manners. The impact of competition on a typical generator's value is obtained under both direct and sequential strategies.

2 - Valuation of CCS-ready Coal-fired Power Plants: A Multi-dimensional Real Options Approach

Reinhard Madlener, Professor, RWTH Aachen University, Mathieustr. 6, Aachen, 52074, Germany, RMadlener@eonerc.rwth-aachen.de, Wilko Rohlfs

The economic valuation of a CCS-ready coal power plant is strongly influenced by the time between the investment and the CCS retrofit. To determine the optimal time delay we develop a real options model with a multi-dimensional optimal threshold value that incorporates uncertainty in the price of fuel input, CO2, electricity, capture, transport and storage (CTS), and investment cost.

3 - Duopolistic Competition Under Risk Aversion and Uncertainty

Afzal Siddiqui, University College London, Department of Statistical Science, London, United Kingdom, afzal@stats.ucl.ac.uk, Michail Chronopoulos, Bert De Reyck

A monopolist typically defers entry into an industry as both price uncertainty and the level of relative risk aversion increase. The former attribute is present in most energy industries, while the latter may be relevant for reasons of market incompleteness or the presence of technical uncertainty. By contrast, it has been shown that the presence of a rival hastens entry under risk neutrality. Here, we examine how duopolistic competition affects the entry decisions of risk-averse investors.

■ SA03

C - Ballroom D3, Level 4

Underground Mining Applications

Sponsor: Energy, Natural Resources and the Environment/ Mining
Sponsored Session

Chair: Alexandra Newman, Associate Professor, Colorado School of Mines, Room 319, Engineering Hall, Golden, CO, 80401, United States of America, anewman@mines.edu

1 - Long-term Extraction and Backfill Scheduling in a Complex Underground Mine

Donal O'Sullivan, PhD Student, Colorado School of Mines, Division of Economics and Business, 816 15th Street, Golden, CO, 80401, United States of America, dosulliv@mymail.mines.edu, Alexandra Newman

We present an integer programming model to optimize the production schedule for 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 a forty-eight month time horizon.

2 - Undergound and Open Pit Models for Mine Planning

Andres Weintraub, Department of Industrial Engineering, University of Chile, Santiago, Chile, aweintra@dii.uchile.cl, Felipe Caro, Rafael Epstein, Marcel Goic

We present a system developed for CODELCO, one of the largest copper mine companies in the world. The system is based on a model for long range planning, where underground, open pit and mixed mines are considered. The production chain from mine to final product is considered. The system is in use in most of the 7 CODELCO mines. Results show that by supporting decisions through use of the model, significant improvements in production and net income have been obtained.

■ SA04

C - Ballroom D4, Level 4

Joint Session Clean Energy/ ICS: Modeling Future Energy Infrastructures

Cluster: Clean Energy/ Computing Society
Invited Session

Chair: William Hart, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, United States of America, wehart@sandia.gov

1 - Wind Farm Network Design

Richard Chen, Sr. Member of Technical Staff, Sandia National Laboratories, P.O. Box 969, Livermore, CA, 94551-0969, United States of America, rlchen@sandia.gov, Amy Cohn, Duncan Callaway

Wind-generated electricity is widely regarded as the most promising way to reduce pollution and greenhouse gas emissions, but it also presents new challenges not found in the design of conventional generation networks. We present a new model, Wind Farm Network Design (WFND), for generation- and transmission- expansion planning that integrates both wind-based and conventional power generation. An accelerated Benders Decomposition algorithm is proposed to efficiently solve WFND.

2 - Design of Robust Hedging Strategies for U.S. Electric Sector Planning

Joe DeCarolis, Assistant Professor, North Carolina State University, 2501 Stinson Drive, Campus Box 7908, Raleigh, NC, 27695, United States of America, jdecarolis@ncsu.edu, Kevin Hunter, Sarat Sreepathi

This talk describes a multi-stage stochastic optimization of the U.S. electric sector under a climate policy. The model optimizes the retirement, installation, and utilization of generating capacity over the next 40 years. Future CO2 targets are modeled as stage-wise uncertain parameters. To test the robustness of the resultant hedging strategy, a technique called modeling to generate alternatives is discussed.

3 - Optimal Design of Biofuel Production System and Resource Allocation: A California Case Study

Chien-Wei Chen, University of California-Davis, 5000 Orchard Park Cir 7612, Davis, CA, 95616, United States of America, scwchen@ucdavis.edu

A well designed biofuel production system may alleviate greenhouse gas emission and energy security issues. An important question is how to maintain a low-cost and low-risk biofuel supply system under future uncertainties such as demand, supply, and technologies. A two-stage stochastic programming model is developed for an entire biofuel pathway. To overcome the computational challenges, an effective decomposition method based on progressive hedge (PH) method is implemented.

4 - The Role of Storage Facility Design in Disruption Management of Biofuel Supply Chains

Yongxi Huang, University of California-Davis, One Shields Avenue, Davis, CA, 95616, United States of America, yxhuang@ucdavis.edu, Yueyue Fan

A biofuel supply chain consists of various components that are interdependent of each other. A crucial question is how to improve the reliability of the biofuel system against potential disruptions. A stochastic mixed-integer programming model that integrates feedstock seasonality, geographic variation, and demand fluctuation is developed, aiming at minimizing the total expected cost of the entire biofuel supply chain. Progressive Hedging method was used to solve the stochastic model.

■ SA05

C - Ballroom D5, Level 4

A Good Walk Analyzed: Operations Research in Golf

Sponsor: SpORts
Sponsored Session

Chair: Nicholas G. Hall, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States of America, hall_33@fisher.osu.edu

1 - Analyzing the Impact of New Groove Rules in Professional Golf

Jason Acimovic, Massachusetts Institute of Technology, 77 Massachusetts Ave, E62-459, Cambridge, MA, 02139, United States of America, acimovic@mit.edu, Douglas Fearing, Stephen Graves

In 2010, the USGA implemented new rules regarding golf clubs grooves. Using a model that predicts how well players perform on each hole, we examine data from both before and after the rule change to determine the impact both on outcomes and style of play.

2 - A Proposal for Redesign of the FedEx Cup Playoff Series on the PGA TOUR

Nicholas G. Hall, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States of America, hall_33@fisher.osu.edu, Chris Potts

We propose a redesign of the FedEx Cup playoffs, including a strongly seeded match play TOUR Championship. We analytically estimate the probability that a player with a particular rank before The TOUR Championship finishes in various positions. All players control their own destiny, and are rewarded for strong season performance. Marquee name players are guaranteed participation late in the event. Our design meets the objectives listed by Commissioner Finchem in a 2008 blog about the playoffs.

3 - A Shot Value Approach to Assessing Golfer Performance on the PGA Tour

Mark Broadie, Professor, Columbia University, 3022 Broadway, 415 Uris Hall, New York, NY, 10027, United States of America, mnb2@columbia.edu

Shot value analysis is used to assess the performance of golfers in different parts of the game, e.g., long tee shots, putts, sand shots and others. Using extensive data, we rank PGA Tour golfers in various skill categories. The main factor in Tiger Woods' scoring advantage is his exceptional long game. Long game shots explain more than half the difference in scores between the top 100 and the second 100 golfers on the tour. The impact of the USGA's groove rule change is investigated.

4 - Testing Tournament Predictive Power Theory with PGA Golf Data
Robert Connolly, Kenan-Flagler Business School at the University of North Carolina at Chapel Hill, Chapel Hill, NC, Robert_Connolly@kenan-flagler.unc.edu, Richard Rendleman

An enduring aim of tournament theory is a full understanding of how different tournament structures sort out participants to produce tournament outcomes. Ryvkin and Ortmann (2008) study three different tournament structures, demonstrating analytically and with simulations several important propositions about the predictive power of tournaments (the probability that the best participant wins the tournament). Their analysis focuses on how the number of participants, the noise level in participant performance, and the distribution of player types affects the predictive power of contests, binary elimination tournaments, and round-robin tournaments. Among other things, they document interesting non-monotoniticies in the impact of the number of participants and the noise level on tournament predictive power. In this paper, we exploit an established model of participant skill and random variation in scoring among PGA TOUR players to structure and execute tests of the predictions of the Ryvkin-Ortmann model. Specifically, we apply the skill estimation model in Connolly-Rendleman (2008) to a pool of 354 professional golfers with varying skill levels and scoring volatility. With this pool of participants, we then simulate the tournament structures of Ryvkin-Ortman along with several structures specific to golf, varying the number of participants, the noise level, and the distribution of player skill. We document the extent to which the predictions of Ryvkin-Ortmann are confirmed in our simulations. We also explore the predictive power associated with small field events on the PGA TOUR (like The Tour Championship) vs. regular PGA TOUR events with a typical large field (e.g., the Valero Texas Open).

■ SA06

C - Ballroom E, Level 4

Tutorial: Provably Near-optimal Approximation Algorithms for Operations Management Models

Cluster: Tutorials
Invited Session

Chair: Retsef Levi, Associate Professor of Management, Massachusetts Institute of Technology, Sloan School of Business, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, retsef@mit.edu

1 - Provably Near-optimal Approximation Algorithms for Operations Management Models
Retsef Levi, Associate Professor of Management, Massachusetts Institute of Technology, Sloan School of Business, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, retsef@mit.edu

The session provides a survey of several recent results on the design and analysis of provably near-optimal approximation algorithms for operations management multistage stochastic optimization models. We will discuss cost-balancing based algorithms for core stochastic inventory control models, and linear programming based control for models concerned with the management of reusable resources.

■ SA07

C - Ballroom F & G, Level 4

JFIG Paper Competition Finalists - I

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Hayriye Ayhan, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, hayhan@isye.gatech.edu

1- JFIG Paper Competition
Hayriye Ayhan, Professor, Georgia Institute of Technology, Atlanta GA, United States of America, hayhan@isye.gatech.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. 39 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, three of the six finalists-selected in two rounds of review, will present their papers. For the selected finalists and the abstracts of the selected papers, please refer to the online program.

■ SA08

C - Room 11A, Level 4

Service Parts Logistics

Sponsor: Location Analysis
Sponsored Session

Chair: Mehmet Candas, Sr. IT Architect / OR Analyst, Advanced Micro Devices, 7171 Southwest Pkwy, Building 200, 2B.833, Austin, TX, 78735, United States of America, mfcandas@gmail.com

1 - Network Design and Inventory Management for Service Parts Logistics with System-wide Service Level
Mehmet Candas, Sr. IT Architect / OR Analyst, Advanced Micro Devices, 7171 Southwest Pkwy, Building 200, 2B.833, Austin, TX, 78735, United States of America, mfcandas@gmail.com, Erhan Kutanoglu

Decision of network design and inventory stocking usually have been made sequentially in practice. We study the integrated problem for Service Parts Logistics with system-wide and time-based service level requirement. We first develop decomposition-based methodology for a special case of the problem with customer-centric service level requirement. Then we extend our approach for the original system-wide problem.

2 - When to use Decentralized Stocks and Lateral Transshipments in Spare Parts Networks
Geert-Jan Van Houtum, Eindhoven University of Technology, School of Industrial Engineering, Eindhoven, Netherlands, G.J.v.Houtum@tue.nl, Alan Scheller-Wolf, Bram Kranenburg

On one hand, spare parts generally have low demand rates and hence spare parts stocks should be centralized to create pooling effect. On the other hand, you need them at close distance of installed machines to avoid long down times. A network of decentralized stocks with lateral transshipments meets both wishes. We present analytical and numerical results on the comparison of this network to other basic networks.

3 - A Heuristic to Ddetermine Near-optimal Base Stock Levels in a Two-echelon Distribution Network
Rob Basten, Eindhoven University of Technology, P.O. Box 513, Pav. E.08, Eindhoven, 5600 MB, Netherlands, r.j.i.basten@tue.nl, Geert-Jan Van Houtum

We consider a spare parts network consisting of a central warehouse and local stock points. The local stock points face Poisson demand and backorder any unfulfilled demand, for which they pay a penalty cost. At both echelon levels, we consider holding costs and one-for-one replenishments. We give some useful properties of the cost function and we propose a heuristic that sets near-optimal base stock levels.

■ SA09

C - Room 11B, Level 4

Inventory and Supply Chain Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Jeannette Song, Professor, Duke University, Fuqua School of Business, 1 Towerview Drive, Durham, NC, 27708, United States of America, jssong@duke.edu

1 - Inventory Management with Purchase Order Errors and Rework
Yan Jiang, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, YanJiang2008@u.northwestern.edu, Diego Klabjan, Nicole DeHoratius

In a retail DC, purchase orders occasionally arrive with errors and thus have to be reworked. We study how should retailers adjust their inventory policies in anticipation of purchase order errors and rework. The performance of our adjusted ordering policy is compared with standard policies using real-world data. The comparison helps retailers understand and quantify the cost impact of purchase order errors and rework.

2 - Supplier Diversification with Price-dependent Demand
Tao Li, The University of Texas at Dallas, 800 W. Campbell Rd., Richardson, TX, 75080, United States of America, tao.li@utdallas.edu, Suresh Sethi, Jun Hang

We study sourcing problem of a firm with price-dependent demand and two unreliable suppliers. We show firm's diversification decision does not depend on the correlation of suppliers' reliabilities. In the diversification zone, the firm's total order quantity decreases as suppliers become more correlated. Interestingly, when the two suppliers' reliabilities are independent and their costs are low, the optimal order quantity for a supplier is only affected by his cost and his rival's reliability.

3 - Basestock Policies in Supply Chain Networks: Robust vs. Stochastic Optimization

Alex Rikun, Massachusetts Instititute of Technology - Operations Research Center, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, arikun@mit.edu, Dimitris Bertsimas, David Gamarnik

We address the problem of computing basestocks in supply chain networks using the robust optimization approach. Our algorithm handles arbitrary network topologies, fixed costs, and exhibits fast convergence and practical running time. In a numerical study, performance of the algorithm on three types of networks is compared to a stochastic simulation-based heuristic, and our algorithm demonstrates comparable (sometimes better) average performance, while having much lower standard deviation.

4 - Mechanism Design for Supply Chain Sustainability

Fang Liu, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States of America, fang.liu2@duke.edu, Jeannette Song, Tracy Lewis

We consider a supply chain consisting of a supplier and a retailer. The market is sensitive to the product quality. The supplier can invest to improve quality and the retailer can invest to improve market sensitivity to quality .We present an incentive mechanism that induces both parties to choose the system-optimal decisions.

■ SA10

C - Room 12A, Level 4

An Operations Management Perspective to Energy Applications

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Georgia Perakis, William F. Pounds Professor of Operations Research and Operations Management, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA, United States of America, georgiap@mit.edu

1 - A New Proposal for Electricity Market Design: A Fairness Based Approach

Dimitris Bertsimas, Professor, Massachusetts Instititute of Technology, 77 Massachusetts Avenue, Building E40-139, Cambridge, MA, 02139, United States of America, dbertsim@mit.edu, Andy Sun

More than half of the electricity in the US is generated in deregulated markets hence its efficient design is important. We propose a family of auction/pricing schemes based on "fairness" for the uplift problem. Fairness has not been considered in electricity market design. We review current practices, outline our contributions and discuss our proposal based on the real-world data of ISO New England's day-ahead market.

2 - Consumer Choice Model for Forecasting Demand and Designing Price Incentives for Solar Technology

Ruben Lobel, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA, United States of America, rlobel@mit.edu, Georgia Perakis

We model the adoption of solar panels as a technology diffusion process. Customers are assumed to follow a discrete choice model. The policy maker is designing incentives (subsidies) in order to achieve a desired adoption target with minimum cost for the system, taking advantage of network externalities such as imitating social behavior and learning-by-doing. We demonstrate how to use this model for forecasting and subsidy policy design with an empirical study of the German solar market.

3 - Loss of Efficiency in Deregulated Electricity Markets: A Supply Function Equilibrium Approach

Jonathan Kluberg, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA, United States of America, kluberg@mit.edu, Georgia Perakis

This work proposes a novel definition of efficiency for electricity markets, which presents several advantages compared to existing metrics. It accounts for the surplus of consumers and producers, it is well defined in the case of elastic demand, and it allows us to compare markets across network structures. After defining the notion of efficiency, we establish theoretical guarantees on the maximum loss of efficiency induced by deregulation with and without network constraints.

■ SA11

C - Room 12B, Level 4

Models for Operational Flexibility

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Reza Ahmadi, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, rahmadi@anderson.ucla.edu

1 - A Tactical Planning Model for a Serial Manufacturing System

Pallav Chhaochhria, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Ave E40-149, Cambridge, MA, 02139, United States of America, pallavc@mit.edu, Stephen Graves

We develop a tactical planning model for a serial manufacturing system that produces multiple families of discrete parts in a make-to-order setting. There is uncertainty in demand, yield and raw material lead-time. The model segments the production line with decoupling inventories, and determines the rules for work release and production in each segment. It also decides the safety stock level for finished goods and decoupling buffers, work-in-process inventory and raw material ordering policy.

2 - Incorporating Forecast Revisions in Inventory Management of Multiple Products

Foaad Iravani, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, firavani@anderson.ucla.edu, Sriram Dasu, Reza Ahmadi

The Markovian Model of Forecast Evolution (MMFE) is a useful tool for modeling advance demand information, which embraces a diverse range of well-known time-series models. Past literature has applied MMFE to various inventory control models for a single product. We incorporate MMFE into a multi-product inventory model and investigate the impact of interdependent information updates, product substitution and co-production on the optimal policy.

3 - Operational Flexibility in Strategic Supply Chain Trading with Spot Market

Chen Peng, Stanford University, 14 Comstock Circle, Apt 106, Stanford, CA, 94305, United States of America, chenpeng@stanford.edu, Hau Lee

We investigate a supply chain where a buyer procures a commodity from an oligarchy seller via two channels: a fixed-price contract and a spot market. Firstly, the seller allocates his production capacity between the two channels, which may affect the spot price. Then the buyer signs a fixed-price contract with the seller. Finally, the buyer decides how much to actually procure from the two channels after observing demand. The equilibrium outcome is discussed and managerial insights are provided.

■ SA12

C - Room 13A, Level 4

Incentives in Supply Chains

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Wenqiang Xiao, New York University, KMC 8-72, 44 W 4 Street, New York, NY, 10012, United States of America, wxiao@stern.nyu.edu

1 - Motivating Suppliers in a Dynamic Moral Hazard Environment

Hao Zhang, University of Southern California, 3670 Trousdale Pkwy, Bridge Hall 401, Los Angeles, CA, 90089, United States of America, zhanghao@marshall.usc.edu, Hongmin Li, Charles Fine

We study a supply chain triad with a risk-neutral manufacturer (the principal) and two risk-averse suppliers who can make private efforts to improve the quality of supplies. We consider two incentive structures over an infinite horizon: rewarding suppliers with higher profit margins or with greater business volumes. We show that in both cases there exist certain trapping positions in terms of future arrangements. The suppliers are motivated to make high efforts to secure a favorable position.

2 - Transparency of Information Acquisition in Supply Chains
Li Tian, Hong Kong University of Science and Technology, Department ISOM, HKUST, Clear Water Bay, Hong Kong - PRC, litian@ust.hk, Hongtao Zhang, Shilu Tong

A retailer attempts to acquire demand information but his attempt may have successful or unsuccessful outcome. Should he keep the outcome secret, or should he make it transparent to the upstream manufacturer? When facing a powerful manufacturer, such as one who can dominate the terms of trade by offering a quantity bundle contract menu, the retailer may become less disadvantageous, and gain more from his information, by making his information acquisition process transparent to the manufacturer.

3 - Procurement Bundling: How to Acquire Technology for Almost Free
Leon Chu, Assistant Professor, University of Southern California, Marshall School of Business, Los Angeles, CA, 90089, United States of America, leonyzhu@usc.edu, Yunzeng Wang

We study a procurement mechanism when a buyer would like to acquire technologies along with products and compete current suppliers in the future market. For the two-supplier case, each supplier has a dominant bidding strategy for the technology provision that specified by the difference of the suppliers' technology strength and the ratio between the current project size and the future market size. The suppliers' technology provision can vary non-continuously with the market size ratio.

4 - Pre-order Price Guarantee in Advance Selling
Xuying Zhao, University of Notre Dame, 361 MCOB, Notre Dame, IN, United States of America, xzhao1@nd.edu, Zhan Pang

When consumers pre-order not-yet-released items, they may observe a price drop after release. Under a pre-order price guarantee policy, consumers get refund for the price difference if the pre-order price is higher than the price right after release. We study the pre-order price guarantee policy. Our research questions include: when should a firm offer such a policy? With pre-order price guarantee, at what price should a firm sell during the advance selling period and during the selling season?

5 - Selling to Competing Newsvendors with Non-discriminating Contracts
Stephen Shum, Hong Kong University of Science & Technology, School of Business and Management, Hong Kong - PRC, sshum@ust.hk, Qian Liu, Ruirui Li

It is a common practice for a supplier to offer the same contract to different buyers. In the United States, the Robinson-Patman Act forbids selling to different retailers at discriminating prices. We study a supplier's contracting problem under non-discriminating practice. We show that a retailer's ordering quantity may be increasing in the wholesale price. We also characterize the supplier's optimal strategy under wholesale price contract, return contract and rebate contract.

■ SA13

C - Room 13B, Level 4

Retail Supply Chains and Product Variety

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Mumin Kurtulus, Assistant Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States of America, mumin.kurtulus@owen.vanderbilt.edu

1 - Private Label Introduction: Does it Benefit the Supply Chain?
Victor Martinez de Albeniz, Associate Professor, IESE Business School, Av. Pearson 21, Barcelona, Spain, valbeniz@iese.edu, Marc Sachon

This paper analyzes the channel dynamics in a category where a private label is introduced. We focus on the impact of private labels on retail and wholesale equilibrium prices, as well as on the profits of each firm of the supply chain. While private label introduction helps the retailer reduce manufacturer brand's prices, we find that it does not always improve the total profits of the supply chain, only when cross-elasticities are small, i.e., competitive interactions are weak.

2 - A Complexity Model of Assembly Supply Chains in the Presence of Product Variety
Hui Wang, PhD, Industrial and Operations Engineering, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, johnwang@umich.edu, Goker Aydin, S. Jack Hu

We propose a metric for the complexity of an assembly supply chain. The metric takes into account the supply chain configuration, product variety offered by the supply chain, and the demand split among the products. We investigate how this complexity metric relates to the cost of the supply chain and show that complexity and cost are equivalent under certain conditions. We illustrate how this complexity measure can be used as a proxy for cost in decision making.

3 - Assortment Planning and Pricing in the Presence of Returns
Alex Grasas, Assistant Professor, Universitat Pompeu Fabra, Ramon Trias Fargas, 25-27, Barcelona, 08005, Spain, alex.grasas@upf.edu, Aydin Alptekinoglu

Using a nested-MNL-based consumer choice model, we study a retailer's assortment, pricing and return policy decisions. The retailer must choose its assortment from an arbitrary set of differentiated products, and determine the price and refund amount for every product. We derive a simple metric to rank products, which reveals the optimal assortment quite efficiently. Results are then compared to the case when no returns are allowed.

4 - How to Select Category Captains for Category Management?
Alper Nakkas, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States of America, alper.nakkas@owen.vanderbilt.edu, Mumin Kurtulus

Category captainship refers to the practice where a retailer relies on one of the leading manufacturers in a category for strategic recommendations regarding category management. We investigate the impact of category captain selection decision on the profits in a supply chain with multiple manufacturers selling through a single retailer. We show that retailers should create an environment in which the benefit for the retailer is endogenously determined by the competition among manufacturers.

■ SA14

C - Room 14, Level 4

Innovative OR/MS Applications for the Hospitality Industry

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Rohit Verma, Cornell University, 338 Statler Hall, Ithaca, NY, United States of America, rv54@cornell.edu

1 - Sequence Effects in Service Bundles: Marketing and Operational Implications
Michael Dixon, PhD Candidate, Cornell University, G-80 Statler Hall, Ithaca, NY, 14853, United States of America, mjd295@cornell.edu, Rohit Verma

We investigate whether the sequence schedule of discrete events within a service bundle impacts customer repurchase behavior. Using a unique data source provided by a renowned performing arts venue, we build and test an econometric model to predict season ticket subscription repurchase and to determine if the temporal placement of events impacts repurchase. We find evidence of peak, end, and trend effects and discuss the importance of sequence in determining service design and scheduling.

2 - An Examination of Factors Driving Fractional Service Ownership: Evidence From Resort Timeshares
Gregory Heim, Assistant Professor, Mays Business School at Texas A&M University, 320 Wehner Building, 4217 TAMU, College Station, TX, 77843-4217, United States of America, GHeim@mays.tamu.edu, Bedanta Talukdar

Little research examines timeshares or other fractional ownership services. We examine whether timeshare vacation experiences or options more strongly affect the valuation and ownership of timeshare units. We empirically evaluate several timeshare option types, facility brand and location, facility service experiences, and nearby amenities and landmarks. Several option types contribute to timeshare unit values and purchases. Options tend to contribute as much value as resort experience features.

3 - Heuristic Approaches to Setting Prices on Priceline
Chris Anderson, Cornell University, Ithaca, NY, United States of America, canderson@cornell.edu

Priceline's name-your-own-price model has become increasingly popular for both consumers and services providers - consumers looking for travel deals and service providers looking to reach price sensitive customers. During this talk I will outline Priceline's inventory allocation model and its implications for service providers. I will summarize approaches for setting prices and allocations at Priceline -highligting a case study at a large convention hotel.

4 - In Search of Optimum Service Scripting: Comparing Manager and Customer Perceptions

Rohit Verma, Cornell University, 338 Statler Hall, Ithaca, NY, United States of America, rv54@cornell.edu, Liana Victorino

Service scripting is a commonly used approach to enhance the effectiveness of a service encounter between a customer and an employee. This study addresses an important question related to service scripting - is there an optimum level of scripting for different types of service processes? We will present results of a video experiment designed to compare manager and customer perceptions for service scripting and its relationship to performance.

■ SA15

C - Room 15, Level 4

Behavioral Operations in Practice

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Kay-Yut Chen, Principal Scientist, HP Labs, MS 1U-2, 1501 Page Mill Road, Palo Alto, Ca, 94303, United States of America, kay-yut.chen@hp.com

1 - The Use of Human Subjective Probabilitistic Information in Work Force Planning

Kay-Yut Chen, Principal Scientist, HP Labs, MS 1U-2, 1501 Page Mill Road, Palo Alto, Ca, 94303, United States of America, kay-yut.chen@hp.com, Pano Santos, Maria-Teresa Gonzalez, Alex Zhang

One important piece of information, to resource management in the consulting business, is the probability of winning of the deals being pursued. Inside HP, sales managers are required to report a "win" probability for each deal. With a behavioral model, sale managers are found to be bounded rational, prone to positive biases but nevertheless informative. The model is also used to "adjust" the reports. The adjustment cuts down the error rate by half while increasing information revelation by 20%.

2 - Human Behavior Challenges for Workforce Planning Mathematical Models

Pano Santos, HP Labs, 1501 Page Mill, Palo Alto, CA, United States of America, cipriano.santos@hp.com, Alex Zhang, Kay-Yut Chen, Maria-Teresa Gonzalez

Services labor planning is ideal for Behavioral OM research. Business complexity - many services, labor skills, regions, is perfect for large scale optimization. Also, there are many behavioral issues, from the evaluation of workforce planning decisions - what are the proper criteria to allocate an employee to a job; to the solicitation of preferences of project assignments. In this talk, we outline an optimization model of labor resources & discuss related behavioral issues.

3 - Kindness Can be Expensive: A Model of Reciprocity in a Service Firm

Claudia Marquez-Nava, Instituto Tecnologico de Estudios Superiores de Monterrey, 2000 Eduardo Monroy Càrdenas, San Antonio Buenavista, Toluca, MX, Mexico, A00961076@itesm.mx

Reciprocity, as a behavioral factor, has a strong effect on employee productivity. This paper incorporates this factor into a dual service-labor market where two service firms compete. The results show that reciprocity can be harmful for employees' and firms' profitability. Service firms should consider these counterintuitive results before determining their strategies on both markets.

■ SA16

C - Room 16A, Level 4

Integer Programming Based Scheduling & Dispatching

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Myoungsoo Ham, Member of Technical Staff, Samsung Austin Semiconductor, 12100 Samsung Blvd, Austin, TX, 78754, United States of America, m.ham@samsung.com

1 - Real Time Scheduling of Cluster Tools using Binary Integer Programming

Jaehyung An, PhD Student, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, jaehyung.an.2013@anderson.ucla.edu, Myoungsoo Ham, Wonyup Ko

Cluster tools are widely used in wafer fabrication processes. The most predominant problems with cluster tools are the scheduling issues that are characterized by the added complexity due to the physical structure and job flow patterns. In order to address this prevalent problem, a job shop scheduling model for cluster tools is introduced to minimize the makespan via binary integer programming. The model is solved using XpressMPTM then the result is compared with other dispatching rules.

2 - A Dynamic Bottleneck Capacity Modeling

Dongjin Kim, Industrial Engineering Lead, Micron Technology Inc, 6581 Creek Run Drive, Centreville, VA, 20121, United States of America, djkim@micron.com

Wafer fabrication is a dynamic system due to the high variability from both equipment and process. The dynamic bottlenecks consistently shift in a daily and hourly basis that can cause the WIP bubbles in the line. We developed an optimization-based Linear Programming and Queuing modeling approach to predict Fab bottlenecks for the next 12 hours, which utilizes current tool and WIP prediction by part/step level.

■ SA17

C - Room 16B, Level 4

Inventory and Pricing Applications in Supply Chains

Cluster: Practice of OR/MS
Invited Session

Chair: Markus Ettl, IBM Research, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, msettl@us.ibm.com

1 - Managing Inventory Freshness for Perishable Products

Zhengliang Xue, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, zxue@us.ibm.com, David D. Yao, Markus Ettl

We study optimal depletion and replenishment strategies in an inventory system with perishable products. Fresh products are sold at full price. Aged products can either be sold at full price in the primary retail channel, or at a discounted price in a secondary channel. Expired products are discarded. In each period, the retailer decides a depletion amount for aged products, and a replenishmen quantity for fresh products. The goal is to maximize the total expected discounted profit.

2 - Inventory Management Under Competitive Pricing

Yiwei Chen, Massachusetts Institute of Technology, Sloan School, Cambridge, MA, United States of America, ywchen@mit.edu

We investigate the impact of stochastic pricing on inventory replenishment decisions in a competitive pricing environment. A market follower is able to forecast prices of products offered by a market leader to make optimal joint pricing and inventory decisions.

3 - Planning Work Releases with Workload Dependent Lead Times and Stochastic Demand

Reha Uzsoy, Clifton A. Anderson Distinguished Professor, North Carolina State University, 400 Daniels Hall College of Engineering, North Carolina State University, Raleigh, NC, 27695, United States of America, ruzsoy@ncsu.edu, Seza Orcun, Karl Kempf

We address the problem of planning production releases in a serial multistage production-inventory system with workload dependent lead times and stochastic demand. We propose a chance-constrained mathematical programming model and an iterative scheme by which lead times and safety stock levels are updated. Computational experiments evaluating the performance of the approach are presented.

4 - Differentiated Configuration Pricing Strategies for Multi-commodity RFQs

Markus Ettl, IBM Research, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, msettl@us.ibm.com, Karthik Sourirajan, Zhengliang Xue

In this paper, we model pricing strategies for request-for-quotes (RFQs) in multi-commodity bid configurations with unconstrained execution. We develop win probability estimation models that compute the probability of winning a bid at a given price, and profit optimization models that compute the optimal price for a bid by balancing the probability of winning a bid at a price with the profitability of the bid at the given price.

■ SA18

C - Room 17A, Level 4

Optimization Modeling

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Tarun Kumar, IBM T.J. Watson Research Center, Yorktown Heights, NY, United States of America, ktarun@us.ibm.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Class Rostering at Roosevelt University using AMPL and LPsolve
Barry King, Butler University, 4600 Sunset Ave, Indianapolis, IN, 46208, United States of America, king@butler.edu, Terri Friel

This paper outlines successful efforts taken at Roosevelt University to construct semester class schedules using a mixed integer linear programming problem to develop a schedule of classes at two campuses. A variety of scheduling constraints are handled by the modeling language. The paper discusses using the AMPL modeling language and the LPsolve mixed integer solver. It further discusses the ease of using Microsoft Access as an input interface for clerical personnel.

2 - AMMLE- Bridging the Can Between Development and Deployment of Mathematical Models
Tarun Kumar, IBM T.J. Watson Research Center, Yorktown Heights, NY, United States of America, ktarun@us.ibm.com, Kai Pan, David Jensen

We present an innovative approach to seamlessly develop and deploy mathematical models in an enterprise environment. We showcase the ability to auto-generate production code that can be deployed to a corporate enterprise environment to improve decision making by leveraging Predictive and Prescriptive analytics. We also review the object model and API that we have developed that enables platform independent formulation of the optimization models.

3 - Semester Assignment of United States Air Force Academy Cadets to Courses
Gerardo Gonzalez, Colorado School of Mines, Division of Economics and Business, Golden, CO, United States of America, gegonzal@mymail.mines.edu

We present an integer program that offers courses during appropriate periods and then schedules students into those courses. The model accepts course offerings and student's 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).

■ SA19

C - Room 17B, Level 4

Customer Behavior Models

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Dan Zhang, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A1G5, Canada, dan.zhang@mcgill.ca

1 - Advance Demand Information, Price Discrimination, and Pre-order Strategies
Fuqiang Zhang, Washington State University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, fzhang22@wustl.edu, Cuihong Li

This paper studies the pre-order strategy that a seller may use to sell a perishable product in an uncertain market. By accepting pre-orders, the seller is able to obtain advance demand information for inventory planning and price-discriminate the consumers. We study the value of advance demand information and investigate the seller's optimal pre-order strategy choice (i.e., whether the pre-order option should be offered and whether it should be coupled with price guarantees).

2 - Risk Pooling with Strategic Customers
Robert Swinney, Assistant Professor, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, Swinney_Robert@GSB.Stanford.Edu

We investigate the value of various risk pooling strategies when a firm sells to strategic, or forward-looking, customers. Such customers anticipate future changes in price and product availability due to multiperiod pricing strategies, and may take this information into account when making their own purchasing decisions. We consider the impact of this behavior on the value of risk pooling both for a single firm and for a supply chain.

3 - Dynamic Pricing Competition with Strategic Customers Under Vertical Product Differentiation
Dan Zhang, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A1G5, Canada, dan.zhang@mcgill.ca, Qian Liu

We consider multi-period dynamic pricing competition between two sellers offering vertically differentiated products to strategic customers that are inter-temporal utility maximizers. We establish a unique Markov perfect equilibrium, which admits simple recursive expressions. An extensive numerical study reveals the key role of product quality. Furthermore, we show that dynamic pricing is often undesirable for both sellers and commitment to charge a fixed price is often very valuable.

■ SA20

C - Room 18A, Level 4

Pricing and Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Hongmin Li, Assistant Professor, Arizona State University, W.P. Carey School of Business, Tempe, AZ, 85287, United States of America, Hongmin.Li@asu.edu

1 - Dynamic Pricing of Substitutable Products Under Logit Demand
Goker Aydin, Associate Professor, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States of America, ayding@indiana.edu, Minsuk Suh

We consider the problem of dynamically pricing two substitutable products over a predetermined, finite selling season. We use a choice model that captures the effect of prices and stock-outs on customer choice. Interestingly, the optimal price of a product may decrease as the end of the season approaches or the other product's stock level decreases. We prove, however, that the optimal price difference between the two products and the optimal purchase probabilities behave in predictable ways.

2 - Dynamic Pricing with Restocking Opportunities
Jian Li, Assistant Professor, Northeastern Illinois University, College of Business and Management, Chicago, IL, 60625, United States of America, JLi@neiu.edu, Xiaowei Xu

This paper studies a joint dynamic pricing and inventory control problem, in which the retailer dynamically adjusts the product price and has multiple opportunities to replenish her inventory at preset time spots. Each replenishment incurs both fixed and variable costs. By significantly extending the sample-path method in Zhao and Zheng (2000) and using the concept of K-concavity, we prove that the optimal inventory control policy in the presence of dynamic pricing is (s, S)-polices.

3 - Consumer Memory-dependent Pricing and Product Introduction Policies
Hasan Arslan, Sawyer Business School, Suffolk University, 73 Tremont Street, Boston, MA, 02108, United States of America, harslan@suffolk.edu, Soulaymane Kachani, Kyrylo Shmatov

We analyze how pricing and product introduction decisions for successive product generations can be formed when demand is impacted by the reference price formed by consumers. We characterize the product introduction timing and pricing policies explicitly for two successive generations, and propose a general quasi-analytic solution. We also extend the analysis to a competitive environment.

4 - Pricing Multiple Products with the Multinomial Logit and Nested Logit Models
Hongmin Li, Assistant Professor, Arizona State University, W.P. Carey School of Business, Tempe, AZ, 85287, United States of America, Hongmin.Li@asu.edu, Tim Huh

We consider the problem of pricing multiple differentiated products with the Multinomial Logit model and the Nested Logit model, and show a concavity property of the revenue function under each model even when the price sensitivity parameters may vary with products. We compare the optimal solution to the oligopolistic equilibrium solution. In addition, we apply it to problems of inventory control and revenue management, and establish structural results on the optimal policies.

■ SA21

C - Room 18B, Level 4

Healthcare Modeling, Evaluation, and Optimization

Sponsor: Service Science
Sponsored Session

Chair: Behlul Saka, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, bsaka@uark.edu

1 - Biologically Guided Intensity Modulated Radiation Therapy Planning Optimization

Behlul Saka, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, bsaka@uark.edu, Ronald Rardin, Mark Langer

Biologically guided radiation therapy incorporates the biological responses of tissues to radiation or "sensitivities" changing over the course of the treatment. Updated information on tumor sensitivity over time invites adjusting radiation delivered across the treatment volume in order to yield more effective plans. We propose an optimization approach that adapts IMRT plans in response to the changes in the tumor sensitivity subject to both cumulative and per-session limits, and present some preliminary results.

2 - Models for Evaluation of Supply Chain Risk with Application to Health Care Management

Guangfu Zeng, University of Texas at Arlington, 1609 Lake Meade Dr., Allen, TX, 75002, United States of America, guangfu.zeng@mavs.uta.edu

Today's uncertain business environment requires supply chain managers to assess the degree of risk across a whole gamut of activities in a supply chain and develop suitable strategies to mitigate them. Our research will develop a new methodology in supply chain risk analysis, and build several quantitative models for evaluation of general supply chain risk, by using data envelopment analysis and rough set theory. We apply the risk evaluation models to health care supply chain risk management.

3 - Cardinal Scales for Health Evaluation

Charles Harvey, Professor, Retired, University of Houston, 5902 NW Pinewood Place, Corvallis, OR, 97330, United States of America, cmharvey1@earthlink.net, Lars ÿsterdal

Policy studies often evaluate health for an individual or for a population by using ordinal scales or expected-utility scales. This paper develops scales of a different type, commonly called cardinal scales, that measure changes in health. Also, we argue that cardinal scales provide a meaningful and useful means of evaluating health policies. Thus, we develop a means of using the perspective of welfare economics as an alternative to ordinalist and expected-utility perspectives.

4 - The Impact of EMR Capability on Hospital Performance

Wei Wu, University of Tennessee Knoxville, 329 Stokely Management Center, Knoxville, TN, 37996, United States of America, wwu3@utk.edu, Bogdan Bichescu, Randy Bradley

There is limited evidence that Electronic Medical Record (EMR) systems lead to better hospital performance. There is increasing pressure on hospitals to adopt EMR systems, despite the lack of empirical evidence to support such investments. Using a sample of 130 hospitals that are in the upper echelon of EMR capabilities, we examine the impact of EMR on control-adjusted measures of hospital performance. Our findings have implications regarding the realistic impact of EMR on hospital performance.

■ SA22

C - Room 18C, Level 4

Technology and Service Optimization

Sponsor: Service Science
Sponsored Session

Chair: Tugrul Daim, Portland State University, P.O. Box 751, Portland, OR, 97224, United States of America, tugrul@etm.pdx.edu

1 - Decision Making Process for Off-shore Outsourcing IT Services and Software Development

Rosine Hanna, PhD Student, Portland State University, P.O. Box 751, Portland, OR, 97207, United States of America, rosine@pdx.edu

Several studies presented frameworks that focus on guiding decision makers 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 projects. The goal of this research is to present a framework of offshore outsourcing that incorporates the entire offshore outsourcing processes, relationship and risk management processes.

2 - Capability Maturity Model: The Case of Care Coordination and HIT Adoption

Nima A. Behkami, Oregon Health & Science University, 3181 Southwest Sam Jackson Park Road, Portland, OR, United States of America, behkamin@ohsu.edu, David A. Dorr, Tugrul Daim

Adopting Health Information technology, especially to improve the quality of care management, has been a challenge for organizations. We adapt the Capability Maturity Model (CMMI) to the use of Health Information Technology (HIT) to better manage the care of patients with multiple chronic illnesses. We study the implementation of the Care Management Plus (CM+) model, a program intended to redesign primary care teams and health information technology use.

3 - Study of the Efficiency and Efficiency Patterns of the U.S. University Technology Commercialization

Jisun Kim, Portland State University, P.O. Box 751, Portland, OR, 97207-0751, United States of America, kimjisun73@gmail.com, Tugrul Daim, Timothy Anderson

The main purpose of this study is to provide better understanding of U.S. university technology commercialization (UTC) activity by evaluating the efficiencies of their practices and identifying efficiency changing patterns over time. The influencing factors are explored to understand their impact on the performances and define the characteristics of the patterns. The study also presents some significant time-lags observed among the technology transfer variables.

4 - Technology Roadmapping in the Energy Sector: Energy Efficiency in the Pacific NW

Tugrul Daim, Portland State University, P.O. Box 751, Portland, OR, 97224, United States of America, tugrul@etm.pdx.edu, Joshua Binus, Jisun Kim

This paper presents the process and the results of a regional roadmapping project. The project identified the market drivers, available and required products and services, available and required technologies and finally the gaps and the R&D programs to fullfill these gaps. The focus of the roadmap was energy efficiency in the pacific NW. More than 20 organizations took part in the effort.

■ SA23

C - Room 18D, Level 4

Service Innovation in Developing Economies I

Sponsor: Service Science
Sponsored Session

Chair: JianQiang Hu, Professor, Fudan University, 670 GuoShun Road, Siyuan Building, Room 508, Shanghai, 200433, China, hujq@fudan.edu.cn

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

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

There exist many two-tier service systems with a toll-free subsystem and a toll subsystem coexisting. We study the second-best price and capacity decisions for the toll subsystem with the consideration of self-financing constraint.

2 - The Impact of Government Intervention on Airline Operations in China

JianQiang Hu, Professor, Fudan University, 670 GuoShun Road, Siyuan Building, Room 508, Shanghai, 200433, China, hujq@fudan.edu.cn, Chenbo Zhu

In 2007, the Chinese aviation authority asked the five airlines with service between Shanghai and Beijing to form an express shuttle alliance so that their tickets could be interchanged. In this paper, we will study the impact of such government intervention on the competitiveness of the market and airline operations. We first investigate the existence of Nash equilibrium in such an environment. We then analyze how seat allocations, airfares, and revenues of the airlines will be affected.

3 - Provide Financial Risk Management as Service

Tie Liu, IBM Research - China, Bld19 Zhongguancun Software Park,Haidian, Beijing, 100193, China, liultie@cn.ibm.com

We present an innovative financial risk management service framework for small-media sized commercial banks which require quantitative risk management from Basel II accord. Risk calculation models and external data collection are two difficult issues for banks. We propose a SOA based system to deal with the challenges, where flexible computation support services are provided with a much less cost for banks, such as risk computation service, business logic service and data management service.

■ SA24

C - Room 19A, Level 4

Joint Session SPPSN/ HAS: Health and Humanitarian Applications of Revenue Management

Sponsor: Public Programs, Service and Needs/ Health Applications
Sponsored Session

Chair: Mallory Soldner, Georgia Institute of Technology, 609 Virginia Ave. NE, Apt. 8206, Atlanta, GA, United States of America, msoldner@gatech.edu

Co-Chair: Melih Celik, Georgia Institute of Technology, 765 Ferst Drive, NW, 30332-0205, Atlanta, GA, 30339, United States of America, melihcelik@gatech.edu

1 - Scaling Up HIV Treatment in Resource-limited Settings Under Supply Uncertainty

Sarang Deo, Assistant Professor, Northwestern University - Kellogg School of Management, Evanston, IL, United States of America, s-deo@kellogg.northwestern.edu, Charles Corbett

HIV clinics operating in developing countries have to contend with an uncertain supply of drugs. This creates a trade-off between enrolling new patients and providing uninterrupted treatment to those already enrolled. We formalize this trade-off using a stochastic dynamic program, derive the optimal policy for the number of new enrollments and compare its performance with that of policies used in practice.

2 - Capacity Allocation Model for Chronic Care

Sarang Deo, Assistant Professor, Northwestern University - Kellogg School of Management, Evanston, IL, United States of America, s-deo@kellogg.northwestern.edu, Tingting Jiang, Steve Samuelson, Seyed Iravani, Karen Smilowitz

Most health care operation models focus either on efficiency improvements in the delivery system or improvements in clinical decisions. We consider a novel setting of community-based delivery of chronic asthma care, where it is necessary to integrate these two approaches. We develop and analyze a joint disease progression and capacity allocation model to investigate how operational decisions can improve population level health outcomes. We 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.

3 - The Optimality of Myopic Inventory Policies in Blood Banking

Yan Qin, Doctoral Student, ISOM Department, Warrington College of Business Administration, University of Florida, Gainesville, FL, 32611, United States of America, yan.qin@warrington.ufl.edu, Anand Paul, Aydin Alptekinoglu

In this paper, we construct a multi-period finite horizon model of blood bank storage and distribution based on discussions with managers from a local blood bank. Assuming stationary demand and supply distributions, we show - using some new Markov Decision Processes machinery developed in the paper - that there is an optimal myopic policy. Under non-stationary demand and supply, myopic optimality is proved in the two-period case. Empirical analysis is to be conducted based on real data.

4 - Policies for Blood Allocation in Developing Countries

Melih Celik, Georgia Institute of Technology, 765 Ferst Drive, NW, 30332-0205, Atlanta, GA, 30339, United States of America, melihcelik@gatech.edu, Mallory Soldner, Ozlem Ergun, Julie Swann

We consider the problem of allocating blood units to hospitals from a collection center in a developing country. We present a tool using an optimization model that aids monthly allocation decisions, then develop dynamic programming models with stochastic demand requests for the real-time allocation decisions, and lastly consider the overall allocation problem when individual hospitals use blood according to different service policies and develop models that incorporate system-optimal behavior.

■ SA25

C - Room 19B, Level 4

Joint Session SPPSN/ HAS: Public Health Models

Sponsor: Public Programs, Service and Needs/ Health Applications
Sponsored Session

Chair: Hannah Smalley, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, hkolberg3@gatech.edu

1 - A Simulation Model of Local Public Health Response to Pertussis Events

Travis Worth, North Carolina State University, 400 Daniels Hall College of Engineering, North Carolina State University, Raleigh, NC, 27695, United States of America, stworth@ncsu.edu, Jean-Marie Maillard, Erika Samoff, Anne-Marie Meyer, Reha Uzsoy, Javad Taheri, Aaron Wendelboe

We present a discrete-event simulation model of the response of the North Carolina public health system to pertussis events. We model the information transfer between actors of the NC-PHIN (North Carolina Public Health Information Network) and local health departments, and examine the effect of different alerting strategies and resource allocations on the number of confirmed cases.

2 - Cost-effectiveness Analysis of Vaccination and Self-isolation in Case of an H1N1 Outbreak

Hamed Yarmand, PhD Student, North Carolina State University, 373 Daniels Hall, 111 Lampe Dr, Raleigh, NC, 27695-7906, United States of America, hyarman@ncsu.edu, Julie Ivy, Stephen Roberts

We have conducted a cost-effectiveness analysis to examine the relative importance of vaccination and self-isolation in case of H1N1 by developing a simulation model for the spread of H1N1. The optimization model consists of two decision variables, vaccination fraction and self-isolation fraction, and two constraints for the surge capacity and attack rate. The optimization model seeks the most cost-effective control policy by considering the relative marginal costs for each decision variable.

3 - Modeling the Optimal Timing of Joint Replacement Surgery

Diana Negoescu, PhD Candidate, Management Science and Engineering, Stanford University, 206 Rosse Lane, # 201, Stanford, CA, 94305, United States of America, negoescu@stanford.edu, James Huddleston, Margaret Brandeau

The optimal timing of joint replacement surgery is a difficult problem for surgeons and patients alike. For younger patients, the survival of the artificial joint is an important concern, while for older patients, fitness to undergo surgery is an important factor. We develop a stochastic control model that takes as input the patient's current age, overall health, joint functionality and discounting preferences and advises whether the patient should have surgery in the very near future.

■ SA26

C - Room 4A, Level 3

Pattern Search in Scientific Domain

Sponsor: Data Mining
Sponsored Session

Chair: Lian Duan, University of Iowa, 523 Hawkeye Ct, Iowa City, IA, United States of America, lian-duan@uiowa.edu

1 - Data Utility Approach Towards K-anonymity

Malika Mahoui, Indiana University-Purdue University, Indianapolis, IN, United States of America, mmahoui@iupui.edu

K-anonymity is an approach proposed to ensure data privacy by ensuring that no one individual can be distinguished within a group of at least k individuals. We present new algorithms that implement k-anonymity and at the same time allow data owners to have more control on the utility of the data they make available.

2 - Robust Hierarchical Linkage

Pramod Gupta, Georgia Institute of Technology, 266 Ferst Drive, Atlanta, GA, 30332-0765, United States of America, pramodgupta@gatech.edu, Maria-Florina Balcan

One of the most widely used techniques for data clustering is agglomerative clustering. However, it is well known, that many of the classic agglomerative clustering algorithms are not robust to noise. We propose and analyze a new robust algorithm for bottom-up agglomerative clustering. We show that our algorithm can be used to cluster accurately in cases where the data satisfies a number of natural properties and where the traditional agglomerative algorithms fail.

3 - Rank Optimization for Survival Analysis

Kaan Ataman, Chapman University, One University Drive, Orange, CA, 92866, United States of America, ataman@chapman.edu, Nick Street

Machine learning algorithms designed for classification or regression tasks are in general not fit for handling censored data commonly seen in customer churn analysis, medical treatment evaluations, and component reliability tests. We present a linear programming-based rank optimization algorithm and show that on several real-world problems our algorithm performs better in general than Cox's Proportional Hazard Regression, the most commonly-used survival analysis method.

4 - Efficiently Finding Maximal Fully-correlated Itemsets in Large Databases

Lian Duan, University of Iowa, 523 Hawkeye Ct, Iowa City, IA, United States of America, lian-duan@uiowa.edu, Nick Street, Lizhen Tong

In this paper, we proposed two techniques to search the maximal fully-correlated itemset (MFCI). First, we identify the correlation upper bound for any good correlation measure to avoid unnecessary IO cost, and make use of their common monotone property to prune many pairs. In addition, we build an enumeration tree to save the fully-correlated value (FCV) for all the MFCIs under a given initial correlation threshold. Experimental results show that our algorithm is efficient.

■ SA27

C - Room 4B, Level 3

Optimizing Uncertain or Noisy Functions

Sponsor: Computing Society
Sponsored Session

Chair: Stephen Billups, Associate Professor, University of Colorado, Denver, Department Math & Stat Sciences, CB 170, P.O. Box 173364, Denver, CO, 80217-3364, United States of America, Stephen.Billups@ucdenver.edu

1 - Gaussian Process Response Surface Optimization

Dan Lizotte, Postdoctoral Fellow, University of Michigan, 426 Thompson #2067, Ann Arbor, MI, 48109, United States of America, danjl@umich.edu, Dale Schuurmans, Russell Greiner

Response surface methods construct a Gaussian process model of an objective function based on all observed data points. The model is then used to compute which point the method should acquire next in its search for the global optimum of the objective. Although they are intended to be "black-box," these methods are potentially sensitive to tuning parameters and model choice. We examine these issues and suggest rules of thumb for using response surface methods.

2 - Estimating Derivatives of Computationally Noisy Functions

Stefan Wild, Computational Mathematician, Argonne National Laboratory, 9700 S. Cass Avenue, Bldg 240, 1154, Argonne, IL, 60439, United States of America, wild@mcs.anl.gov, Jorge More'

We have recently developed the ECNoise algorithm for quantifying computational noise in deterministic simulation-based functions. Derivative estimates for such functions can be vital to terminating optimization routines and for performing sensitivity analysis. In this talk we show how estimates of the noise can be used to compute optimal step sizes for finite difference schemes. Our numerical results validate derivatives obtained in this manner with an automatic differentiation derivative.

3 - Advanced Uncertainty Quantification for Optimization Under Uncertainty

Brian Adams, Sandia National Laboratories, P.O. Box 5800, MS-1318, Albuquerque, NM, 87185, United States of America, briadam@sandia.gov, Michael Eldred

Numerous uncertainties affect computational model credibility, including parametric uncertainty, numerical error, and model form. I will survey advanced uncertainty quantification algorithms which assess the effect of parametric uncertainties on model outputs. Such methods, available alongside nonlinear optimization methods in DAKOTA, enable optimization under uncertainty, reliability-based design, and extrema robustness assessment. I will describe these, together with relevant applications.

4 - Derivative-free Optimization of Expensive Functions with Errors using Weighted Regression

Stephen Billups, Associate Professor, University of Colorado, Denver, Department Math & Stat Sciences, CB 170, P.O. Box 173364, Denver, CO, 80217-3364, United States of America, Stephen.Billups@ucdenver.edu, Jeffrey Larson

We propose a derivative-free algorithm for optimizing computationally expensive functions with computational error. The algorithm is based on the trust-region regression method proposed by Conn, Scheinberg, and Vicente, but uses weighted regression to obtain more accurate model functions at each trust region iteration. Weighted regression provides a straightforward means for handling i) differing levels of uncertainty in function evaluations, and ii) errors induced by poor model fidelity.

■ SA28

C - Room 4C, Level 3

Statistical Modeling and Analysis of Biological Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jing Li, Assistant Professor, Industrial Engineering, Arizona State University, Tempe, AZ, United States of America, jing.li.8@asu.edu

Co-Chair: Hui Yang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States of America, huiyang@usf.edu

1 - Modeling of Near Field Electrospinning Process using Response Surface Methodology

Binil Starly, Assistant Professor, University of Oklahoma, 202 W Boyd St, Rm 116B, Norman, OK, 73019, United States of America, starlyb@ou.edu, Vivek Kamaraj, Thirumalpathy Padmanabhan

The past decade has seen a tremendous advancement to the production of polymeric nanofibers for applications in biomedical engineering applications. In this investigation, we focus on the 'near field electrospinning process' (NFES) to produce aligned nanofibers of biopolymers. A Response Surface Methodology approach was used to understand the inter-dependance of the manufacturing process parameters that ultimately determine the deposition ability and the final diameter of the fibers.

2 - Virtual Instruments for Cardiovascular Healthcare using ECG Signals

Trung Le, Oklahoma State University, Stillwater, OK, United States of America, trung.le@okstate.edu

This research presents a new approach for real-time simulation of the heart dynamics where the heart activation functions are derived from electrocardiogram (ECG) signal. The results show that the model could discern the effect of variations in the electrical activations. The findings support the developing of a virtual instrument for clinical diagnostic in lieu of expensive instrumentation and suggest diagnosis methods for certain cardiovascular diseases not easy to diagnosis from the ECG.

3 - Computer Model of Glycosylation Modulation in Cardiac Cell Action Potentials

Hui Yang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States of America, huiyang@usf.edu, Yun Chen

Cardiac electrical signaling is controlled and modulated by the voltage-gated cellular ionic channel dynamics. This paper presents a computer model for the simulation of regulated and aberrant glycosylation modulated ion channel activity. This study characterizes the mouse ventricular myocyte action potential (AP) based on the experimental voltage-clamp data of ionic currents, and analyzes the cardiac pathological behaviors in the microscopic levels.

4 - Systems Biology Approach Towards Drug Target Identification for Type 2 Diabetes Mellitus

Soundar Kumara, Pearce Chair Professor, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, skumara@psu.edu, Manini Madireddy

The number of morbidly obese diabetics world is rising. Many of these patients undergo bariatric surgery; in some of the cases it was found that these patients turned non-diabetic after the surgery. We use network science based approach to build Protein Interaction Networks (PIN) and conducted topological analysis to infer the important proteins. We formulate a new metric which is able to generate a list of proteins that maybe important to T2DM.

■ SA29

C - Room 5A, Level 3

Journal of Quality Technology Invited Papers

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Daniel Apley, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, apley@northwestern.edu

1 - Sensitivity Analysis of Optimal Designs for Accelerated Life Testing

Eric Monroe, Six Sigma Blackbelt, Intel Corporation, 5000 W. Chandler Blvd., Mailstop CH2-117, Chandler, AZ, 85226-3699, United States of America, eric.m.monroe@intel.com, Rong Pan, Douglas Montgomery, Connie Borror, Christine Anderson-Cook

In experimental testing, we strive to select combinations of input factors that yield optimal results. Alphabetic optimal designs are commonly used in such applications. We examine the issue of model parameter sensitivity to the selection of an accelerated life test based on the UC-optimality criterion, minimizing of the prediction variance at the usage condition, using a generalized linear model framework. We examine the implications of choice of experimental design, sample size, and censoring.

2 - Likelihood Ratio-based Distribution-free EWMA Control Charts
Fugee Tsung, Professor and Head, Department of Industrial Engineering and Logistics Management, Hong Kong University of Science and Tech, Clear Water Bay, Kowloon, Hong Kong - PRC, season@ust.hk

Nonparametric or distribution-free charts are useful in statistical process control when there is a lack of or limited knowledge about the underlying process distribution. Most existing approaches in the literature are for monitoring location parameters. They may not be effective with a change of distribution over time. This paper develops a new distribution-free control chart based on the integration of a powerful nonparametric goodness-of-fit test and the EWMA control scheme.

3 - Self-starting CUSCORE Control Charts for Individual Multivariate Observations
Guido Masarotto, Department of Statistical Sciences, via Cesare Battisti 241/243, Padova, Italy, guido@stat.unipd.it, Giovanna Capizzi

During the process start-up or in the case of short runs, process parameters are unknown, and Phase I samples cannot be gathered to accurately estimate control limits for prospective monitoring. Self-starting schemes can be applied to these low-volume applications. We propose two new self-starting CUSCORE-type control charts for monitoring the mean of a multivariate normal distribution. These novel procedures are able to outperform the previously suggested self-starting control charts.

■ SA30

C - Room 5B, Level 3

Nanomanufacturing & Nanoinformatics I

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

Co-Chair: Tirthankar Dasgupta, Assistant Professor, Harvard University, Science Center, 1 Oxford Street, Cambridge, MA, United States of America, dasgupta@stat.harvard.edu

1 - Quantitative Characterization and Modeling of Nanoparticle Dispersion in Polymer Composite
Chia-Jung Chang, PhD Student, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, United States of America, cchang43@gatech.edu, Lijuan Xu, Qiang Huang, Jianjun Shi

TEM images are commonly used to represent the nanoparticle dispersion and developing the quantitative measure of it is strongly needed. We propose the engineering-driven nonhomogenous Poisson process model incorporated with Gaussian random field to capture the dispersion. The model parameters are estimated through Bayesian MCMC. Both simulation and case studies of nano-silica/epoxy composites images are conducted. The approach is generally applicable to other nanocomposite materials as well.

2 - Space Filling Design with Unknown Constraints
Tirthankar Dasgupta, Assistant Professor, Harvard University, Science Center, 1 Oxford Street, Cambridge, MA, United States of America, dasgupta@stat.harvard.edu, Li Zhu

This research explores space filling designs with complex constraints. We propose sequential methods that will generate designs with space-filling properties within unknown yield regions of the operable design space by systematically carving out regions of no-morphology.

3 - Modeling the Interaction Among Nanostructures for Local Morphology Control
Lijuan Xu, PhD Student, University of Southern California, 3715 McClintock Avenue, GER 236, Los Angeles, CA, 90089, United States of America, lijuanxu@usc.edu, Qiang Huang

Due to limited understanding of local growth mechanisms, control of local nanostructure morphology is extremely challenging. In this talk, we employ Gaussian Markov random field model to characterize the area specific variability by specifying interaction among neighboring nanostructures and then link the estimation with physical parameters for local morphology control. Both simulated data and real collected nanowire growth data are studied to validate the approaches.

4 - Sequential Synthesis of Nanomaterials via Level Expansion
Xu Xu, University of Wisconsin, Madison, Department of Statistics, 1300 University Ave, Madison, WI, 53706, United States of America, xuxu@stat.wisc.edu, Young Deok Hwang, Taewan Kim, Fei Wang, Xudong Wang, Peter Qian

We propose a new design argumentation method, called level-expansion, for sequential synthesis of nanomaterials. Given an initial design at two levels, this method creates a follow-up design by expanding some factors into four levels. Unlike the fold-over method, the proposed scheme can accommodate non-linear effects and also achieve some degree of dealiasing. The effectiveness of this method is illustrated by simulation examples and a case study of sequential synthesis of Zinc-Oxide nanowires.

5 - A Statistical Method for Analyzing the Morphology of Nanoparticles
Chiwoo Park, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843-3131, United States of America, chiwoo.park@tamu.edu, Subrata Kundu, Bani Mallick, David Huitink, Jianhua Huang, Yu Ding, Hong Liang

We propose a statistical method to analyze morphology of nanoparticles. This study is motivated by the fact that the properties of materials synthesized with nanoparticles are highly correlated to the sizes and shapes of the nanoparticles. One could attain desired properties if the sizes and shapes are controlled. The method simultaneously infers boundaries of nanoparticles from noisy micrographs and classifies the particles by similarity of the boundaries with a unified probability model.

■ SA31

C - Room 5C, Level 3

Data Mining in Healthcare Informatics and Clinical Decision Support

Sponsor: Data Mining
Sponsored Session

Chair: Sung Won Han, Post-doctoral Researcher, University of Pennsylvania, 423 Guardian Drive, Philadelphia, PA, 19104, United States of America, hansungw@mail.med.upenn.edu

1 - Healthcare Surveillance Under Regional Correlated Data
Sung Won Han, Post-doctoral Researcher, University of Pennsylvania, 423 Guardian Drive, Philadelphia, PA, 19104, United States of America, hansungw@mail.med.upenn.edu, Jiang Wei, Kwok Tsui, William Woodall

In healthcare surveillance, the timely detection of disease clusters is crucial. Most health surveillance research is based on the assumption that observations are independent. We propose healthcare surveillance methods that utilize regional correlations. Through simulations, we show that our proposed methods perform better than existing ones and detect outbreaks more efficiently. We also present an example of breast cancer in New Hampshire for the application to correlated data.

2 - Using Data Mining to Schedule Clinic Appointments Over Multiple Days
Michele Samorani, PhD Candidate, Leeds School of Business, University of Colorado at Boulder, UCB 419, Boulder, CO, 80309-0419, United States of America, Michael.Samorani@Colorado.EDU, Linda Laganga

Overbooking appointments is a common way to improve a clinic performance in presence of no-shows. Existing works use the no-show rate to determine the optimal clinic setting (number of slots and length of each slot), but they assume that patients have the same no-show probability. We use classification techniques to predict the no-show probability of individual patients, and, through simulation studies, we show that using this information leads to a higher clinic performance.

3 - A Machine Learning-based Healthy Lifestyle Recommender
Nick Street, Professor, University of Iowa, Pappajohn Business Building, Iowa, IA, 52242, United States of America, nick-street@uiowa.edu, Chih-Lin Chi, Jennifer Robinson

Machine learning techniques used in health care decision making allow robust and easily-updated prediction of risk, but are rarely used as a tool to minimize that risk. We present a framework that combines inductive learning with optimization to suggest an action (or set of actions) that maximizes the patient's chance of a desirable outcome. Our case study is a healthy lifestyle recommendation system that provides individualized, customizable recommendations to minimize heart disease risk.

4 - Health-care Fraud Detection with Machine Committee
Yeolwoo An, Master Student, Ajou University, Ajou University, Suwon, 443-749, Korea, Republic of, willism81@gmail.com, Hangseok Kim, Hyunjung Helen Shin

Health care bill claim review process is heavily dependent on human assessment, which can be subjective and error-prone. One way to reduce the possible human mistakes is to use an objective backup reference, i.e.,the assessment result from a machine trained on the bill claim dataset. If a consensus from a committee of different machines can be made, the assessment becomes more objective than that of a single machine. We evaluate the proposed committee on the dataset offered by HIRA, 2007.

■ SA32

C - Room 6A, Level 3

Joint Session ICS/ QSR: Statistical Methods for Optimization

Sponsor: Computing Society/ Quality, Statistics and Reliability
Sponsored Session

Chair: Shiyu Zhou, Associate Professor, University of Wisconsin - Madison, 1513 University Ave., Madison, WI, 53706, United States of America, szhou@engr.wisc.edu

1 - Annealing Evolutionary Stochastic Approximation Monte Carlo for Global Optimization

Faming Liang, Texas A&M University, Department of Statistics, College Station, TX, United States of America, fliang@stat.tamu.edu

We present a new algorithm, the so-called annealing evolutionary stochastic approximation Monte Carlo (AESAMC) algorithm as a general optimization technique. AESAMC possesses a self-adjusting mechanism, which makes it less likely get trapped by local energy minima. AESAMC is tested on multiple optimization problems. The numerical results indicate that AESAMC can potentially outperform simulated annealing, the genetic algorithm, and some other metaheuristics in function optimization.

2 - Penalty Decomposition (PD) Approach for General Sparse Pursuit Problems

Zhaosong Lu, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca, Yong Zhang

We propose PD methods for general l_0-norm minimization problems. Under some suitable assumptions, we establish that any limit point of the sequence generated by the methods when applied to the l_0-norm constrained problems satisfies a first-order optimality condition that is generally stronger than one natural optimality condition. Finally, we apply the methods to compressed sensing, sparse logistic regression and sparse inverse covariance selection.

3 - Adaptive Evolutionary Monte Carlo for Heuristic Optimization

Yuan Ren, interCLICK Inc., 900 River Reach Dr, Apt 414, Fort Lauderdale, FL, United States of America, renyuan1010@gmail.com, Yu Ding, Faming Liang

This talk presents an adaptive evolutionary Monte Carlo algorithm (AEMC), which hybrids a tree-based predictive model with an evolutionary Monte Carlo sampling procedure for the purpose of global optimization. AEMC falls into the category of adaptive Markov chain Monte Carlo algorithms and is the first one that simulates multiple Markov chains in parallel. AEMC is used to optimize a sensor placement problem in a manufacturing process, as well as to optimize a suite of standard test functions.

4 - A New Optimization Framework for the Network Reliability Design Problem

Andrew Kiekhaefer, PhD Student, University of Iowa, 248 ERF, The University of Iowa, Iowa City, IA, United States of America, akiekhae@engineering.uiowa.edu, Yong Chen

We present a new optimization framework for the general network reliability design problem, focusing on efficient evaluation. This framework consists of a population-based global guidance system, a selection-of-the-best-subset procedure, and a duplicate evaluation process for fast independent evaluation of duplicate designs. Overall, this framework shows runtime improvements of over fifteen times that of the baseline method. Numerical examples and parameter robustness are discussed.

■ SA33

C - Room 6B, Level 3

Computational Optimization: Theories and Applications

Sponsor: Computing Society
Sponsored Session

Chair: Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50014, United States of America, lzwang@iastate.edu

1 - A Framework of GPU-accelerated Evolutionary Algorithms for Global Optimization

Weihang Zhu, Assistant Professor, Lamar University, P.O. Box 10032, Beaumont, TX, 77710, United States of America, humorstar@gmail.com, James Curry, Victor Zaloom

This paper presents a framework of massively parallel evolutionary algorithms with graphics hardware acceleration on global optimization problems. The objective of this study was to determine the effectiveness of using Graphics Processing Units (GPU) as a hardware platform for evolutionary algorithms. The main contribution of this paper was the parallelization analysis and performance analysis of the evolutionary algorithms with GPU acceleration.

2 - An Exact Algorithm for Covering Rectangular Requests with a Single Rectanglular Target

Manish Bansal, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, bans1571@neo.tamu.edu, Kiavash Kianfar

We consider positioning a target rectangle on 2-dimensional plane to partially cover a set of existing rectangular areas (requests) to maximize total coverage reward. Applications include camera surveillance and imaging. We introduce a reduced solution space and present a novel branch-and-bound exact algorithm. Our computational results show that our approach significantly outperforms the existing PVT algorithm in case of large regions or heterogeneous reward rates.

3 - Allocating Ancillary Service Capacity for Energy Suppliers

Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr, Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu

Ancillary services are reserves to support the transmission of energy while maintaining reliable operation of transmission systems. The ancillary services are procured by the independent system operator (ISO). The current bidding process is sub-optimal and we propose an optimization based approach which allocates the fixed capacity to major ancillary services and apply nesting afterward. The model instance is both convex and smooth and the real world scale problem can be efficiently solved.

4 - Obtaining Tighter Relaxations of Linear Programs with Linear Complementarity Constraints

Bin Yu, Graduate Student, Search ResultsRensselaer Polytechnic Institute, 110 8th Street, Troy, NY, 12180, United States of America, yub@rpi.edu, Jong-Shi Pang, John Mitchell

Omitting the complementarity constraints from a linear program with complementarity constraints gives a linear programming relaxation. We discuss various methods to tighten the relaxation by exploiting complementarity. Different types of linear constraints are introduced, second order cone constraints are also constructed. Computational results are included, comparing the benenfit of the various constraints on the value of the relaxation.

■ SA34

C - Room 7, Level 3

Network Interdiction and Restoration Problems

Sponsor: Computing Society
Sponsored Session

Chair: Thomas Sharkey, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St., Troy, NY, United States of America, sharkt@rpi.edu

1 - Exact Interdiction Models and Algorithms for Disconnecting Networks via Node Deletions

Siqian Shen, PhD Candidate, Department of ISE, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, siqian.shen@gmail.com, Roshan Goli, J. Cole Smith

Node deletion problems have received much attention due to their importance in applications of military, medicine, and social activities. We aim to maximize the graph disconnectivity by deleting nodes, and formulate the problem using mixed integer programming interdiction models. We demonstrate the computational efficacy of the MIP models, and study valid bounds by examining intermediate dynamic programming solutions to k-hole subgraphs.

2 - Dispatching Rules for Network-based Scheduling

Sarah Nurre, Rensselaer Polytechnic Institute, 110 8th Street, ISE CII 5015, Troy, NY, 12180, United States of America, nurres@rpi.edu, Thomas Sharkey

We examine a new class of network-based scheduling problems with applications to restoring infrastructure systems. The objective of these problems captures how well the network comes online. We provide the complexity of these problems and propose novel dispatching rules. Promising computational results are presented for various objectives.

3 - Fortifying Unreliable Facilities in the Public Sector: Finding a Risk Equitable Solution

Hugh Medal, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hugh.medal@uark.edu, Chase Rainwater, Manuel D Rossetti, Ed Pohl

We study the problem of fortifying unreliable facilities with the objective of minimizing the maximum worst case disruption cost over all demand points. This new objective finds solutions that hedge against the worst case and are equitable over all demand points in regard to risk. A mixed integer programming (MIP) model is developed as well as a set covering based exact algorithm. Our findings indicate that this objective is not only practically relevant but also results in a tractable model.

4 - Dynamic Network Interdiction Models with Applications to Law Enforcement
Chase Rainwater, University of Arkansas, INEG Department, Fayetteville, AR, 72701, United States of America, cer@uark.edu, Thomas Sharkey, Ajay Malaviya

We propose a class of multi-period network interdiction problems that focuses on scheduling the activities of law enforcement officials in order to successfully interdict criminals in the illegal drug supply chain. This class of problems contains several novel features motivated through collaborations with city-level law enforcement officials. We discuss computational challenges faced when solving real-life problem instances and propose methodology enhancements to address these issues.

■ SA35

C - Room 8A, Level 3

Asymptotic Analysis of Stochastic Network

Sponsor: Applied Probability
Sponsored Session

Chair: Hengqing Ye, Hong Kong Polytechnic University, Kowloon, Hong Kong - PRC, lgtyehq@inet.polyu.edu.hk

1 - Asymptotic Analysis of Large Sensor Networks
Kavita Ramanan, Professor, Brown University, Division of Applied Mathematics, Providence, RI, United States of America, Kavita_Ramanan@brown.edu

We will describe an analysis of distributed algorithms for parameter estimation in large sensor networks with imperfect communication. This includes joint work with Soummya Kar and Jose Moura.

2 - Stationary Distribution Convergence for a Multiclass Single-server Queue in Heavy Traffic
Toshiyuki Katsuda, QC com, 1-20-21 Kitano, Yasu-city, Shiga, 520-2361, Japan, ktmail@hera.eonet.ne.jp

In the recent work of Katsuda, established was the stationary distribution convergence for a multiclass single-server queue in heavy traffic. The key to the proof is to show state-space collapse in stationarity and the tightness of the stationary scaled workload under the conditions of finite moment generating functions on the residual primitive variables. In this talk we show such convergence result under much weaker moment conditions, following the recent work of Budhiraja and Lee.

3 - Optimal Admission to M/M/k/N Queues with Several Customer Types and Holding Costs
Eugene Feinberg, Stony Brook University, Department of Applied Math. & Stat., Stony Brook, NY, 11794-3600, United States of America, efeinberg@notes.cc.sunysb.edu, Fenghsu Yang

We study optimal admission to an M/M/k/N queue with several customer types. Rewards consist of revenues collected from admitted customers and holding costs, both of which depend on customer types. The goal is to find an admission policy that maximizes average rewards per unit time. This paper describes the structures of optimal, canonical, bias optimal, and Blackwell optimal policies. Problems with one holding cost function for all customers have been studied previously in the literature.

4 - Control and Staffing for Call Center Outsourcing with Rework
Jiheng Zhang, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, Hong Kong - PRC, jiheng@ust.hk, Eser Kirkizlar

We study a system with both in-house and outsourcer call centers. We assume that the service quality of the outsourcer is not as high as the in-house one and hence some customers are rerouted to the in-house call center for further help after receiving service at the outsourcer. Using a fluid approximation, we jointly determine the optimal control rule and the staffing policy that asymptotically minimize the long-run average staffing, holding, and reneging costs under heavy traffic regime.

5 - A Stochastic Network Under Proportional Fair Resource Control - Diffusion Limit with Multiple Bottlenecks
Hengqing Ye, Hong Kong Polytechnic University, Kowloon, Hong Kong, Hong Kong - PRC, lgtyehq@inet.polyu.edu.hk, David D. Yao

We study a network operating under the proportionally fair allocation, by which each server is shared among job classes that requires its service, proportional to the queue lengths. We establish the diffusion limit of the network, allowing multiple bottlenecks in the network, and without some of the conditions required in prior studies. We also provide a characterization of the class of allocation schemes among which the proportional fair allocation minimizes a quadratic cost objective function.

■ SA36

C - Room 8B, Level 3

The First Undergraduate OR Course

Sponsor: INFORM-ED
Sponsored Session

Chair: Susan Martonosi, Assistant Professor, Harvey Mudd College, Department of Mathematics, 301 Platt Boulevard, Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu

1 - OR: The Physics of Day-to-day Life
Richard Larson, Professor, Massachusetts Institute of Technology, E40-233, Cambridge, MA, 02139, United States of America, rclarson@mit.edu

OR is much more about problem framing and formulation and a lot less about rigorous math and optimization. We propose OR for high schoolers and/or liberal arts majors: OR as physics for daily life, in queues, delivering mail, avoiding infectious diseases, waiting for busses, understanding elections, etc. We draw from a new on-line learning project, BLOSSOMS, Blended Learning Open Source Science or Math Studies. http://blossoms.mit.edu We invite others to contribute to BLOSSOMS.

2 - Introductory Optimization for Undergraduates
James Orlin, Professor, Massachusetts Institute of Technology, E53-363, Cambridge, MA, 02139, United States of America, jorlin@mit.edu

We teach a traditional optimization class at MIT, but in a non-traditional approach. I will discuss some aspects of teaching that may be useful for other courses. I will show my approaches for (i) algorithm animation in PowerPoint, (ii) making tutorials more engaging, and (iii) making Excel more user friendly for students.

3 - One Mathematician's Approach to Linear Optimization
Glenn Hurlbert, Arizona State University, School of Math & Stat Sciences, Tempe, AZ, United States of America, hurlbert@asu.edu

I teach Linear Optimization from the point of view of learning mathematics, proving theorems, and making connections to other areas of mathematics. This approach necessitates different goals and objectives than a more applied approach that may involve using modern software to model and solve large toy problems, for example. In this talk I will outline what seems most fundamental to build such a course around, along with what more peripheral material I have included from one semester to the next.

4 - The First (and Often Only) O.R. Course: Something for Everyone
Susan Martonosi, Assistant Professor, Harvey Mudd College, Department of Mathematics, 301 Platt Boulevard, Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu

Introduction to O.R. is offered as a technical elective for our math and general engineering majors. Because this is often the only O.R. course students take before deciding whether or not to pursue a graduate degree in O.R., I offer something for everyone by showing both the power of O.R. to solve complex, real-world problems and its rich theoretical underpinnings. In this talk, I will address some of the costs and benefits incurred by the trade-offs I have made in designing this course.

■ SA37

C - Room 8C, Level 3

Stochastic Network Bounds and Approximations

Sponsor: Applied Probability
Sponsored Session

Chair: John Hasenbein, Associate Professor, University of Texas at Austin, Graduate Program in OR/IE, Austin, TX, United States of America, jhas@mail.utexas.edu

1 - Computing Stationary Distributions for Diffusion Limits of G/Ph/n+GI Queues
Shuangchi He, Georgia Institute of Technology, 2500 Pleasant Hill Road, Duluth, GA, 30096, United States of America, heshuangchi@gatech.edu, Jim Dai

We develop an algorithm to compute the stationary distribution of a diffusion process that serves as an approximation for G/Ph/n+GI queues in QED regime. The algorithm is based on the finite-element method. A critical part of the algorithm is to choose an appropriate reference density. Using a conjecture for the tail behavior of the stationary distribution of the limit diffusion process, we propose a systematic method to choose the reference density. Computational experiences will be discussed.

2 - A Lower Bound on the Cost of Assemble-to-order Inventory Systems

Martin Reiman, Alcatel-Lucent Bell Labs, 600 Mountain Avenue, Murray Hill, NJ, 07974, United States of America, marty@research.bell-labs.com, Qiong Wang

Dogru, Reiman and Wang (2010) showed that a particular stochastic program (SP) provides a lower bound on the cost in an assemble-to-order (ATO) inventory system where all components have identical lead times. We extend this result to ATO systems with non-identical lead times. We also discuss properties of this SP as lead times grow large.

3 - Positive Recurrence of Semimartingale Reflecting Brownian Motions

Jim Dai, Edenfield Professor, Georgia Institute of Technology, School of Industrial and, Systems Engineering, Atlanta, GA, 30332, United States of America, dai@gatech.edu, Maury Bramson, J. Michael Harrison

Multidimensional semimartingale reflecting Brownian motions (SRBMs) arise in applied probability as diffusion approximations for multi-station stochastic processing networks. We study the positive recurrence of a d-dimensional SRBM. Building on prior work by El Kharroubi et al. (2000, 2002), we provide necessary and sufficient conditions for positive recurrence in dimension d = 3. I will also discuss the implication of a recent example by Bramson for an SRBM in dimension d=6.

4 - Optimal Paths in Large Deviations of RBM in 3-D

Ziyu Liang, University of Texas at Austin, Graduate Program in OR/IE, Austin, TX, United States of America, liangzy@mail.utexas.edu, John Hasenbein

We analyze a variational problem which arises from large deviations for reflected Brownian motion in three dimensions. In particular we provide results on the form of the minimizing paths for certain RBM's in the three dimensional positive orthant.

■ SA38

C - Room 9A, Level 3

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, Mail Code 205-45, Pasadena, CA, 91125, United States of America, abompadr@gmail.com

1 - Latent Variable Graphical Model Selection Via Convex Optimization

Venkat Chandrasekaran, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D570, Cambridge, MA, 02139, United States of America, venkatc@mit.edu, Alan Willsky, Pablo Parrilo

Suppose we have sample observations of a subset of a collection of random variables, with no knowledge of the relationship between the observed and latent variables, nor the number of latent variables. We describe identifiability conditions and a tractable convex program to learn a statistical model over the full set of variables. This program consistently estimates model structure in the "high-dimensional" regime, with the number of observed/latent variables growing with the number of samples.

2 - A Lagrangian Decomposition Based Branch and Bound Approach to Quadratic 0-1 Programs

Zhen Zhu, Purdue University, Department of Computer Science, LWSN, 305 N University Street, West Lafayette, IN, 47907, United States of America, zzhu@purdue.edu, Nan Kong, Oleg A. Prokopyev

In this paper, we present an innovative Lagrangian decomposition based branch and bound method to solve Quadratic 0-1 programs (QBP) with linear constraints. We introduce a set of nonlinear constraints that duplicate the original decision variables. The quadratic binary program is then decomposable. So we can obtain a Lagrangian relaxation bound by solving a number of linear binary programs. An effective variable selection rule along with other computational improvement strategies is discussed.

3 - Convergence Rate of McCormick Relaxations

Agustin Bompadre, Postdoctoral Fellow, California Institute of Technology, 1200 E. California Boulevard, Mail Code 205-45, Pasadena, CA, 91125, United States of America, abompadr@gmail.com, Alexander Mitsos

Theory is developed for the convergence order of convex relaxations of factorable functions by McCormick [Math. Program. 10 (2), 147-175, 1976]. The convergence rate of addition, multiplication and composition are proven and then the propagation of these rules is discussed. The convergence properties are compared with alternative methods theoretically and for numerical examples. Consequences for the efficiency of global optimization of nonconvex nonlinear programs are discussed.

■ SA39

C - Room 9B, Level 3

Joint Session OPT/ MIF: Branchwidth, Treewidth, and Integer Programming

Sponsor: Optimization/ Integer Programming/ Minority Issues
Sponsored Session

Chair: Illya Hicks, Associate Professor, Rice University, 6100 Main St., Houston, TX, 77251-1892, United States of America, ivhicks@rice.edu

1 - A Combinatorial Optimization Algorithm for Solving the Branchwidth Problem

J. Cole Smith, Professor, University of Florida, Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, cole@ise.ufl.edu, Elif Ulusal, Illya Hicks

We consider the problem of computing an optimal branch decomposition of a graph. Branch decompositions have proven to be useful in solving many NP-hard problems, such as the traveling salesman, independent set, and ring routing problems, by means of combinatorial algorithms that operate on branch decompositions. We develop an implicit enumeration algorithm for the optimal branch decomposition problem and examine its performance on a set of classical graph instances.

2 - The Cunningham-Geelen Algorithm in Practice: Branch-decompositions and Integer Programs

Susan Margulies, Pfeiffer-VIGRE Post-doctoral Instructor, Rice University, 6100 Main St. MS #134, Houston, TX, 77005, United States of America, susan.margulies@rice.edu, Jing Ma, Illya Hicks

Consider the integer program $\max(c^T x : Ax = b, x >= 0,)$ where A is non-negative and the column-matroid M(A) has constant branch width. Cunningham and Geelen introduce a pseudo-polynomial time algorithm for solving this IP that takes a branch decomposition T of M(A) as input. We report on computation results of a C++ implementation of this algorithm, where the branch decomposition T is produced by a heuristic. We test against various problem instances, and compare the algorithm with Gurobi.

3 - A Branch-and-price-and-cut Method for Computing the Bramble

Sibel Sonuc, PhD Student, University of Florida, 303 Weil Hall, Gainesville, FL, United States of America, sibel.bilge@ufl.edu, Illya Hicks, J. Cole Smith

We examine the problem of finding the bramble number of a graph. A bramble is a set of connected subgraphs such that every pair of subgraphs is adjacent in the sense that they contain a common node, or an edge connects the two subgraphs. The bramble number is the largest cardinality of a minimum hitting set over all bramble elements. We provide a branch-and-cut-and-price methodology that generates columns corresponding to bramble elements, and rows corresponding to hitting sets.

■ SA40

C - Room 9C, Level 3

Interfaces and Metaheuristics in COIN-OR

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: Joao Goncalves, IBM Research, 1101 Kitchawan Rd, Yorktown Heights, NY, United States of America, jpgoncal@us.ibm.com

1 - The Optimization Services Project

Kipp Martin, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States of America, kmartin@chicagobooth.edu

In this talk we provide an update on recent developments in the COIN-OR project Optimization Services.

2 - Modeling Cone Optimization Problems with COIN OS

Imre Polik, Lehigh University, Department of Industrial and Systems Engineering, 200 West Packer Avenue, Bethelehem, PA, 18015, United States of America, imre@polik.net

We present the extension of COIN OS to model cone optimization problems. We discuss the design principles of the extension. In the end we are able to model problems with matrices, thus extendeing the general modelling capabilities of COIN OS. This is joint work with Kipp Martin, Horand Gassmann and Jun Ma.

3 - Pulp a Linear Programming Toolkit for Python

Stuart Mitchell, Research Fellow, University of Auckland, Private Bag 92019, Auckland, 1142, New Zealand, s.mitchell@auckland.ac.nz

PuLP https://www.coin-or.org/PuLP/ is a Toolkit for modelling and solving linear and mixed integer programs in Python. PuLP was created by J.S. Roy and released under a MIT licence. PuLP development focuses on ease of use and quick development. Dippy is a recent extension of PuLP to interface with DIP https://projects.coin-or.org/Dip a framework for implementing a variety of decomposition-based branch-and-bound algorithms for solving mixed integer linear programs.

4 - METSlib: A Metaheuristics Framework in Modern C++
Mirko Maischberger, University degli Studi di Firenze, Dipartimento di Sistemi e Informatica, Via S. Marta, 3, Firenze, 50129, Italy, maischberger@dsi.unifi.it

As framework for the rapid development of search strategies based on the exploration of a neighborhood METSlib offers the basic building blocks to assemble customized solvers using fully modular algorithms such as Tabu Search, SA and LS, combined in complex strategies. The user can implement a single model and neighborhood and easily try different algorithmic variations. We also present a Parallel Iterated TS solver for some extensions of the Vehicle Routing problem.

■ SA41

C - Room 10A, Level 3

Recent Advances in Mixed-Integer Nonlinear Optimization I

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Sven Leyffer, Computational Mathematician, Argonne National Laboratory, Mathematics & Computer Science, 9700 South Cass Ave, Argonne, IL, 60439, United States of America, leyffer@mcs.anl.gov

1 - QP Diving for MINLP
Sven Leyffer, Computational Mathematician, Argonne National Laboratory, Mathematics & Computer Science, 9700 South Cass Ave, Argonne, IL, 60439, United States of America, leyffer@mcs.anl.gov

We present a new algorithm for solving MINLPs that exploits hot-starting capabilities of QP solvers by performing a series of QP dives. The resulting algorithm is globally convergent for convex MINLPs. Unlike traditional branch-and-bound approaches, the new algorithm re-uses the factors that are computed in each QP solve, resulting in order-of-magnitude performance improvements. We present preliminary numerical results with an implementation in MINOTAUR, our new open-source MINLP solver.

2 - Global Optimization with MINOTAUR
Ashutosh Mahajan, Post Doc, MCS Division, Argonne National Lab, 9700 S Cass Avenue, Argonee, IL, 60527, United States of America, mahajan@mcs.anl.gov, Sven Leyffer

We describe MINOTAUR, a solver designed for solving mixed-integer nonlinear programs. The focus of the talk will be on methods and algorithms that are specifically designed for global optimization of nonlinear programs. These include methods for presolving, branching and generating valid inequalities. We demonstrate the effects of these techniques on benchmark instances.

3 - MILANO: A New Matlab-based Toolbox for MINLP
Hande Benson, Associate Professor, Drexel University, Department of Decision Sciences, LeBow College of Business, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu

In this talk, we present details of MILANO (Mixed-Integer Linear and Nonlinear Optimizer), a Matlab-based toolbox for solving mixed-integer optimization problems. For MINLP, it includes implementations of branch-and-bound and outer approximation algorithms and solves the nonlinear subproblems using an interior-point penalty method introduced by Benson and Shanno (2005) for warmstarts. Special consideration is given for problems with cone constraints. Numerical results will be presented.

4 - Convex Outer Approximations for Bounded Multilinear Functions
Mahdi Namazifar, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, United States of America, namazifar@wisc.edu, Pietro Belotti, Andrew Miller

This research studies linear envelopes for single-term and bounded multilinear functions defined over a hyper-rectangle. Tight convex relaxations for such nonconvex functions are crucial in finding reasonable lower bounds in a spacial branch-and-bound framework for global optimization problems. This is motivated by the fact that many global optimization solvers use polyhedral relaxations to compute lower bounding solutions.

■ SA42

C - Room 10B, Level 3

Scenario Generation in Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: James Luedtke, University of Wisconsin-Madison, 1513 University Av., Madison, WI, United States of America, jrluedt1@wisc.edu

1 - A Probability Metrics Approach for Bias and Variance Reduction in Optimality Gap Estimation
Guzin Bayraksan, Assistant Professor, University of Arizona, Systems & Industrial Engineering, Tucson, AZ, 85721, United States of America, guzinb@sie.arizona.edu, Rebecca Stockbridge

Monte Carlo sampling-based estimators of optimality gaps for stochastic programs are known to be biased. We present a bias reduction method via a probability metrics approach, which can be done in polynomial time in sample size. We focus on A2RP procedure and present extensions for MRP procedure. We show that the resulting estimators produce consistent point estimators and asymptotically valid confidence intervals. Our computational results show that this procedure can also reduce variance.

2 - Statistical Generation of Scenarios for Stochastic Programs
Peter Qian, University of Wisconsin-Madison, 1300 University Ave, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

Scenario generation is a critical aspect of the Sample Average Approximation method in stochastic programming. I will discuss several new classes of space-filling designs for generating scenarios in more flexibly and efficiently than the sample Monte Carlo method. Specific designs to be covered inlude nested Latin hypercube designs, sliced Latin hypercube designs and nested U designs.

3 - Scenario Generation in Unit Commitment with Intermittent Wind Energy
Ali Koc, Postdoctoral Researcher, IBM TJ Watson Research Center, Yorktown Heights, NY, 10598, United States of America, akoc@us.ibm.com, Jayant Kalagnanam

Power system operators typically solve a unit commitment problem to minimize total start-up and fuel costs of the generators while meeting their demand over a planning horizon. Recent regulations require grids accept renewable energy such as wind. Due to the intermittency of wind, grid operators need to obtain representative probability distributions from a set of wind forecasts. We compare two scenario generation schemes in terms of their effect on the system profitability and reliability.

4 - First Order Convergence of Sparse Grid Method in Two-stage Linear Problem
Michael Chen, Assistant Professor, York University, 4700 Keele Street, Toronto, M3J 1P3, Canada, chensy@galaxy.math.yorku.ca, Sanjay Mehrotra

Theoretical analysis of sparse grid method for numerical integration is based on mixed-derivative function spaces. However the recourse function in two-stage linear problem is multivariate piecewise linear and does not belong to a mixed-derivative space. We overcome this difficulty by constructing a logarithmic mollifier function, and prove the first order convergence rate of the method.

■ SA43

C - Room 1, Level 2- Mezzanine

Patient Flows, The Emergency Department, and Healthcare Operations Management

Sponsor: Health Applications
Sponsored Session

Chair: Mark Van Oyen, Associate Professor, University of Michigan, Industrial & Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, vanoyen@umich.edu

Co-Chair: Soroush Saghafian, PhD Candidate, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, soroush@umich.edu

1 - Optimization of Overbooking Decisions for Patient Appointment Scheduling
Bjorn Berg, North Carolina State University, Raleigh, NC, 27695, United States of America, bpberg@ncsu.edu, Brian T. Denton, Thomas R. Rohleder, PhD

No-shows adversely affect the daily operations of outpatient clinics by contributing unnecessary resource idle time and decreasing anticipated reimbursements. Balancing patient waiting time and resource utilization with no-shows is a challenge to many providers. The L-shaped method is used to solve a stochastic programming formulation of overbooking for scheduling patient arrivals with attendance and duration uncertainty. Results are presented based on an endoscopy suite as a case study.

2 - Improving the Performance of a Hospital ER Fast-track
Amy Ward, USC, Marshall School of Business, BRI 401H, Los Angeles, CA, 90089, United States of America, amyward@marshall.usc.edu, Linda Green

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 show how a flexible policy which dynamically gives scheduling priority to urgent or non-urgent patients better balances waiting times for urgent patients with the fraction of LWBS.

3 - A Multiclass Queueing Model for Kidney Transplant
Yichuan Ding, Stanford University, 14 Comstock Circle, Apt 106, Stanford, CA, 94305, United States of America, y7ding@stanford.edu, Stefanos Zenios

There have been calls to revise the cadaver kidney allocation policy because of kidney shortage. We propose a categorization-based policy in which patients are divided into exclusive queues by their choices of kidney qualities. We show that a unique equilibrium queue-lengths exits and the queue lengths converge to an Ornstein-Uhlenbeck process centering at that equilibrium. The conclusion lends managerial insights for policy design.

4 - Overcoming Crowding in Emergency Departments: A New Streaming Mechanism
Soroush Saghafian, PhD Candidate, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, soroush@umich.edu, Mark Van Oyen, Jeffrey Desmond, Steven Kronick, Wallace Hopp

We consider a new process and patient flow mechanism to overcome crowding in Emergency Departments (EDs). "Streaming" classifies patients based on admission to hospital. We use (1) Queueing Theory and (2) high fidelity simulation based on hospital data. We clarify the operational performance of the streaming and pooling mechanisms. We also generate insights into how EDs can improve their performance by better use of final disposition predictions.

■ SA44

C - Room 2, Level 2- Mezzanine

Panel Session: Critical Areas of Research at the Intersection of Industrial and Systems Engineering and Health Care

Sponsor: Health Applications
Sponsored Session

Moderator: Rupa Valdez, University of Wisconsin-Madison, 3261 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53711, United States of America, rsvaldez@wisc.edu

1 - Panel Discussion: Critical Areas of Research for Industrial and Systems Engineering and Health Care
Panelists: Rupa Valdez, University of Wisconsin-Madison, 3261 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53711, United States of America, rsvaldez@wisc.edu, Cerry Klein, National Science Foundation, 4201 Wilson Boulevard, Arlington, United States of America, cklein@nsf.gov, Jose Zayas-Castro,Professor and Chair, University of South Florida, Department of Industrial & Management Sy, Gainesville FL, United States of America, josezaya@usf.edu, Mark Daskin, Professor, University of Michigan, 1205 Beal Ave, Ann Arbor MI 48109, United States of America, msdaskin@umich.edu, James Benneyan,Northeastern University, 360 Huntington Avenue, Boston MA, United States of America, benneyan@coe.neu.edu

Accelerating progress toward a ubiquitous, resilient, patient-centered, and accountable health care system requires innovation in and adoption of industrial and systems engineering (ISyE) knowledge. In a workshop jointly sponsored by AHRQ and NSF in September 2009, a research agenda was developed which detailed the domains of ISyE knowledge needed to meet the challenges of health care. This session provides an opportunity to learn about and discuss the completed research agenda and report.

■ SA45

C - Room 6, Level 2- Mezzanine

Joint Session HAS/ SPPSN: Resource Allocation Modeling for Infectious Disease Control

Sponsor: Health Applications/ Public Programs, Service and Needs
Sponsored Session

Chair: Sabina Alistar, Stanford University, P.O. Box 17244, Stanford, CA, 94309, United States of America, ssabina@stanford.edu

1 - A Multi-level HIV Resource Allocation Model
Greg Zaric, Associate Professor, Ivey Business School, 1151 Richmond St., London, Canada, gzaric@ivey.uwo.ca, Monali Malvankar, Xinghao Yan

HIV resource allocation models often assume a single decision maker and a single level of decision making. However, real allocation processes involve multiple decision makers at different levels. A donor may allocate to countries, with further allocations being made to lower level jurisdictions before funds are allocated to programs. We introduce a multi-level resource allocation model and investigate the use of incentive schemes to align the objectives of decision makers at different levels.

2 - Recommendations for Increasing the use of Resource Allocation Models in Public Health
Anke Richter, Associate Professor, Naval Postgraduate School, 699 Dyer Rd, Bldg 234, Monterey, CA, 93943, United States of America, arichter@nps.edu, Arielle Lasry

Resource allocation models have not had a substantial impact on public health funding decisions. We highlight several difficulties encountered in attempts to implement such models including: model complexity, data requirements, multiple stakeholders, funding issues and political and ethical considerations. We then make recommendations as to how these difficulties may be overcome.

3 - Decision Making in HIV Prevention and Treatment Scale Up: Bridging the Gap From Theory to Practice
Sabina Alistar, Stanford University, P.O. Box 17244, Stanford, CA, 94309, United States of America, ssabina@stanford.edu

Significant scale up of global HIV prevention and treatment efforts is needed to control the epidemic. Model-based tools can help determine the optimal allocation of resources. Decision makers have little guidance as to which packages of interventions at what scale will yield the best results in their particular settings. We discuss the features required by a practical decision making model that will include the key relevant theoretical insights for accurate modeling of intervention effects.

4 - The Cost-effectiveness of PCR to Control TB in a Mature TB/HIV Co-epidemic
Abra Jeffers, Stanford University, Stanford, CA, 94309, "United States of America, abra@stanford.edu

We compare the cost-effectiveness of the use PCR for TB diagnosis versus the current diagnostic algorithm comprised of sputum microscopy, microbiological culture, chest x-ray and empirical diagnosis in an urban population in South Africa. A compartmental model incorporating dynamic transmission of both HIV and TB is used to evaluate the costs and effects of this strategy.

■ SA46

C - Room 7, Level 2- Mezzanine

Panel Discussion: Social Networking and Operations Research

Cluster: Invited Panels on Professional Issues
Invited Session

Moderator: Laura McLay, Assistant Professor, Virginia Commonwealth University, 1015 Floyd Ave, Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu

1 - Panel Discussion: Blogging and Tweeting about Operations Research: A Panel Discussion about Social Networking
Panelists: Laura McLay, Assistant Professor, Virginia Commonwealth University, 1015 Floyd Ave, Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu, Aurelie Thiele, Associate Professor, Lehigh University, 200 W. Packer Ave., Bethlehem PA 18015, United States of America, aurelie.thiele@lehigh.edu, Wayne Winston, Professor, Indiana U School Of Business, 10th and Fee Lane, Bloomington IN 47401, United States of America, winston@indiana.edu, Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts Amherst, Isenberg School of Management, Amherst MA 01003, United States of America, nagurney@gbfin.umass.edu

How can blogs, twitter, FaceBook, LinkedIn and other social networking tools be used in conjunction with operations research? In this panel discussion, we discuss a number of ways in which operations research has been successfully used to improve scientific literacy, recruit students, and increase knowledge about our field in the general public. We will also discuss new social networking challenges.

■ SA47

C - Room 8, Level 2- Mezzanine

Stochastic Models for Biological Systems

Cluster: Computational Biology and Bioinformatics
Invited Session

Chair: Ming-Ying Leung, Professor, The University of Texas at El Paso, 500 W. University Avenue, El Paso, TX, 79968, United States of America, mleung@utep.edu

1 - Effect of Data Set Size on Support Vector Machine Feature Selection for O-Glycosylation Sites
Raul Cruz-Cano, Assistant Professor, University of Maryland, Department Epidemiology and Biostatistics, College Park, MD, 20742, United States of America, raulcruz@umd.edu, Ming-Ying Leung

Support Vector Machines (SVMs) are supervised learning methods widely used for classification. Using a set of known input/output vectors as training set, SVMs can predict the classification of unseen examples. Moreover, the SVM approach allows feature elimination to be conducted to suggest which input variables are relevant for this task. In this research we examined how the size of the training set influence the rankings of the input variables needed to identify O-Glycosylation sites.

2 - Stochastic Model of Bistability in Gene Regulatory Modules
Marek Kimmel, Professor, Rice University, Department of Statistics, Houston, TX, 77005, United States of America, kimmel@rice.edu

Decision making in cells may involve switching to different modes of gene expression, e.g., in the differentiation of blood cell precursors. In the deterministic framework, bistability leads to hysteresis-like phenomena. However, when stochastic component plays a role in transcription, tunneling from one equilibrium to the other occurs and the dynamics may change. We explore the range of behaviors possible based on an exact stochastic model, its diffusion approximation, and a simulation study.

3 - Methods for Cluster Detection of Patterns in Biological Sequences
Wendy Lou, Professor, University of Toronto, Division of Biostatistics, Dalla Lana School of Public Health, Toronto, ON, M5T 3M7, Canada, wendy.lou@utoronto.ca

The detection of clusters of patterns (identical or non-identical) in a long biological sequence is often of interest in establishing genetic signals. The probability of occurrence of a cluster for a given sequence, assuming some underlying distribution for the bases that make up the biological sequence, can be used as a tool for this purpose. Computational methods for cluster detection will be presented, followed by an example involving palindrome clusters in DNA sequences.

4 - Growing, Slowing, Growing Again: A Branching Process Model of How Cells Survive Telomere Shortening
Peter Olofsson, Associate Professor, Trinity University, Department of Mathematics, San Antonio, TX, 78212, United States of America, Peter.Olofsson@Trinity.edu, Alison Bertuch

Telomeres are regions at the ends of chromosomes. As chromosomes divide telomeres shorten progressively, a process which is counteracted by the enzyme telomerase. In the absence of telomerase, cells eventually stop dividing and become senescent. However, a small fraction of cells may develop alternative processes of telomere maintenance independent of telomerase. A branching process is proposed to model a population of yeast cells and its growth pattern in response to telomere dynamics.

■ SA48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - SAS Global Academic Program- Enterprise Guide Demonstration
Tom Bohannon, Higher Education Consultant, SAS Global Academic Program, SAS Campus Drive, Cary, NC, 27513, United States of America, tom.bohannon@sas.com

This demonstration shows how one can use the menu driven tasks in SAS Enterprise Guide 4.2, the point and click interface to SAS, to perform common reporting and research tasks: querying, reporting, and analyzing data. SAS Enterprise Guide provides a SAS graphical point-and-click interface that helps you exploit the power of SAS and publish dynamic results in a Microsoft Windows client application.

2 - Automatic Forecasting Systems - Capabilities of Autobox
Tom Reilly, Automatic Forecasting Systems, P.O. Box 563, Hatboro, PA, 19040, United States of America, tomreilly@autobox.com

Autobox launched in 1976 adjusts for outliers and adds variables to fix the data to where it should have been so that the model and forecast isn't skewed. Adapting to changes like trends, level shifts and seasonal pulses. Adjusting for lead/lag effects for causal variables like price, promotion, holidays, etc.

■ SA49

C -Room 10, Level 2- Mezzanine

Software Development, IT Outsourcing and Productivity

Sponsor: Information Systems
Sponsored Session

Chair: Kunsoo Han, Assistant Professor, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, kunsoo.han@mcgill.ca

1 - Managerial Attention and Performance in IT Outsourcing: Integrating Categorization and Interruptions
Anand Gopal, University of Maryland, Robert H. Smith School of Business, College Park, MD, United States of America, agopal@rhsmith.umd.edu, Balaji Koka

We examine why almost 50% of technology outsourcing projects fail by framing it as a resource deployment problem - how do managers choose between competing projects to deploy scarce resources? We identify managerial attention as a critical determinant of managerial priorities. We develop a framework that integrates both categorization and contextual approaches to explain managerial priorities and its effect on resource deployment, thus arguing for a nuanced view of attention in outsourcing.

2 - The Impact of IT on the Relative Productivity of Transaction and Production Labor
Barrie R Nault, Professor, University of Calgary, 2500 University Drive NW, Calgary, AB, T2N 1N4, Canada, nault@ucalgary.ca, Tracey Dean Stock

We partition the labor input into different sectors of the US economy by whether the input is transaction-based or production-based. Using this partition we are able to measure the relative productivity of transaction- and production-based labor inputs. In addition, employing a specialized formulation, we can determine the impact of information technology investment on the productivity of these different labor inputs.

3 - A Study of Development Approaches, Design Quality and Energy Efficiency in Open Source Software
Sandra Slaughter, Georgia Institute of Technology, 800 W. Peachtree St. NW, Atlanta, GA, 30308, United States of America, Sandra.Slaughter@mgt.gatech.edu, Chiara Francalanci, Eugenio Capra

We examine the effects of traditional development approaches on design quality and energy efficiency for open source software applications. Our analysis reveals an intriguing pattern: for smaller applications, a greater use of traditional approaches including frameworks and external libraries has a beneficial effect on software energy efficiency, but a detrimental effect on design quality. The opposite is true for larger applications. This poses an interesting decision trade-off for managers.

4 - IT Labor, IT Outsourcing and Productivity
Kunsoo Han, Assistant Professor, McGill University, 1001 Sherbrooke Street West, Montreal, QC, H3A 1G5, Canada, kunsoo.han@mcgill.ca, Kangbae Lee, Barrie R Nault

We examine the impact of IT labor on productivity and the relationship between IT labor and IT outsourcing. We find that IT labor has made a significant contribution to industry output separate from that of IT capital. More importantly, IT labor has a positive impact on the output elasticity of IT outsourcing, and that impact appears to come mostly from high-skill IT labor. This supports the view that IT labor and IT outsourcing can be complements.

■ SA50

C -Room 11, Level 2- Mezzanine

Economics of Digital Goods

Sponsor: Information Systems
Sponsored Session

Chair: Ramesh Sankaranarayanan, Assistant Professor, University of Connecticut, 2100 Hillside Road, U-1041, Storrs, CT, 06074, United States of America, Ramesh.Sankaranarayanan@business.uconn.edu

1 - Collective Dynamics in Resolving Uncertainty in Crowdsourced Markets

Vandana Ramachandran, University of Utah, Operations and Information Systems, Salt Lake City, UT, 84112, United States of America, vandana@business.utah.edu, Chris Ward

We study crowdsourced markets for digital goods (designs), characterized by simultaneous voting contests and repeated interactions across participants who submit goods, vote to determine winners and consume winning goods. The firm here faces uncertainty about the future performance of the good. We model the effects of network interactions, peer influence, and experience as early stage indicators of the success of crowdsourced goods, and discuss implications for the design of crowdsourced markets.

2 - Analysis of Coupon Trading Activities in Online Marketplaces

Bhavik Pathak, Assistant Professor, Indiana University South Bend, 1700 Mishawaka Ave, South Bend, IN, 46530, United States of America, bkpathak@iusb.edu, Sarv Devaraj

Advances in IT enable sellers to offer personalized shopping experience and targeted promotions. Marketers have been practicing price discrimination by selectively distributing promotional coupons to customers. IT-enabled online marketplaces facilitate trading of coupons between customer segments. In this paper, we explore the trading of coupons on eBay, formulate the seller's profit maximization problem under this phenomenon, and analyze the drivers of coupon trading in online marketplaces.

3 - Digital Goods and Markets: Emerging Issues and Challenges

Ramesh Sankaranarayanan, Assistant Professor, University of Connecticut, 2100 Hillside Road, U-1041, Storrs, CT, 06074, United States of America, Ramesh.Sankaranarayanan@business.uconn.edu, Ram Gopal, Sudip Bhattacharjee, James Marsden

We explore the nature of digital goods, and how technological advances continue to cause disruptive change in a range of digital goods industries, such as movies, music, video games, software, and print media - sometimes in the nature of a market, sometimes in the products themselves. In our paper, we highlight the questions addressed by prior research, and draw upon emerging industry trends to present a framework for further research in this area.

■ SA51

C -Room 12, Level 2- Mezzanine

Operations Research Support to the Warfighter

Sponsor: Military Applications
Sponsored Session

Chair: James Treharne, Center for Army Analysis, 6001 Goethals Road, Fort Belvoir, VA, 20151, United States of America, james.treharne@us.army.mil

1 - Predicting Outcome of a Counter-insurgency

Justine Blaho, Operations Research Analyst, Center for Army Analysis, 6001 Goethals Road, Fort Belvoir, VA, 22033, United States of America, justine.blaho@us.army.mil

This analysis, using historical data of over 100 irregular wars, examines the relationship between underlying data and the outcome of the conflict, and estimates the likelihood of success of the counter-insurgent force. This analysis, using binary logistics regression, has been used to inform Operation Enduring Freedom, and is continuing to be explored and adapted to inform future requirements for the US Army.

2 - Wartime Polling Analysis

Sang Sok, Center for Army Analysis, 6001 Goethals Rd, Fort Belvoir, VA, 22060, United States of America, sang.sok@us.army.mil

This work focuses on the use of polling analysis to inform planning and assessments of Operation Enduring freedom in Afghanistan. The Center for Army Analysis has consolidated polling analysis from seven different sources, and created tools to provide feedback to senior commanders. This feedback is used to inform the assessment of progress and to inform future planning efforts.

3 - Afghanistan Growth and Retention Analysis

David Smith, US Army, United States of America, david.a.smith@us.army.mil

Study focuses on the force requirements in Operations Enduring freedom for both Coalition Forces and the indigenous Afghan Security Forces, risk incurred in those force levels, and the generation process in place to create that force. This study, requested and used senior commanders in Afghanistan, includes a suite of models developed using binary logistic regression, multi-variate regression, Monte-Carlo simulation, discrete-event simulation, and case study analysis.

■ SA52

C -Room 13, Level 2- Mezzanine

OR, Management, and the Enterprise

Sponsor: Military Applications
Sponsored Session

Chair: Greg Parlier, Institute for Defense Analyses, Madison, AL, United States of America, gparlier@ida.org

1 - Balanced Quality Management: Concept and Implementation

Deokhwan 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, Yongseop Kim, Jaeseung Choi, Insik Kim

Balanced Quality Management (BQM) is a new concept of quality management for a defense acquisition that balances the effort to manage the quality on each phase of its acquisition life-cycle (i.e., design-manufacturing and operation) based on collaborative links among phases. This study introduces the concept of BQM and proposes three strategies to implement it.

2 - MIST - Management Innovation as a Strategic Technology

Greg Parlier, Institute for Defense Analyses, Madison, AL, United States of America, gparlier@ida.org

Increasingly, the term Business Intelligence (BI) is used to encompass both "analytics" and the data processes and technologies used for collecting, managing, and reporting decision-oriented information. Nonetheless, management is often impeded by organizational pathologies. A complementary relationship between DSS and MIS is needed to fully capitalize on the promise of BI. Ultimately, it is this management innovation approach that will enable senior leaders and managers to generate knowledge and better decisions from the growing amounts of information and improved situational awareness made available by advances in information systems technologies.

■ SA53

C -Room 14, Level 2- Mezzanine

Network Algorithms

Cluster: New Trends in Wireless Networks: A Large-scale Systems Perspective
Invited Session

Chair: Devavrat Shah, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D670, Cambridge, MA, United States of America, devavrat@mit.edu

1 - Medium Access Algorithms

Jinwoo Shin, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, jinwoos@mit.edu, Devavrat Shah

Medium access control (MAC) is essential for efficient operation of well engineered communication networks. Despite of exciting progress in the past few decades, the desired solution has been remained illusive till recently. In this paper, we present an extremely simple, distributed and high-performance MAC algorithm. Methodically, our framework can be applied to a wide class of dynamic network resource allocation problems.

2 - Scheduling for Small Delay in Multi-channel Downlink Wireless Networks

Shreeshankar Bodas, The University of Texas at Austin, Dept of Electrical and Computer Engg, 1 University Station C0803, Austin, TX, 78712, United States of America, shreeshankar@mail.utexas.edu, Sanjay Shakkottai, R Srikant, Lei Ying

We investigate the wireless downlink network scheduling problem in a multi-user multi-channel (e.g., OFDM-based) setting, with the aim of guaranteeing small per-user delay. We show that the classic MaxWeight algorithm results in a very poor delay performance in a large deviations sense. We present an iterative algorithm called Server-Side Greedy (SSG) that, in addition to being throughput-optimal, guarantees a good per-user delay performance, and also has small computational complexity.

3 - Load Balancing in the Cloud
Yi Lu, University of Illinois, 1406 W. Green Street, Urbana, IL, United States of America, yilu4@uiuc.edu

Efficient resource sharing is key to the performance of cloud applications, such as search and map-reduce clusters. The randomized load balancing algorithm, also known as "power of twois popular for its ease of implementation. However, existing analysis does not extend readily to general service time distributions. We propose a new framework of analysis and found that more than two choices are needed to cross the performance threshold for general distributions.

4 - Utility Optimization in Congested Queueing Networks
Neil Walton, University of Cambridge, Centre for Mathematical Sciences, Wilberforce Road, Cambrige, CB3 0AJ, United Kingdom, N.S.Walton@statslab.cam.ac.uk

We consider a multi-class single server queueing network as a model of a packet switching network. The rates packets are sent into this network are controlled by queues which act as congestion windows. By considering a sequence of such congestion windows we allow the network to become congested. We show the stationary throughput of routes on this sequence of networks converges to an allocation that maximizes aggregate utility subject to the network's capacity constraints.

■ SA54

C -Room 15, Level 2- Mezzanine

Technology Assessment and Forecasting I

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Fred Phillips, Professor, Alliant International University, Avenue of Nations, San Diego, CA, 92131, United States of America, fphillips@alliant.edu

1 - Helping Public Schools Help Students Succeed - Now!
Rick Goldgar, CTO / Deputy CIO, Texas Education Agency, 1701 N. Congress Ave., MS 4-115, Austin, TX, 78701, United States of America, rickeclectic@yahoo.com

The Texas PEIMS system annually collects detailed student, personnel and finance data for 4.6M students, 300,000 teachers and 1200 districts. A 2009 investigation criticized PEIMS as a costly and mostly retrospective, compliance oriented system. In response, Texas is creating a new system, TSDS, to provide districts with timely, actionable data to improve student performance and ease collection burdens. This presentation describes the goals, architecture, status and expected outcomes for TSDS.

2 - Technology Assessment Through Multiple Perspectives and Gap Analysis: Case of Pyrolysis Oil As an Alternative District Heating Fuel
Inthrayuth Mahapol, Portland State University, 1900 SW 4th, Portland, OR, United States of America, zign_in@hotmail.com, Tugrul Daim, Josh Ailes, Marwan Lingga

This paper reviews the prospects of Pyrolysis Oil as a district heating fuel. The analysis is done through a case at Portland State University in Portland, Oregon. The case in first analyzed through Linstone's multiple perspectives of technical, organizational and personal. A multi criteria hierarchical model is built to evaluate the technologies. Constant-sum approach is used for quantifying expert judgements.

3 - Technological Forecasting by Citation Network Analysis
Yuya Kajikawa, Assistant Professor, The University of Tokyo, 2-11-16 Yayoi Bunkyo-ku, Tokyo, Japan, kaji@ipr-ctr.t.u-tokyo.ac.jp, Naoki Shibata, Junichiro Mori, Hisashi Kashima

Citation mining is becoming important because of the information flood. In this contribution, methodology, examples, and limitations of citation mining are illustrated. Topics include illustration of academic landscape, detection of emerging domains, prediction of future core papers, and extraction of difference among corpus. It also includes the limitations of the analysis such as validity of corpus, selection of link creating method, time lag and granularity of analysis.

4 - Using Data-driven Social Network Analysis for Insights on Innovation and Change
Martha Russell, Senior Research Scholar, Stanford University, #230 Wallenberg Hall, Bldg. 160, 450 Serra Mall, Stanford, CA, 93405, United States of America, marthar@stanford.edu, Jukka Huhtamaki, Neil Rubens, Kaisa Still

We apply the concept of innovation ecosystems - systems of innovation networks - to an analysis of links between firms and their human and financial resources to observe indicators of the broad system of innovation networks for value co-creation. In the context of a case study, we present a theoretical framework for our work and use network analysis of a socially constructed data on firms and actors, evaluated as drivers of convergence in innovation ecosystems.

■ SA55

C -Room 16, Level 2- Mezzanine

What Can We Learn From Patents?

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Manuel Sosa, INSEAD, Boulevard De Constance, Fontainebleau, France, manuel.sosa@insead.edu

1 - Project Ambiguity and Solution Search in Fluid Design Teams
Enno Siemsen, University of Minnesota, 3-150 Carlson School of Management, 321 - 19th Ave S, Minneapolis, MN, 55455, United States of America, siems017@umn.edu, Mani Subramani, Min Li, Dishan Kamdar

Most design projects require some degree of search for solutions. Communication within or around the project design team should help facilitate such search. We differentiate between internal direct, external direct and indirect search patterns. What type of communications patterns improve search? Do highly ambiguous projects require different search patterns? We analyze the interplay between project ambiguity, communication patterns and performance using data from outsourced design projects.

2 - R&D Investments and Operational Performance
Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu, Jürgen Mihm

We examine the effect of the variability in R&D investments on a firm's operational performance. We hypothesize that firms that increase or decrease R&D investments in a short period of time, reduce the effectiveness of these investments irrespective of the absolute level of the investment.

3 - The Impact of Fit on Inventor Performance
Lee Fleming, Harvard Business School, Morgan 485, Boston, MA, 02163, United States of America, lfleming@hbs.edu, Eric Lin

Surrounded by similar colleagues, inventors may be less likely to explore beyond the boundaries of their own expertise. In this paper, we explore how the degree of inventor fit influences inventor output. Using over 30 years of patent data, we find that high degrees of fit as measured by similarity in technical focus between an inventor and an organization may have a positive effect on the impact of an inventor's work, but a negative effect on his creativity.

4 - Understanding the Adoption of Good Ideas
Manuel Sosa, INSEAD, Boulevard De Constance, Fontainebleau, France, manuel.sosa@insead.edu, Jürgen Mihm

Why are some good ideas more easily adopted than others? We address this question by examining the entire population of US design patents and identifying important determinants of successful patents. We measure patent success as the number of references made by other patents.

■ SA56

C - Room 1, Level 1

Simulation Modeling Best Practices

Sponsor: Simulation Society
Sponsored Session

Chair: Rainer Dronzek, Director, Operations Research, McDonald's, 1253 N Schmidt Road, Romeoville, IL, 60446, United States of America, rainer.dronzek@us.mcd.com

1 - Autonomous Agents for Healthcare: Above the Process Oriented Analysis
Maxim Garifullin, Sr. Consultant, Genpact, 1 Research Circle, Niskayuna, NY, 12309, United States of America, Maxim.Garifullin@ge.com

We consider moving from process oriented approach for modeling healthcare systems to incorporating sets of essentially active and independent components interacting with each other. Using the combination of agent based and discrete event simulations we imitate behavior of hospitals components and study the emerging behavior. We will present architectures and approaches we use at the workshop.

2 - Thinking Agile: Taking a Milestones Approach to Simulation Project Management
James Sawyer, Managing Consultant, IBM, 4111 Northside Pkwy NW, Atlanta, GA, 30327, United States of America, jim.sawyer@us.ibm.com, Ben Fuqua

Change is inevitable in the course of any project - and how you manage it can make the difference between project success and project failure. We'll explore how simulation practitioners can take advantage of best practices from the software development community to better manage change, using what we call the "Milestones Approach". Learn how thinking agile can help you improve your project management processes and deliver better results to your customer.

3 - Right Tool for the Right Job - Leveraging a Suite-of-Models Approach to Problem Solving
James Burke, McDonald's Corporation, 1253 N Schmidt Road, Romeoville, IL, 60446, United States of America, james.burke@us.mcd.com

Models are often built for a specific purpose, but companies then may want to leverage that investment and re-use the model to explore other research, usually requiring additional development. Extending the original model adds for re-use on a similar problem has many obstacles. This presentation describes a multi-tool, right-tool for the right job approach where keeping models closer to their original intent, and having more of them is explored.

■ SA57

C - Room 2, Level 1

Risk Sharing and Forecasting in Supply Chains

Cluster: Risk Management
Invited Session

Chair: John Birge, University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, jrbirge@uchicago.edu

1 - Supply Chain Contracting: Procurement From Distant Markets
Ayhan Aydin, PhD Candidate, University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, aaydin@chicagobooth.edu, John Birge, Izak Duenyas

Distant manufacturers provide significant opportunities for large global brand owners. However, overseas procurement has less flexibility than domestic options. We investigate an alternative contracting scheme with the distant manufacturers, which allows risk sharing, and study the benefits under different circumstances. We observe significant savings in procurement costs and increased efficiency of the chain under moderate conditions.

2 - Trade Credit in Supply Chains: Multiple Creditors and Priority Rules
Song Alex Yang, University of Chicago/London Business School, 5807 S Woodlawn Ave, Chicago, IL, 60637, United States of America, syang1@chicagobooth.edu, John Birge

We study how different priority rules influence trade credit terms and supply chain efficiency when multiple creditors are present. We find that in general, trade credit with low priority allows suppliers to earn high profits. However, trade credit with high priority may improve chain efficiency.

3 - On the Quantification of Future Uncertainty by Assessing Past Forecast Accuracy
Yun Shin Lee, PhD Candidate, University of Cambridge, Judge Business School, Cambridge, CB2 1AG, United Kingdom, ysl27@cam.ac.uk, Stefan Scholtes

Constructing prediction intervals is an effort to quantify the level of uncertainty in forecasts and is an important first step of risk management. We propose an estimation method for prediction intervals which is based on finding an empirical distribution of past forecast errors. We give an asymptotic justification of the method and evaluate the performance of the method by simulation and empirical study. We find that the method is robust against model misspecification.

■ SA58

C - Room 3, Level 1

Current Developments in Quantitative Finance

Cluster: Quantitative Finance
Invited Session

Chair: Thaleia Zariphopoulou, University of Texas at Austin, IROM Department, Austin, TX, 78712, United States of America, zariphop@math.utexas.edu

1 - CAPM Revisited: Forward-looking Betas
Jean-Pierre Fouque, Professor, UC Santa Barbara, Statistics and Applied Probability, South Hall 5504, Santa Barbara, CA, 93106 3110, United States of America, fouque@pstat.ucsb.edu

In this talk we will show how to calibrate betas of stocks using implied volatility skews (joint work with E. Kollman). Stressed-beta models and explicit formulas will also be presented (joint work with A. Tashman).

2 - Recent Developments in Volatility Derivatives
Peter Carr, Morgan Stanley, 1585 Broadway, New York, NY, 10036, United States of America, Peter.P.Carr@morganstanley.com

Volatility derivatives include variance swaps, volatility swaps, optons on realized variance, and timer options. The recent spikes in volatility have enhanced interest in these products. We survey the financial landscape and discuss approaches for pricing and hedging.

3 - Optimal Trading Between Heterogeneous Risk-Averse Investors in the Derivatives Market
Tim Leung, Assistant Professor, Johns Hopkins University, 3400n Charles Street, Baltimore, MD, 21218, United States of America, timleung@jhu.edu

The derivatives market has grown rapidly, and has played a key role in the recent financial crisis. In this talk, we will discuss a stochastic model for the bid-ask prices of derivatives in an incomplete market, and solve for the optimal static positions for the derivatives buyers and sellers who may have different risk aversion levels and market views. We will examine analytically and numerically the impacts of various factors on the optimal trading volume.

4 - Risk Measures in a Multiasset Model with Transaction Costs
Birgit Rudloff, Assistant Professor, Princeton University, ORFE department, Princeton, NJ, 08544, United States of America, brudloff@princeton.edu

We consider a market with d assets and proportional transaction costs and extend the notion of set-valued risk measures to the case of random solvency cones at terminal time. This accounts for random exchange rates and/or random transaction costs. Dual representations are given in terms of vector probability measures, allowing for an interpretation close to the scalar case. We present several examples including the average value at risk and the superhedging price.

■ SA59

H - Salon A, 4th Floor

Combinatorial Optimization I

Contributed Session

Chair: Minghe Sun, Professor, University of Texas at San Antonio, College of Business, One UTSA Circle, San Antonio, TX, 78249, United States of America, minghe.sun@utsa.edu

1 - A Dual Bounding Scheme for a Territory Design Problem
Monica Elizondo, Master Student, Universidad Autonoma de Nuevo Leon, CIDET-FIME, AP 111 - F,Cd. Universitaria, San Nicolas, NL, 66450, Mexico, melizondo.amaya@gmail.com, Roger Z. Rìos-Mercado, Juan Diaz

A real-world territory design problem arising in a beverage distribution firm is addressed. This problem involves finding a p-partition of a set of geographic units to minimize a p-center measure of dispersion, subject to balance constraints. Dual bounds are obtained using a binary search over a range of coverage distances and considering a maximal covering model. Empirical work includes an evaluation of the algorithmic performance. Keywords: territory design, Lagrangian relaxation.

2 - Application of Genetic Algorithms to Gene Interactive Rules
Farhad Azadivar, Professor, University of Massachusetts Dartmouth, 40 William Street, South Dartmouth, MA, 02748, United States of America, fazadivar@umassd.edu

Creation of cancer cells are the result of changes induced to gene interactive rules. In this paper a genetic algorithm is applied to a simulated model of gene interactions rules to determine the optimum alterations of these rules to prevent formation of cancerous cells.

3 - Heuristics and Approximation Algorithms for Optimization Problems with Submodular Costs
Dan Stratila, Rutgers University, 640 Bartholomew Rd, Rm 107, Piscataway, NJ, 08854, United States of America, dstrat@rci.rutgers.edu

We consider several discrete optimization problems with costs that are given by submodular functions, such as the facility location problem with submodular costs. We introduce a new approach for obtaining heuristics and approximation algorithms for such problems that involves iteratively solving a certain submodular optimization problem. Time permitting, we will discuss applications to computational methods, and applications to other problems, such as network design and inventory problems.

4 - A Simplex-based Primal-dual Algorithm for the Perfect B-matching Problem
Jingjie Xiao, PhD Student, Purdue University, School of Industrial Engineering, West Lafayette, IN, 47907, United States of America, xiaoj@purdue.edu, Joseph F. Pekny, Paul Bunch

Although standard computational tools are used, in the algorithm engineered for the perfect b-matching problem (PBMP), we are able to exploit problem physics by controlling primitive operations of the simplex method such as selection of entering and exiting variables. Specifically, a cutting plane approach is used to solve the PBMP so that only 1/2 integral solution values are encountered en route to the optimal solution, allowing for economical detection of violated facet defining constraints.

5 - A Tabu Search Procedure for a Variable Selection MIP Model in Multiple-Class Classification

Minghe Sun, Professor, University of Texas at San Antonio, College of Business, One UTSA Circle, San Antonio, TX, 78249, United States of America, minghe.sun@utsa.edu

A tabu search procedure is developed to solve an MIP model for variable selection in multiple-class classification problems. Discriminant functions are constructed while variables are selected. Strategies are designed to select variables to enter and leave the discriminant functions. Recency based tabu conditions are used and aspiration criteria are developed to override tabu conditions. Very good results are obtained when the tabu search procedure is applied to publically accessible data sets.

■ SA60

H - Salon B, 4th Floor

Decision Quality - In Search of Theoretical Foundation

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 - The Practitioners Wish List for DA Research

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

We will discuss the results of a survey of leading practitioners conducted by the Society of Decision Professionals. The survey will determine which kind of research topics could be most helpful to advancing the practice of decision analysis and achieve greater market penetration of strategic decisions. A panel of practitioners will expand on the top five items on the wish list.

■ SA63

H - Room 404, 4th Floor

Real Options and Applications

Sponsor: Decision Analysis
Sponsored Session

Chair: Tianyang Wang, University of Texas at Austin, McCombs School of Business, University of Texas at Austin, Austin, TX, 78712, United States of America, Tianyang.Wang@PhD.mccombs.utexas.edu

1 - Flexibility and Uncertainty in Agribusiness Projects: Investing in a Cogeneration Plant

Luiz Brandao, Professor, Pontifical Catholic University of Rio de Janeiro, Rua Marques de São Vicente 225, Gavea, Rio de Janeiro, RJ, 22451-900, Brazil, brandao@iag.puc-rio.br, Augusto Arenaro, Carlos Bastian-Pinto, Joe Hahn

Energy generation from biomass has become a source of increasing interest. We analyze a sugar cane mill in Brazil that has an option to add a bioelectricity cogeneration unit. We model sugar, ethanol and electricity prices as stochastic mean reverting processes and solve using a mean reverting lattice under the real options approach. The results indicate that significant value can be derived from the flexibility to choose the optimal timing of investment in the cogeneration unit.

2 - Copulas-based Decision Tree

Tianyang Wang, University of Texas at Austin, McCombs School of Business, University of Texas at Austin, Austin, TX, 78712, United States of America, Tianyang.Wang@PhD.mccombs.utexas.edu, James Dyer

There is a growing need for the ability to specify and generate multivariate dependent random variables as primitive inputs to stochastic models. This paper proposes a copulas-based approach to model multiple dependent factors in decision trees allowing general marginal distributions and general copulas functions. The approach can serve as an efficient and practical tool for multifactor decision analysis and real options pricing.

3 - Value of Information as an American Option

Babak Jafarizadeh, PhD Researcher, University of Stavanger, Dept of Petroleum Engineering, N-4036, Stavanger, Norway, babak.jafarizadeh@uis.no

Some information acquisition activities can be postponed within a predefined time-frame. In the uncertain situations, the option to postpone this activity to a later, more favorable time may create additional value for the decision maker. In this paper we discuss the value that comes from holding an option to acquire information in a time period and suggest a Simulation-based numerical approach to calculate the associated value.

4 - Oilfield Asset Valuation with Multiple Sources of Uncertainty

William J. Bailey, Principal, Schlumberger-Doll Research, 1 Hampshire Street, Cambridge, MA, 02139, United States of America, wbailey@slb.com, David Wilkinson, Benoit Couet

The valuation of an oilfield asset with multiple sources of uncertainty is presented using a modified form of the Smith & Nau multi-lattice scheme. Private and public uncertainties are treated in a systematic manner (with a practical management 'roadmap' for hedging) such that the valuation (with or without optionality) has explicable and unambiguous meaning. All reservoir-related subjective probabilities are retained and a consistent valuation, irrespective oil price path, is forthcoming.

5 - A Non-censored Binomial Lattice Approach for Modeling Mean Reverting Stochastic Processes

Joe Hahn, Pepperdine University, 24255 Pacific Coast Highway, Malibu, CA, 90263, United States of America, Joe.Hahn@pepperdine.edu, Carlos Bastain, Luiz Brandao

In this paper we propose a non-censored binomial lattice model that is more precise and has some other distinct advantages over the existing models used for approximating mean reverting processes. We compare the alternative approaches and apply them to a hypothetical real option valuation problem.

■ SA68

H - Room 415, 4th Floor

Supply Chain Management in eBusiness

Sponsor: eBusiness
Sponsored Session

Chair: Daewon Sun, University of Notre Dame, 359 MCoB, Notre Dame, IN, United States of America, dsun@nd.edu

1 - Bundling in a Supply Chain

Hemant Bhargava, University of California, Davis, Davis, CA, United States of America, hemantb@ucdavis.edu

Many retailers serve as aggregators of products from upstream independent manufacturers. This business model occurs in television, online music, and many other settings. We discuss how the existence of double marginalization in these settings fundamentally alters the economic features of bundling.

2 - On and Beyond Information Sharing: An Empirical Analysis of Value of Vendor Managed Inventory

Oliver Yao, Associate Professor, Lehigh University, 621 Taylor St., Bethlehem, PA, 18015, United States of America, yuy3@lehigh.edu, Yan Dong, Martin Dresner

Using a unique, item level dataset, we examine benefits of both the information sharing and decision transfer components of to both upstream firms and downstream firms. Performance is measured using inventory, stockouts and the bullwhip effect ratio. Our major findings are that VMI adds value for both downstream and upstream firms, and that the decision transfer component of VMI adds significant benefits on top of the benefits derived from the sharing alone.

3 - Coordinating a Supply Chain with a Manufacturer-owned Online Channel

Daewon Sun, University of Notre Dame, 359 MCoB, Notre Dame, IN, United States of America, dsun@nd.edu, Xuying Zhao, Jennifer Ryan

We consider a dual channel supply chain in which a manufacturer sells a single product to end-users through both a traditional retail channel and a manufacturer-owned direct online channel. We model each channel as a newsvendor problem, with price and order quantity as decision variables. In addition, the manufacturer must choose the wholesale price to charge to the independent retailer.

■ SA69

H - Salon F, 6th Floor

Student Rail Research Competition

Sponsor: Railway Applications
Sponsored Session

Chair: Michael Gorman, Associate Professor and J. Berry Endowed Fellow, University of Dayton, School of Business - MIS, OM DSC Dpt., 300 College Park, Dayton, OH, 45419-2130, United States of America, Michael.Gorman@notes.udayton.edu

1 - Rail Applications Section Student Paper Contest - FINALIST Presentations
Michael Gorman, Associate Professor and J. Berry Endowed Fellow, University of Dayton, School of Business - MIS, OM DSC Dpt., 300 College Park, Dayton, OH, 45419-2130, United States of America, Michael.Gorman@notes.udayton.edu

The entrants in the RAS Student Paper Contest will present their research at this session. The winner will be announced at the RAS Business meeting Sunday night. The finalists were not determined prior to the abstract submission deadline.

2 - Robust Train Dispatching Model Under a Dynamic and Stochastic Environment: A Scenario-based Rolling Horizon Solution Approach
Xuesong Zhou, University of Utah, Department of Civil Engineering, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu, Lingyun Meng

This paper aims to solve the robust train dispatching problem under a major disruption with dynamic and stochastic information. Based on a stochastic programming with recourse framework, the proposed model periodically optimizes schedules for a relatively long rolling horizon, while selecting and disseminating a robust meet-pass plan for every roll period. A multi-layer branching solution procedure is developed to systematically generate and select meet-pass plans under different stochastic scenarios. Illustrative examples and numerical experiments are used to demonstrate the importance of robust disruption handling under a dynamic and stochastic environment.

3 - Delay Management with Re-Routing of Passengers
Twan Dollevoet, Econometric Institute and ECOPT, Erasmus University RotterdamDepartment of Logistics, Netherlands Railways , P.O. Box 1738, NL-3000, NL-3000 DR Rotterdam, Netherlands, dollevoet@ese.eur.nl, Marie Schmidt, Anita Schobel, Dennis Huisman

Delay management answers the question whether trains should wait for a delayed feeder train or should depart on time. We present a delay management model that allows passengers to adjust their route in case of delays and give an integer programming formulation. Furthermore, we present a polynomial algorithm for the special case of one origin-destination pair, which can be applied to obtain lower bounds for the general problem. Computational experiments on real-world data of Netherlands Railways show that significant improvements can be obtained by considering re-routing explicitly.

4 - New Jersey Chapter: 2010 Student Contest Winner
David Hunt, Oliver Wyman, 212 Carnegie Center, Princeton, NJ, 08540, United States of America, David.Hunt@oliverwyman.com

The winner of the New Jersey Student Contest will present their work. This contest is open to all students attending a NJ school, or any student who is a NJ resident. The finalist this year include two papers on queueing theory, one on supply chain, and one from the airline industry. The winner will be determined at a NJ Chapter meeting in late September.

5 - Flight Sequence Model for Flight Conflict Resolving Problem
Zhe Liang, Rutgers University, 900 Davidson Rd, Piscataway, NJ, United States of America, liangzhe@eden.rutgers.edu, W. Art Chaovalitwongse, Elsayed Elsayed

Everyday Oakland ARTCC receives requested flight plans from the airlines entering the Pacific airspace. It is common that the flight plans from different airlines incur conflicts due to FAA safety standards. The flight conflict rescheduling problem is to resolve the conflicts with the minimum cost. We propose a flight sequence model (FSM) for the problem, and use column generation to solve the FSM. The computational results show that the FSM outperforms all other methods in all test cases.

■ SA70

H - Salon G, 6th Floor

Advanced Optimization Approaches to Dynamic Airspace Configuration

Sponsor: Aviation Applications
Sponsored Session

Chair: Shervin AhmadBeygi, Senior Operations Research Analyst, Metron Aviation, 45300 Catalina Ct, Sterling, VA, 20166, United States of America, Shervin.AhmadBeygi@metronaviation.com

1 - Optimal Airspace Partitioning: Cell Based Optimization Approach
Arash Yousefi, Principal Analyst, Metron Aviation Inc., 45300 Catalina Court, Suite 101, Dulles, VA, 20166, United States of America, arash.yousefi@metronaviation.com

We present a methodology for clean sheet partitioning of airspace to air traffic control sectors. We decompose a given piece of airspace into cells and compute metrics for each cell to capture traffic topology. We develop Mixed Integer Linear Programs to cluster cells into airspace sectors. For a given traffic pattern, the goal is to simultaneously minimize the number of sectors and total controller workload, and balance the workload among sectors.

2 - A Math Programming Based Heuristic for Solving an Optimal Sectorization Problem
Shin-Lai Tien, University of Maryland, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, alextien@umd.edu

An optimal sectorization problem has been formulated to address demand variation by using time-varying controller staffing. To generate quality solutions within time limit, a heuristic based on math programming is introduced. Various neighborhood definitions for local search will be developed and tested. The experimental results show that the proposed heuristic approach can effectively improve best found solutions.

3 - Dynamic Airspace Configuration using Approximate Dynamic Programming
Rajesh Ganesan, George Mason University, 4400 Univ Dr MS 4A6, Fairfax, VA, 22030, United States of America, rganesan@gmu.edu, Sameer Kulkarni

Dynamic Airspace Configuration is a NextGen Air Transportation System concept that proposes to migrate from the present static structure of the National Airspace System (NAS) to a more dynamic airspace, which is capable of adapting to changing traffic patterns and weather conditions to efficiently utilize the capacity of the NAS. This talk addresses the issue of dynamic restructuring of the airspace to meet capacity requirements on a daily basis using an Approximate Dynamic Programming Algorithm.

4 - Air Traffic Flow Management Under NextGen Mixed Equipage Conditions
Ali Tafazzoli, Senior Analyst, Metron Aviation, Inc., 45300 Catalina Ct. Suite 101, Dulles, VA, 20166, United States of America, ali.tafazzoli@metronaviation.com, Girishkumar Sabhnani, Babak Khorrami, Arash Yousefi

Unlike today's National Airspace System, the NextGen airspace will consist of both ground-controlled and self-separated operations. We define a notion of a feasible region for self-separated airspace in 3D space of percent-equipped aircraft, traffic complexity, and aircraft count based on the human factors studies. Furthermore, we extend an existing traffic flow management model to include requirements for mixed-equipage operations within the NextGen time frame.

■ SA71

H - Salon H, 6th Floor

Transportation, Public

Contributed Session

Chair: Zhang Dong, Tongji University, A227, NO.4800 Cao'an Rd., Shanghai, 210804, China, zhangdong_traffic@126.com

1 - Bus Network Design using Genetic Algorithm
Hadi Sadrsadat, PhD Candidate, University of Maryland, Dept of Civil &Environmental Engineering, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, hadisadr@umd.edu, Ali Haghani, Hossein Poorzahedi

This study is devoted to solve bus network design problem using genetic algorithm. The fitness function is defined as the benefit to the users, subject to constraints that distribute bus routes over the study area and do not allow required fleet size exceed available fleet size. Several good solutions were generated in reasonable time through a sensitivity analysis by changing the parameters of the problem affecting bus route geographical distribution.

2 - The Value of Optimization in Dynamic Ride-sharing
Xing Wang, Georgia Institute of Technology, ISYE, 765 Ferst Drive, Atlanta, GA, United States of America, xwang35@isye.gatech.edu, Niels Agatz, Martin Savelsbergh, Alan Erera

While ride-sharing is not new, the ubiquity of Internet enabled smartphones allows practical dynamic ride-sharing. To exploit hardware capabilities, ride-sharing systems need to match riders and drivers on short-notice in ways that reduce system-wide vehicle-miles and costs. In this research we develop optimization-based approaches for ride-sharing. To asses the merits of our methods we present a simulation study based on real-life travel demand data from the Metro Atlanta.

3 - Demand Driven Transport in Developing Nations: Pareto Tradeoffs
Chandrasekhar Prabala, Infosys Technologies Limited, Electronics City, Bangalore, India, venkata_p@infosys.com, G. N. Srinivasa Prasanna, Sunil Kumar Vuppala

We present results on demand driven transportation (DDT), targeted towards demand profiles seen in developing nations. Shared vehicles (e.g. buses) are allocated and scheduled to serve 1000's of potentially conflicting riders (an order of magnitude more than previous work). We present tradeoffs between request advance notice period, demand satisfaction percentage, and fleet size. Initial results indicate that DDT's can approach the cost effectiveness of public & timeliness of private transport.

4 - Modeling Commuter's Departure Time Choice: A Bayesian Theory Perspective
Zhang Dong, Tongji University, A227, NO.4800 Cao'an Rd., Shanghai, 210804, China, zhangdong_traffic@126.com, Teng Jing, Yang Xiaoguang, Chen Guojun

An agent based simulation platform was developed on basis of a commuters' departure time choosing behavior model which described the feedback and revision characteristics of the travel experience forming process from the Bayesian theory perspective. Also, the traveler information's effects were modeled and studied.

■ SA72

H - Salon J, 6th Floor

Innovations in Pricing of Transportation Systems: I

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Gainesville, FL, 32607, United States of America, yafeng@ce.ufl.edu

1 - A Solution Method for Robust Congestion Pricing Under User Equilibrium
Tao Yao, Assistant Professor, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Byung Do Chung, Tae Il Kim, Terry Friesz

Congestion pricing has been regarded as an efficient method to manage travel demand by affecting travel behavior to minimize social cost or maximize a private firm's revenue. In this talk, we apply a robust optimization (RO) approach to user equilibrium optimal toll problems in the presence of transportation demand uncertainty. A solution method to find robust congestion tolls is proposed and numerical experiments are shown to evaluate the robust solutions.

2 - Pareto-improving Pricing-refunding Schemes in General Bi-modal Transportation Networks
Yu Nie, Assistant Professor, Northwestern University, 2145 Sheridan Road, Evanston, IL, y-nie@northwestern.edu, Yang Liu

This paper explores the existence of Pareto-improving pricing-refunding schemes in a bi-modal general network with heterogeneous users. Transit is explicitly modeled as an alternative to a general highway network that is slower but has a operating cost lower than its highway counterpart. The designs of Pareto-improving pricing-refunding schemes are discussed.

3 - Nonlinear Road Pricing
Siriphong Lawphongpanich, University of Florida, Gainesville, FL, 32607, United States of America, lawphong@ise.ufl.edu, Yafeng Yin

Nonlinear pricing refers to a case in which the price is not strictly proportional to the quantity purchased. In road pricing, such schemes generally yield generalized cost expressions not necessarily linkwise additive. However, for a significant number of nonlinear schemes, we show that link-based user equilibrium conditions exist. When they do not, we show how to modified standard algorithms such as the Frank-Wolfe algorithm to find equilibrium flow distributions under nonlinear pricing.

■ SA73

H - Salon K, 6th Floor

Generalized VRP Models

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa, AL, United States of America, bkeskin@cba.ua.edu

1 - A Lean Vehicle Routing Problem
Jeffrey Ohlmann, University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242, United States of America, jeffrey-ohlmann@uiowa.edu, Michael Fry, Chuanjie Liao

Motivated by collaboration with a third-party logistics provider, we consider the management of the supply network for a company adhering to a lean production strategy. The considerations of low work-in-process inventory, production smoothing, and standardized work introduce temporal scheduling complexities in this lean logistics problem. We discuss and compare our modeling approach to alternatives.

2 - Self-imposed Time Windows in Vehicle Routing Problems with Disruptions and Fixed Shift Durations
Ola Jabali, PhD Student, Eindhoven University of Technology, Den Dolech 2 Paviljoen, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, o.gabali@tue.nl, Tom Van Woensel, Roel Leus, Ton de Kok

We consider the situation where a carrier company assigns time windows to serve its customers. The main difference between this setting and the vehicle routing problem with time windows (VRPTW) is that the time windows are decision variables, rather than constraints. This is optimized under disruptions in travel times. Our solution approach is a tabu search procedure coupled with an LP model, used for setting the time-windows. We compare our results with both VRP and VRPTW benchmark sets.

3 - Line-haul Outsourcing as a Solution for the Empty Balancing Problem in Trucking Transportation
Huy-Nhiem Nguyen, PhD Candidate, University of Arkansas, Room 4207, BELL Eng. Ctr., Fayetteville, AR, 72701, United States of America, hxn002@uark.edu, Ed Pohl, Chase Rainwater, Scott J. Mason

The problem of balancing empty containers is common amongst participants in the transportation sector. Most typically, logistics firms utilize only in-house resources to address this challenge. In this work, we consider line-haul outsourcing to rail transportation as an alternative strategy. We evaluate this strategy through the analysis of a service network design problem formulation that seeks to find the optimal set of outsourced line-hauls.

4 - Analysis of an Integrated Maximum Covering and Patrol Routing Problem
Rong (Shirley) Li, University of Alabama, Tuscaloosa, AL, 35487, United States of America, rli4@crimson.ua.edu, Burcu Keskin

We address the problem of determining the patrol routes and stopping locations of state troopers to cover highways with high frequency of crashes. By generalizing the traditional VRPTW to a public domain, we develop a mixed integer linear model with time limitation. As real life cannot be solved via existing software, we develop search-based heuristics. Via experiments using real data, we test the validity and usability of our model and solutions. We also provide detailed recommendations.

■ SA74

H - Room 602, 6th Floor

Advances in Real Time Route Guidance

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Sushant Sharma, Research Associate, Purdue University, B100, 2700 Kent Avenue, West Lafayette, IN, 47906, United States of America, sharma57@purdue.edu

1 - Quantifying the Qualitative Benefits of Real-time Travel Information
Dong Yoon Song, Purdue University, West Lafayette, IN, United States of America, song50@purdue.edu, Srinivas Peeta

The deployment of Advanced Traveler Information Systems (ATIS) entails analyzing the benefits of real-time travel information for the various stakeholders. In this study, we seek to quantify the qualitative benefits of individual drivers in addition to the commonly analyzed quantitative benefits in terms of travel time savings. The level of satisfaction, the level of reliability, and other qualitative variables will be explored to measure qualitative benefits based on driver behavioral analysis vis-‡-vis the value of real-time travel information.

2 - Network Topology Based Vehicle Sensor Locations Under Dynamic Traffic Conditions

Sushant Sharma, Research Associate, Purdue University, B100, 2700 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. It obtains time-dependent link-path incidence matrices for a given network over a planning period and then uses this information to identify the links in the network that enable maximal observability of traffic flows.

3 - A Dynamic Bilevel Formulation to Model Staggered Work Hours

Wilfredo Yushimito, PhD Candidate, Rensselaer Polytechnic Institute, 110 8th St. JEC 4030, Troy, NY, 12180, United States of America, yushiw@rpi.edu, Jeff Ban, Jose Holguin-Veras

Staggered work hours are achieved by varying the starting and release times in firms, for instance, staggering starting times in interval of 15 minutes, and adjusting their end times accordingly. In this paper we present a bi-level formulation to model staggered work hours: The behavior of the firm is modeled in the upper level as a minimization of the profit loss as a result of the firm's productivity loss. The behavior of the workers is modeled in the lower level as the maximization of their utility function which depends on of their departure time and route choice decisions embedded in a dynamic user equilibrium model. The model is used to provide insights about the interaction between workers and the firm, and why a third agent is required to provide incentives to both agents to stagger the starting times.

4 - Strategic Route Choice Behavior in a Driving Simulator

Hengliang Tian, University of Massachusetts-Amherst, 141 Marston Hall, 130 Natural Resources Road, Amherst, MA, 01003, United States of America, thliang17@gmail.com, Song Gao, Donald Fisher, Brian Post

We investigate travelers' strategic route choice behavior in risky traffic networks using data from human subjects on a full-scale driving simulator, specifically whether travelers plan ahead for real-time information that they will receive later en-route, and whether factors such as network complexity and cognitive load affect the ability to do strategic thinking.

Sunday, 11:00am - 12:30pm

■ SB01

C - Ballroom D1, Level 4

Impact of Environmental Regulation and Renewable-based Generation on Power Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Patricio Rocha, University of South Florida, 4202 E. Fowler Ave., Tampa, FL, United States of America, procha@mail.usf.edu

1 - Augmented Screening Curve Approach to Optimizing Generation Capacity Additions Considering Reserves

Ross Baldick, University of Texas, Austin, TX, United States of America, baldick@ece.utexas.edu, Cheol-Hee Cho

A screening curve approach can be useful to estimate optimal additions to generation capacity for a target year. With increasing penetration of renewables, at least two issues need to be considered. First, the load-duration curve used in a traditional screening approach should be replaced with a net load-duration curve. Second, there is an increase in the amount of capacity needed to provide reserves, and both the capital and operating costs of this capacity should be considered.

2 - Optimal Wind Power Bidding in Electricity Markets

Audun Botterud, Energy Systems Engineer, Argonne National Laboratory, Decision and Information Sciences Div., 9700 S. Cass Ave., Bldg. 221, Argonne, IL, 60439, United States of America, abotterud@anl.gov, Jianhui Wang, Hrvoje Keko, Ricardo J. Bessa

We discuss optimal wind power bidding in the electricity market and propose a methodology to derive optimal day-ahead bids under uncertainty in wind power generation and prices. A probabilistic wind power forecast is used to represent the uncertainty in wind power generation. Different decision criteria, including expected profit, expected utility, and conditional value at risk are used to derive the optimal bidding strategy. We show how the optimal day-ahead bids depend on several factors.

3 - Technology Portfolio and Capacity Investments Under Uncertainty

Tiago Filomena, PhD Student, George Washington University, 1776 G Street NW, Washington, DC, 20005, United States of America, tiagopf@gwu.edu, Enrique Campos-Nanez

We present a model which helps to understand the impact of uncertainty in electricity generation investment. The model is a two-stage game with uncertainty on costs and demand. It helps to forecast the short-term portfolio of technologies, capacity availability and electricity clearing price for an oligopoly. The relation between environmental regulatory uncertainty and electricity capacity generation is discussed.

4 - Carbon Revenue Redistribution Strategies for Electric Power Markets

Patricio Rocha, University of South Florida, 4202 E. Fowler Ave., Tampa, FL, United States of America, procha@mail.usf.edu, Tapas K. Das

The implementation of a CO2 emissions control scheme, either a cap-and-trade program with auctioned permits or a carbon tax, will provide the government with a new source of revenue. Economists advocate for the redistribution of this carbon revenue i.e., the emissions control scheme should be revenue neutral. We present an optimization model to redistribute the carbon revenue collected by an electricity-sector emissions control scheme among consumers and green generators over a planning horizon.

■ SB02

C - Ballroom D2, Level 4

Modeling Oil and Natural Gas Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Fernando Oliveira, Associate Professor, ESSEC Business School, Avenue Bernard Hirsch-BP 50105, Cergy, Cergy, 95021, France, oliveira@essec.fr

1 - Risk Diffusion in Natural Gas Networks by using CVaR Analysis

Parviz Darvish, PhD Candidate, ESSEC Business School, Avenue Bernard Hirsch - BP 50105, Cergy, 95021, France, parviz.darvish@essec.edu, Fernando Oliveira

The European natural gas market network as a strategic energy infrastructure in European countries is exposed to many risks, including demand uncertainty and supply disruptions, due to suppliers' policies, domestic resources depletion, weather problems, terrorist attacks, or political conflicts. In this paper we propose a quantitative risk analysis which considers how risk averse, profit-maximizing participants are affected by the different risk factors and how these spread in this network.

2 - Robust Investment Decisions for Disruption Risk in Petroleum Markets

Nalan Gulpinar, Professor, Warwick Business School, The University of Warwick, Coventry, United Kingdom, Nalan.Gulpinar@wbs.ac.uk, Kabir Katata, Ethem Canakoglu

Energy-dependent economies and energy security strategies need to cope with multiple supply risks of simultaneous oil and gas shortages. In this paper, we are concerned with modelling supply disruption risks and robust investment strategies in petroleum markets. We analyze financial and volumetric losses due to supply disruptions and present computational results to illustrate the performance of robust portfolio optimization models.

3 - Gas-based Industrialization and Export Diversification Strategies, A Portfolio Analysis

Olivier Massol, Assistant Professor, IFP School, 228-232 Avenue Napoleon Bonaparte, Rueil-Malmaison, 92852, France, olivier.massol@ifp.fr

The possession of natural gas resources is generally described as a blessing that should generate export-driven wealth for a small economy. Unfortunately, a casual observation of past performances reveals mixed results, highlighting the large variability of these export revenues. In that context, numerous gas-based industrialization strategies have been advocated as possible remedies. In this study, a mean-variance portfolio analysis is performed to identify optimal diversification strategies.

4 - Design of Financial Contracts and Procurement Risk Management in Oil Markets

Frederic Murphy, Professor, Temple University, Fox School of Business, Philadelphia, PA, United States of America, fmurphy@temple.edu, Fernando Oliveira

We analyze a refiner's procurement risk management strategy when trading in different types of crude oil. We develop a computational model of the decisions faced by a refiner, studying how financial contracts (options and forward contracts) and inventory management interact as insurance policies. We examine the proportion the firm should optimally refine, procure from each type of market, and study how its contractual position is a function of its risk profile.

■ SB03

C - Ballroom D3, Level 4

Open Pit Mining

Sponsor: Energy, Natural Resources and the Environment/ Mining
Sponsored Session

Chair: Marcos Goycoolea, Universidad Adolfo Ibañez, School of Business, Peñalolén, Chile, mgoycool@gmail.com

1 - Methods for Improving the Tractability of the Block Sequencing Problem for Open Pit Mining
Marty Gaupp, Lieutenant Colonel, United States Air Force, AETC Studies and Analysis Squadron, 151 J Street E, Ste 2, Randolph AFB, TX, United States of America, Marty.Gaupp@randolph.af.mil, Christopher Cullenbine, Alexandra Newman, Kevin Wood

A surface mine optimizes its profits by maximizing the net present value (NPV) of minerals extracted from the orebody. This is accomplished by creating a production schedule that defines when each section, or block, of ore is removed while adhering to geospatial and operational constraints. We describe the complexities involved in such a formulation and suggest graph-theoretic based methodologies to expedite the solution times for instances of this block sequencing problem.

2 - Robustness, Risk and Recourse in for Open Pit Minning
Daniel Espinoza, Assistant Professor, University of Chile, Av. Republica 701, Santiago, Chile, daespino@gmail.com, Guido Lagos, Eduardo Moreno, Juan Pablo Vielma

In this work we consider the open pit problem with multiple processing methods, no cut-off grade, and uncertainty in the metal grade for each block. We also consider the case where processing decisions have recourse. We compare three different modeling approaches. The robust model of Bertimas-Sim, Chance constraints, and Conditional value at risk. Al three methods use sampling of the random parameters. Extensive testing on simulated ore-bodies and in some actual mines will be presented.

3 - Improving Solution Times of the LP Relaxation Bound for the Open Pit Mine Block Sequencing Problem
Kelly Eurek, MS student, Colorado School of Mines, Golden, CO, 80401, United States of America, keurek@mymail.mines.edu, Alexandra Newman

Using the standard integer programming formulation for the open pit mining block sequencing problem, we implement a sliding time window heuristic to solve large model instances. Examining the LP relaxation bound, we show validity of the heuristic to provide an optimal solution. Applying techniques to expedite solution time of the LP relaxation bound for the monolith, we demonstrate how improved solution times of the LP relaxation bound can be applied at each iteration of the heuristic.

4 - A LP Approach for the Open-pit Production Scheduling Problem
Eduardo Moreno, Universidad Adolfo Ibanez, Santiago, Chile, eduardo.moreno@gmail.com, Daniel Espinoza, Gonzalo Muñoz, Marcos Goycoolea

In this talk we present a scalable methodology for solving instances of the open-pit mine production scheduling problem. This methodology is based on solving the LP relaxation and applying a heuristic to obtain a good feasible solution. We compare this heuristic with others similar methodologies for this problem, and we discuss the impact of incorporate multiple destinations and variable cut-off grade. Finally, we present some analysis on real instances.

■ SB04

C - Ballroom D4, Level 4

Joint Session Clean Energy/ ICS: Power Grid Vulnerability Studies

Cluster: Clean Energy/Computing Society
Invited Session

Chair: Daniel Bienstock, Columbia University, 500 West 120th St., New York, NY, 10027, United States of America, dano@columbia.edu

1 - Online Control of Cascading Blackouts
Daniel Bienstock, Columbia University, 500 West 120th St., New York, NY, 10027, United States of America, dano@columbia.edu

We describe an algorithm that computes an online control algorithm for dampening cascading blackouts. Immediately after the initial event of the cascade, the algorithm is computed. In subsequent stages of the cascade, the algorithm is applied, with the goal of minimizing the amount of demand lost at the end of the cascade.

2 - Estimating Cascading Blackout Extent using Utility Data and a Branching Process
Ian Dobson, Professor, University of Wisconsin-Madison, ECE Department, 1415 Engineering Drive, Madison, WI, 53706, United States of America, dobson@engr.wisc.edu

We derive and test a probabilistic branching process model of the propagation of cascading transmission line outages with utility data. Then we assume the propagation observed in the utility data and estimate the probability distribution of the total number of lines outaged from assumed initial line outages. This novel bulk statistical approach quantifies the effect of cascading failure in making initial line outages more widespread.

3 - Resilience of the Power Grid to Large Scale Physical Attacks
Gil Zussman, Assistant Professor, Columbia University, Electrical Engineering, 500 W 120 st Room 1300, New York, NY, 10027, United States of America, gil@ee.columbia.edu, Daniel Bienstock, David Hay

We consider geographically correlated failures of parts of the power grid that may be caused by a natural disaster or a physical attack (e.g., an EMP attack). Failures of some power lines may lead to cascading failures of additional lines. Hence, failures of several lines in a specific geographical area may lead to a large scale cascading failure. We develop algorithms for identifying the most vulnerable parts of the network that may provide insight into the development of protection schemes.

■ SB05

C - Ballroom D5, Level 4

The Use of Analytics to Improve In-game Strategy in Sports

Sponsor: SpORts
Sponsored Session

Chair: Bret Myers, Villanova University, 442 Hartford Square, West Chester, PA, 19380, United States of America, bret.myers@villanova.edu

1 - The Use of Analytics to Improve Substitutions in Soccer
Bret Myers, Villanova University, 442 Hartford Square, West Chester, PA, 19380, United States of America, bret.myers@villanova.edu

Soccer managers face an important decision regarding substitutions in a particular match. Unlike many other sports, the number of substitutions in soccer is limited to three according to FIFA, the international governing body for soccer. The focus in this research is using past data to analyze the outcomes surrounding substitutions in soccer matches. The evidence from this study serves to provide soccer managers useful information to improve the chances of getting results in matches.

2 - Using MDP's to Decide When to Challenge Calls in Tennis
John Hasenbein, Associate Professor, University of Texas at Austin, Graduate Program in OR/IE, Austin, TX, United States of America, jhas@mail.utexas.edu, Vamsi Nadimpalli

We develop a Markov decision process model to decide when to challenge an umpire's call in tennis. The model incorporates the challenge type, probability of winning a point on serve, and the perceived probability that the umpire made an incorrect call. We solve the resulting average cost multi-chain MDP model using the dual linear program arising from the Bellman equations.

3 - "Punt, Pass or Kick?" A Refined Approach to Fourth-down Decision Making
Chase Rainwater, University of Arkansas, INEG Department, Fayetteville, AR, 72701, United States of America, cer@uark.edu, Richard Cassady, Lisa Maillart, Yi Zhuang

We examine the critical decision of whether to attempt a field goal, punt or go-for-it on a fourth down. Our approach utilizes a Markov decision process to maximize the probability that a team will ultimately win the game as a function of the current field position, yards-to-go, time remaining and score differential. The transition probabilities associated with the millions of possible state vectors are estimated using play-by-play data from all NFL games played during the 2001-2009 seasons.

4 - Was Joe Girardi Foolhardy? An Analysis of the New York Yankee Manager's Decision to Use Only Three Starting Pitchers
James Cochran, Louisiana Tech University, Department of Marketing & Analysis, P.O. Box 10318, Ruston, LA, 71272, United States of America, jcochran@cab.latech.edu

The 2009 Yankees followed convention by using a 5 man rotation in the regular season, allowing each pitcher 4 days rest between starts. This is done because a pitcher's performance (and probability of winning) is believed to deteriorate with less than 4 days rest between starts. However, the team deviated from this strategy in the World Series and used only its top 3 starting pitchers (allowing each 3 days rest between starts). We use decision analysis to assess the wisdom of this strategy.

■ SB06

C - Ballroom E, Level 4

Tutorial: Using Secondary Data in Operations Management (OM) Research: Overview and Research Opportunities

Cluster: Tutorials
Invited Session

Chair: Vinod R Singhal, Georgia Institute of Technology, College of Management, Atlanta, GA, 30332, United States of America, vinod.singhal@mgt.gatech.edu

1 - A Tutorial on using Secondary Data in Operations Management (OM) Research: Overview and Research Opportunities
Vinod R. Singhal, Georgia Institute of Technology, College of Management, Atlanta, GA, 30332, United States of America, vinod.singhal@mgt.gatech.edu

This tutorial will provide an overview of how to use secondary data in OM research. It will discuss data sources that are available, the research methods and statistics for use with secondary data, and an approach for carrying out this research. Basics of the event study methodology will be discussed. An application that uses this approach will also be discussed.

■ SB07

C - Ballroom F & G, Level 4

JFIG Paper Competition Finalists - II

Sponsor: Junior Faculty Interest Group
Sponsored Session

Chair: Hayriye Ayhan, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, hayhan@isye.gatech.edu

1- JFIG Paper Competition
Hayriye Ayhan, Professor, Georgia Institute of Technology, Atlanta GA, United States of America, hayhan@isye.gatech.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. 39 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, three of the six finalists-selected in two rounds of review, will present their papers. For the selected finalists and the abstracts of the selected papers, please refer to the online program.

■ SB08

C - Room 11A, Level 4

Location Models

Sponsor: Location Analysis
Sponsored Session

Chair: Oded Berman, Professor, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Berman@Rotman.Utoronto.Ca

1 - Variable Radius Max-covering Min-overlap Location Models
Vladimir Marianov, Professor, Pontificia Universidad Catolica de Chile, Department of Electrical Engineering, Vicuna Mackenna 4860, Santiago, RM, 7820436, Chile, marianov@ing.puc.cl, Ha Eiselt

We propose and solve location models that maximize digital terrestrial TV coverage, maximize beneficial multiple coverage and minimize destructive multiple coverage when demands have more than one transmitter within coverage radius, when the covering radius of transmitters is variable. Preliminary computational experience is provided.

2 - Optimizing Capacity, Pricing and Location Decisions on a Congested Network with Balking
Hossein Abouee Mehrizi, University of Toronto - Rotman, Toronto, ON, Canada, H.AboueeMehrizi07@Rotman.Utoronto.Ca, Hassan Shavandi, Oded Berman, Sahar Babri

We consider the problem of making simultaneous decisions on the location, capacity and the price of providing service on a network. We assume that the demand for service from each node follows a Poisson process. The demand is sensitive to both price and distance. Upon arrival to a facility, customers may join the system after observing the number of people in the queue. We develop an algorithm to obtain the optimal capacity, approximate the optimal price and find the optimal locations.

3 - Facility Location and New Product Introduction
Vahideh Sadat Abedi, PhD Candidate, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, VahidehSadat.Abedi07@Rotman.Utoronto.Ca, Oded Berman, Dmitry Krass

A firm offering a new product would like to locate facilities over a network of demand and use optimal price and advertising strategies to boost the projected demand over the time horizon. The advertising and pricing strategies used enhances the location decisions of facilities over time and hence profitability. Therefore, making location and marketing decisions separately is suboptimal. We derive several structural properties of the problem and investigate the structure of the optimal solution.

4 - Covering Links of a Planar Network
Zvi Drezner, Professor, California State University - Fullerton, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu, George Wesolowsky

The problem of locating facilities in the interior of a planar network covering the links of the network is analyzed. Both minimization and maximization of cover are considered. The single facility location problem is solved by the global optimization approach called Big Triangle Small Triangle. The multiple facility maximization problem is solved heuristically. Computational experience with problems of up to 40,000 links demonstrate the effectiveness of the single facility location algorithm.

■ SB09

C - Room 11B, Level 4

Fairness in Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Nikolaos Trichakis, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Ave., Building E40-130, Cambridge, MA, 02139, United States of America, nitric@mit.edu

1 - Managing Hospice Operations Under Medicare Reimbursement
Baris Ata, Northwestern University, Evanston, IL, United States of America, b-ata@kellogg.northwestern.edu, Tava Olsen, Rodney Parker, Bradley Killaly

The Medicare's hospice reimbursement policy consists of a daily payment for each patient under care with a global cap of revenues during the Medicare year, which increases for each newly admitted patient. We demonstrate several unintended consequences of the current reimbursement structure analytically. We also examine if the current policy is responsible for a recent spate of hospice bankruptcies. We propose an alternative policy, which overcomes the existing policy's shortcomings.

2 - Moral Hazard and Limited Liability: How Much Does it Cost?
Santiago Balseiro, PhD Candidate, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, srb2155@columbia.edu, Felipe Balmaceda, Nicolàs E. Stier Moses, José R. Correa

We analyze the social welfare loss due to the existence of a moral hazard in the classical principal-agent problem. In the principal-agent problem, a principal hires an agent to perform a task. The agent chooses his effort intensity, which affects the task's return. Since the principal cannot observe the effort intensity, she ties the agent's compensation to the task's return. We show that the performance of the worst equilibrium depends on the complexity of the delegated task.

3 - Incentive Compatibility and Fairness in Organ Allocation
Anicham Kumarasamy, PhD Candidate, Stanford University, Graduate School of Business, Stanford, CA, United States of America, anichamk@stanford.edu, Stefanos Zenios

Policymakers in the United States have recently proposed to modify the kidney allocation system by assigning higher priority to patients who are on dialysis. We examine how this change may create an incentive for physicians to start their patients on dialysis prematurely. We then discuss how kidneys may have to be wasted in order for allocation to be fair and to discourage premature dialysis initiation.

4 - Fairness, Efficiency and Flexibility in Renal Transplantation
Nikolaos Trichakis, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Ave., Building E40-130, Cambridge, MA, 02139, United States of America, nitric@mit.edu, Dimitris Bertsimas, Vivek Farias

The allocation of deceased-donor kidneys to patients on a waiting list is carried out by ranking them according to a scoring rule. We propose a mechanism for designing scoring rules that allows policymakers to balance efficiency and fairness, taking as input fairness constraints from a broad class of allowable constraints. We use the mechanism to design a scoring rule with the same fairness properties as the rule recently proposed by policymakers, achieving an 8% increase in extra life years.

■ SB10

C - Room 12A, Level 4

Interface of Operations and Finance

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Danko Turcic, Assistant Professor of Operations, Washington University in St. Louis, Olin Business School, Campus Box 1133, St. Louis, MO, 63130, United States of America, turcic@wustl.edu

1 - Capacity Investments in Power Systems
John Birge, University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, jrbirge@uchicago.edu, Vishal Ahuja

Capacity investments in electric power systems require the consideration of multiple uncertainties in addition to prices and demand, such as future network structure, control, and regulation. This talk will describe models that incorporate these uncertainties in a consistent financial framework and the relative impact of uncertainties in these models on investments in renewable technologies.

2 - Integrating Production and Financial Decisions
Rene Caldentey, New York University, Leonard N. Stern School of Business, New York, NY, United States of America, rcaldent@stern.nyu.edu, Chunde Dai

We consider a firm whose net earnings evolve according to a Brownian motion which is influenced by the firm's operating strategy. The firm has to decide on the optimal operating policy (controling the drift of the earnings process) as well as the leverage ratio and the distribution of dividends.

3 - Effect of Term Structure of Futures Price on the Spot Procurement Policies
Ankur Goel, Case Western Reserve University, 10900 Euclid Avenue, 324 Peter B Lewis Bldg., Cleveland, OH, 44113, United States of America, axg312@case.edu, Genaro Gutierrez

We explore the effect of additional term structure information of futures prices on the procurement policies from the spot market. We compare a one-factor stochastic price model with a two-factor model. In addition, we explore the benefits of the frequent calibration of stochastic price process parameters. We conclude the efficacy of two-factor model over one factor model in reducing cost. Also, we show significant benefits of including seasonality in the price process parameters estimation.

4 - Why Risk-neutral Manufacturers Ought to Hedge Commodity Material Purchases
Danko Turcic, Assistant Professor of Operations, Washington University in St. Louis, Olin Business School, Campus Box 1133, St. Louis, MO, 63130, United States of America, turcic@wustl.edu, Ehsan Bolandifar, Panos Kouvelis

We study a linear two-stage supply chain of a risk-neutral supplier (component manufacturer) selling to a risk-neutral manufacturer (intermediate or final good assembler). Both firms rely on credit, require commodity inputs, and face some operational and financial frictions. In the absence of any risk premium, we show that financial hedging increases the expected profits of both firms and improves supply chain efficiency.

■ SB11

C - Room 12B, Level 4

Game Theory in Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Nicholas G. Hall, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States of America, hall_33@fisher.osu.edu

1 - Sequential and Simultaneous Pricing Games in Assembly Systems
Xiaowei Xu, Assistant Professor, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, xiaoweix@andromeda.rutgers.edu

We study an assembly system, in which the suppliers are engaged in either a simultaneous or sequential pricing game. If the suppliers' pricing relationship is strategically substitutable (independent, complementary), then the retail, total supplier and system profits in the simultaneous pricing game are higher than (equal to, lower than) the profits in the sequential game. Log-concavity/linearity/convexity of a demand function implies strategic substitutability/independence/complementarity.

2 - Joint Selling Under Downstream Competition
Shuya Yin, University of California Irvine, Paul Merage School of Business, Irvine, CA, United States of America, syin@exchange.uci.edu, Yuhong He

This paper considers a simple system with n competing final products. Each final product is assembled from two complementary components. All the final products share one common component, which is provided by a monopolist supplier. The other component is dedicated and has n different brands and each brand is managed by an independent supplier. We investigate to what extend the common component supplier and the n competing suppliers would like to form a coalition and jointly sell their products.

3 - Invariance of Allocation Rules in Supply Chain Games
Mahesh Nagarajan, University of British Columbia, BC, Canada, mahesh.nagarajan@sauder.ubc.ca

We characterize sufficient conditions under which, when the number of players is large, dynamically stable coalition structures for a significant class of games remain invariant under the specific allocation rules used to divide profit within coalitions. We explore the associated class of games and allocation rules and discuss the implication to supply chain games.

4 - Cooperation and Subcontracting Issues in Project Management
Nicholas G. Hall, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States of America, hall_33@fisher.osu.edu, Xiaoqiang Cai, Feng Zhang

We consider a project management problem where the project owner outsources the tasks to subcontractors. Task crashing, and task lengthening to reduce resource usage, apply. The cooperation of the subcontractors is studied as a cooperative game that is nonconvex. The game is balanced, and a closed form core allocation is found. We study the design of contracts with the subcontractors to maximize profit. The effects of asymmetric information are studied as a Stackelberg game.

■ SB12

C - Room 13A, Level 4

Joint Session MSOM/ SPPSN: Health and Humanitarian Supply Chains

Sponsor: Manufacturing and Service Operations Management/ Public Programs, Service and Needs
Sponsored Session

Chair: Paul Griffin, Professor and Department Head, Penn State University, Department of Industrial Engineering, 310 Leonhard Bldg, University Park, PA, 16802, United States of America, pmg14@engr.psu.edu

1 - Impact of Infrastructure in African Health Care Delivery
Jacqueline Griffin, PhD Student, Georgia Institute of Technology, Atlanta, GA, 30309, United States of America, jackie.griffin@gatech.edu, Paul Griffin, Martin Savelsbergh

There are many characteristics of a region that can impact the efficiency of a health care distribution system including the location of health and population centers. We develop a model of a health care allocation system which examines trade-offs in equity, efficiency, and health impact. Using the model, we study the impact of settlement and health center locations on these trade-offs and the value of road infrastructure improvements.

2 - Robust Emergency Transportation Management
Tao Yao, Assistant Professor, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Aharon Ben-Tal, Andreas Thorsen, Byung Do Chung

Emergency problems for large scale transportation systems present challenges because of the inherent uncertainty and the complexity of the transportation systems. The main purpose of this talk is to explore the potential of robust optimization (RO) as a general computational approach to manage uncertainty, feasibility, and tractability for large scale emergency transportation problems including dynamic traffic assignment and transportation network design problems.

3 - Agent-based Simulations of Ambulance Diversion
Reidar Hagtvedt, Visiting Assistant Professor of Healthcare Operations Management, Alberta School of Business, University of Alberta, 2-43 Business Building, University of Alberta, Edmonton, AB, T6G2C7, Canada, hagtvedt@ualberta.ca, Gregory Todd Jones

Ambulance Diversion is a problem that is meant to occur only when a hospital cannot accept new patients in a medically responsible manner. However, anecdotal evidence suggests that decentralized systems for managing emergency departments do not always follow such idealistic guidelines. We apply agent-based simulations to investigate system performance, including efficiency, equality of treatment, as well as premature ambulance diversion, by hospital and government policies, as well as geography.

4 - Reducing TB Incidence in Clinical Settings in Resource Constrained Countries

Christina Scherrer, Southern Polytechnic State University, Industrial Engineering, Atlanta, GA, United States of America, cscherre@spsu.edu, Paul Griffin, Iris Yan, Chantelle Minarcine

With the emergence of multidrug (MDR) and extensively drug (XDR) resistant tuberculosis (TB) and its devastating effect on HIV populations, healthcare providers in resource constrained countries are struggling to find cost-effective ways to reduce incidence. We present an analysis for a variety of interventions under administrative, environmental, and respiratory protection controls for hospital and clinical settings. The resulting tool for site-based recommendations for the CDC is discussed.

■ SB13

C - Room 13B, Level 4

Supply Chain Revenue Management and Pricing

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Sila Cetinkaya, Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States of America, sila@tamu.edu

1 - Vendor's Discount Pricing for Product Groups with Price-Sensitive Demand

Ginger Ke, PhD Student, University of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, y3ke@engmail.uwaterloo.ca, James H. Bookbinder

A vendor offers a group-purchase discount in the case of price-sensitive demand for a set of SKUs, purchased by a single buyer. The problem is analyzed in the framework of a Stackelberg game. In light of the buyer's best reaction to the discount, the vendor determines his discount policy such that his payoff from this policy is maximized. Some insights about the optimal discount scheme are presented.

2 - Contract Design for Inventory and Pricing Decisions Under Stochastic Demand with Slutsky Symmetry

Su Zhao, PhD Student, Texas A&M University, 303K, Zachry Engineering Center, 3131 TAMU, College Station, TX, 77840, United States of America, susy.zhao@gmail.com, Sila Cetinkaya, Eylem Tekin

We study the coordination of inventory and pricing decisions over multiple periods in a decentralized buyer-vendor system. The consumer demand is a price-dependent random variable satisfying "Slutsky Symmetry" and unmet demand is lost. The vendor sets the contract parameters whereas the buyer decides on the order quantity and the retail price. We examine the necessary and sufficient conditions for different contractual mechanisms to achieve system optimal under decentralized decision-making.

3 - When Gray Markets Have Silver Linings: All-unit Discounts, Gray Markets and Channel Management

Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, ming.hu@rotman.utoronto.ca, Mike Pavlin, Mengze Shi

We study unauthorized distribution channels (gray markets) caused by a reseller's response to a supplier's all-unit quantity discount offering. We perform a closed-form analysis of the reseller's optimal pricing, inventory and gray market diversion decisions. We identify conditions under which it is optimal for the profit-maximizing supplier to accommodate gray market diversion.

4 - Integrated Replenishment & Liquidation Decisions for a Capacitated Inventory System

Abhilasha Katariya, Graduate Student, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843, United States of America, abhilashapk@neo.tamu.edu, Sila Cetinkaya, Eylem Tekin

We consider a multi-period, integrated replenishment & liquidation problem for a capacitated supplier facing stochastic demand from two markets: primary & secondary. The supplier must decide how much to produce & how much excess inventory to retain, to maximize expected profits. We prove that the optimal policy is characterized by two critical numbers; namely, produce-up-to & retain-up-to levels. We study the relationship between the policy & model parameters & examine effect on the policy.

■ SB14

C - Room 14, Level 4

Service Quality: Pricing and Information

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Ramandeep Randhawa, University of Southern California, 3670 Trousdale Pkwy, Los Angeles, CA, United States of America, ramandeep.randhawa@marshall.usc.edu

1 - Revenue-maximizing Price-lead Time Menus: Capacity and Strategic Delay Optimality

Philipp Afeche, Assistant Professor, University of Toronto, 105 St. George Street, Toronto, ON, M5S3E6, Canada, afeche@rotman.utoronto.ca

We study the impact of the capacity level on the revenue-maximizing price-lead time menu of a service provider who faces heterogeneous customers with private information on their valuations and delay costs. We identify at what capacity levels it is optimal to use strategic delay to artificially inflate the lead time of the slower class. In certain cases strategic delay is optimal only if capacity is relatively abundant, but in other cases only if capacity is relatively scarce.

2 - Buying From the Babbling Newsvendor: Availability Information and Cheap Talk

Gad Allon, Northwestern University, 2001 Sheridan Road, 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.

3 - Signaling Quality Through Price and Service Rate

Senthil Veeraraghavan, Assistant Professor, Wharton School of Business, University of Pennsylvania, 3730 Walnut Street, Jon M. Huntsman Hall, Suite 500, Philadelphia, PA, 19104, United States of America, Senthilv@wharton.upenn.edu, Laurens Debo

We study how a high quality service firm may set its service rates to differentiate from a low quality service firm, when the firm can neither communicate its service value nor its service rate to customers. Rational agents make joining decisions without observing the service rate or quality. We find that the combination of uncertainty about the quality of the service and the service rate can lead to a higher profits for service firms.

4 - Managing Satisfaction in Relationships Over Time

Ioana Popescu, Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, Singapore, ioana.POPESCU@insead.edu, Sam Aflaki

Consider a firm which has the flexibility to adjust and customize service level in order to manage client satisfaction and retention in a repeat-business context. What is the long term value of such flexibility and how should firms manage the service relationship over time? We propose a dynamic model of a firm-client relationship that relies on behavioral theories and empirical evidence to model the endogenous evolution of customer satisfaction and its impact on repurchase decisions.

■ SB15

C - Room 15, Level 4

Behavior in Competitive Markets

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Wedad Elmaghraby, Robert. H Smith School of Business, Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, Wedad_Elmaghraby@rhsmith.umd.edu

1 - When Does it Pay to Delay Supplier Qualification? Theory and Experiments

Elena Katok, Professor, Penn State University, Smeal College of Business, University Park, PA, 16802, United States of America, ekatok@psu.edu, Zhixi Wan, Damian Beil

We study a procurement setting in which the buyer seeks a low price but will not allocate the contract to a supplier who has not passed qualification screening. The buyer wishes to run a price-only, open-descending reverse auction between the incumbent and the entrant, and faces a strategic choice about whether to perform qualification screening on the entrant before or after the auction. We derive analytical results and test them in the laboratory, with human subjects.

2 - Repeated Distributive Negotiations: How Expectations of Future Transactions Impact Present Behaviors

Shweta Oza, Assistant Professor, Marketing, University of Miami, P.O. Box 248027, Coral Gables, FL, 33124, United States of America, soza@miami.edu, Rajesh Bagchi, Haresh Gurnani, Mahesh Nagarajan

We investigate the role that expectations of future transactions (EFT) play in influencing negotiator behaviors. Our rational model demonstrates that for exogenous probability of FT, behaviors in the current negotiation should remain unaffected by EFT. Using three behavioral experiments, we manipulate EFT and show that negotiator behaviors deviate systematically from model predictions. We also identify a moderator, negotiator role (buyer vs. seller), and investigate how this affects behaviors.

3 - Selling Mechanisms in B2B Secondary Market

Ali Pilehvar, PhD Student, Robert H Smith School of Business, University of Maryland, Van Munching Hall, College Park, MD, 20742, United States of America, apilehva@rhsmith.umd.edu, Mirko Kremer, Wedad Elmaghraby

Disposal of surplus inventory in B2B secondary markets is a challenge for any wholesale liquidator. Challenges include uncertainty in number of the buyers, their valuations as well as product quality. A key decision for the wholesale liquidator is the appropriate choice of selling mechanism, such as auctions or fixed-price markets. We investigate this choice problem by both analytically and empirically studying one of the leading wholesale liquidators of surplus inventory in North America.

4 - Why Should Sellers Prefer Sequential Mechanisms?

Andrew Davis, Penn State University, 462A Business Building, University Park, PA, 16802, United States of America, adavis@psu.edu, Anthony Kwasnica, Elena Katok

We investigate two mechanisms used by sellers where buyers must incur a cost to observe their own private value. In the sequential mechanism, a buyer begins by setting a preemptive bid. A second buyer, upon observing this bid, then decides whether or not to enter an auction and compete with the first buyer. In the auction mechanism, the two buyers compete via an auction without any preemptive bid. We find that, counter to theory, the sequential mechanism generates the greatest revenue.

■ SB16

C - Room 16A, Level 4

Next Generation Wafer Fabs

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Jesus Jimenez, Assistant Professor, Texas State University-San Marcos, Ingram School of Engineering, 601 University Dr, San Marcos, TX, 78666, United States of America, Jesus.Jimenez@txstate.edu

1 - Time Space Tradeoffs in GA Based Feature Selection for Workload Characterization

Clara Novoa, Assistant Professor, Texas State University, 601 University Dr, San Marcos, TX, 78666, United States of America, cn17@txstate.edu, Daniel Lowell, Dan Tamir

This work explores time/space tradeoffs inherent to genetic algorithms (GA) by implementing record keeping mechanisms such as cache implementation to minimize redundancy. The application motivating this work is workload characterization to analyze the power performance of semiconductors through feature selection. The experimental results demonstrate the utility of record keeping in the GA domain by showing a reduction in execution time with virtually the same solution quality.

2 - A Decomposition of Productivity Change in the Semiconductor Manufacturing Industry

Chia-Yen Lee, Texas A&M University, Department of Industrial and Systems Eng, College Station, TX, 77840, United States of America, cylee1980@tamu.edu, Andrew Johnson

This study divides a production system into three components: production design, demand support, and operations. Efficiency is then decomposed via Network Data Envelopment Analysis and integrated into the Malmquist Productivity Index framework. An empirical study using data from 1995 to 2000 for the semiconductor manufacturing industry is presented to demonstrate and validate the proposed method.

3 - AMHS Productivity Detractors Affecting Small Wafer Lot Manufacturing

Jesus Jimenez, Assistant Professor, Texas State University - San Marcos, Ingram School of Engineering, 601 University Dr, San Marcos, TX, 78666, United States of America, Jesus.Jimenez@txstate.edu, Robert Wright

Small-lot-size manufacturing will enable cycle time reductions in next generation semiconductor wafer fabs by reducing the amount of wafers per carrier. However, the automated material handling system (AMHS) may become a critical factor that constraints the capacity of the 12-wafer-lot systems as a result of the increased load that the AMHS will suffer. In this research, AMHS productivity detractors affecting these systems are studied using simulation. Results show improved AMHS performance.

■ SB17

C - Room 16B, Level 4

Edelman Encore Presentation

Cluster: Practice of OR/MS
Invited Session

Chair: Michael Gorman, Associate Professor and J. Berry Endowed Fellow, University of Dayton, School of Business - MIS, OM DSC Dpt., 300 College Park, Dayton, OH, 45419-2130, United States of America, Michael.Gorman@notes.udayton.edu

1 - Improving Water Release Policies on the Delaware River Through Operations Research

Peter Kolesar, Professor Emeritus, Columbia University, 314 Uris Hall, 3022 Broadway, New York, NY, 10027, United States of America, pjk4@columbia.edu

The Delaware River provides half of New York City's water, is a habitat for wild trout and has suffered major floods. We describe the analyses and the politics that led to the implementation of our optimization based "Adaptive Release" framework that improved fish habitat by 200% at no increase in the City's drought risk . In addition to meeting the stated goals, our algorithm offers modest increases in flood protection during the hurricane season, and is simpler to administer.

2 - Inventory Optimization at Procter & Gamble: Real Benefits Through Adoption of Inventory Tools

Sean Willems, Associate Professor of Operations Management, Boston University, SMG 673, 595 Commonwealth Avenue, Boston, MA, 02215, United States of America, willems@bu.edu, William Tarlton, Glenn Wegryn

Four billion times a day, P&G brands touch the lives of people around the world. Familiar brand names - Tide, Crest, Gillette, and 300 more - are supplied to 180 countries via 500 supply networks. P&G leveraged its cross-functional organization with OR in a two-step process. First, spreadsheet models locally optimized. Second, P&G's more-complex supply chains implemented multi-echelon inventory optimization. Today, more than 90% of P&G's business units utilize these inventory management tools.

■ SB18

C - Room 17A, Level 4

Optimization in Practice

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Jeremy F. Shapiro, Professor Emeritus, Massachusetts Institute of Technology, 226 Commonwealth Ave, Boston, MA, 02116, United States of America, jfsinc@attglobal.net

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Optimizing Boat Resources at the U.S. Coast Guard: Deterministic and Stochastic Models

Michael Wagner, Saint Mary's College of California, 380 Moraga Rd, Moraga, CA, United States of America, mrw2@stmarys-ca.edu, Zinovy Radovilsky

We detail the results of an applied research project where we optimally allocate a fleet of boats for the United States Coast Guard. The fleet consists of hundreds of boats of different types, which needs to be allocated to approximately 200 stations on both coasts of the United States, as well as Hawaii and Alaska.

2 - Advanced Analytics for Sales & Operations Planning

Jeremy F. Shapiro, Professor Emeritus, Massachusetts Institute of Technology, 226 Commonwealth Ave, Boston, MA, 02116, United States of America, jfsinc@attglobal.net

Sales & Operations Planning is a methodology for coordinating supply chain and demand management decisions. Many companies have implemented S&OP processes but most rely on software that acquires and integrates relevant data but do not employ advanced analytics - optimization models integrated with descriptive models - to support decision making. We discuss how these analytics can be constructed and applied to S&OP problems arising in industrial commodities and consumer package goods companies.

3 - Modeling and Solving a Large-scale Call Center Network Configuration Problem

Hari Natarajan, University of Miami, Miami, FL, United States of America, hari@miami.edu, Anuj Mehrotra, Geoffrey Meester, Michael Seifert

Service firms are increasingly partnering with independent vendors to create call-center networks that deliver high service quality at low costs. We develop a novel MIP model to configure such a network, addressing the vendor selection and call distribution decisions, while balancing cost and revenue considerations. Results from the application of this approach to data from a large firm suggest that our approach can yield considerable cost savings and additional revenues.

4 - OR Applications at Sears

Mike Baum, Senior Statistical Analyst, Operations Analytics Team, Sears Holdings Management Corporation, 1300 Louis Henna Blvd., Round Rock, TX, 78664, United States of America, Mike.Baum@searshc.com

Sears Holdings Corporation is the nation's fourth largest broad line retailer with approximately 3,900 stores in the US and Canada. The Customer Care Network (CCN) operates 16 call centers within the United States and partners with 5 vendors world wide and answers over 15 million customer calls per year in support or the retail store, online, and service businesses. The CCN analytic team uses O.R. techniques to enhance and improve CCN call center operations.

■ SB19

C - Room 17B, Level 4

Modeling Choice in RM

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Vivek Farias, Massachusetts Institute of Technology, Sloan School, 50 Memorial Drive, Cambridge, MA, United States of America, vivekf@mit.edu

Co-Chair: Devavrat Shah, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D670, Cambridge, MA, United States of America, devavrat@mit.edu

1 - Learning and Earning via Iterated Least Squares

N. Bora Keskin, PhD Candidate, Stanford University, 121 Campus Dr. Apt. 3403A, Stanford, CA, 94305, United States of America, Keskin_Bora@gsb.stanford.edu, J. Michael Harrison, Assaf Zeevi

Consider a price-setter who sells a product over a sequence of time steps, observing demand in each sales period. The seller initially does not know the underlying demand model, but can estimate it using observed demand data. We analyze the performance of a dynamic pricing policy that is based on iterated least squares (ILS). We show that the ILS-based policy can perform very poorly due to its dependence on myopic actions. We then propose modifications that guarantee near-optimal performance.

2 - A New Approach to Choice Modeling

Srikanth Jagabathula, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, jskanth@mit.edu, Vivek Farias, Devavrat Shah

Customer choice models are critical in decision making; however, identifying the 'right' choice model to use is a non-trivial task. Thus motivated, we consider: For a 'generic' model of consumer choice (namely, distributions over preference lists) and a limited amount of data on how consumers actually make decisions (such as marginal preference information), how may one predict revenues from offering a particular assortment of choices? We present a framework to answer such questions.

3 - CDLP-based Bid Prices for Network Revenue Management

Gustavo Vulcano, New York University, 44 West Fourth Street, Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu, Isabel Mendez, Juan Manuel Chaneton, Paula Zabala

The primal solution of the linear programming formulation for choice-based revenue management (CDLP) is known to be effective from a revenue perspective. However, from a practical perspective, there is a representation issue since airline systems are in principle incompatible with those offer sets. In this work, we consider a variation of the CDLP that naturally generates bid-prices. From our exhaustive numerical experiments, their performance is promising.

4 - Sparsity in Conjoint Analysis

Garud Iyengar, IEOR Department Columbia University, IEOR Department Columbia University, New York, NY, United States of America, garud@ieor.columbia.edu

In this talk we will motivate the need for sparse part weight vectors in conjoint analysis and then describe fast algorithms for computing these sparse part weight vectors from data in the presence of customer heterogeneity. We will also contrast our proposed methods with semi-parametric statistical techniques such as the Chinese restaurant process and the Indian buffet process.

■ SB20

C - Room 18A, Level 4

Restaurant's Table Top Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Yihua Li, Researcher, Walt Disney World, Coorporate Building, Orlando, FL, United States of America, yihua.li@disney.com

Co-Chair: Lila Rasekh, Researcher, Walt Disney World, Headquarter, Orlando, FL, United States of America, lila.rasekh@gmail.com

1 - Linear Model with Table Combination - A Revenue Management Approach

Yihua Li, Researcher, Walt Disney World, Coorporate Building, Orlando, FL, United States of America, yihua.li@disney.com

This presentation provides an alternative modeling approach to table top revenue management. This linear model enables table combination to satisfy demand from large groups. Compared with alternative models which do not allow table combination, the proposed model brings a substantial amount of additional revenue each year according to the test using operations data.

2 - Market Basket Allocation From Transactional Data: A Heuristic Approach

Jerry Han, Disney, 1375 Buena Vista Drive, Lake Buena Vista, FL, 32830, United States of America, jerry.han@disney.com, Anjali Dange, Laura Beri

An allocation algorithm based on transactional analysis was developed to provide insights into individual purchase patterns within transactions that represent purchases of several individuals. Purchases within each transaction are broken down into individual "basket combinations" according to their relative strength of connections. This method helps identify the impact of product/menu/price changes on purchase patterns as well as strategic impacts for the entire basket purchase patterns.

3 - Forecast Reconciliation Method for a Restaurant Revenue Management SYSTEM (RMS)

Mehmet Gulsen, Walt Disney, Orlando, FL, United States of America, Mehmet.Gulsen@disney.com

The complexity of the demand hierarchy in RMS makes it difficult to implement a straight top-down or bottom up approach. Furthermore, the length of booking window varies significantly from one restaurant to another which makes booking curve based (i.e. pick up) forecasting models less useful. One solution is to employ different forecasting methods in parallel and then consolidate multiple forecasts into a final one based on the characteristics of each restaurant.

4 - A Revenue Management Approach to the Table Top Reservation

Lila Rasekh, Researcher, Walt Disney World, Headquarter, Orlando, FL, United States of America, lila.rasekh@gmail.com

This research is based on the table reservation practice for restaurant business In this paper we present a unique linear model to optimally assign reservations sequentially to table tops to maximize the utilization of the dining tables and their seating capacity in terms of the total revenue. A heuristic provides a quality initial solution to expedite the branch and bound process.

5 - Testing Some Restaurant Revenue Management Models

Bruce Wang, Assistant Professor, Texas A&M University, 3136 TAMU, Zachry Department of Civil Engineering, College Station, TX, 77843, United States of America, bwang@tamu.edu, Yihua Li, Lila Rasekh, Kai Yin

Some optimization models for the restaurant table reservation system have been developed. These static models determine allocation of tables to customer requests with an objective to maximize the total revenue. The presentation will focus on the numerical performances and some analytical results of the models.

■ SB21

C - Room 18B, Level 4

Improving Healthcare Processes

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 - Standardization and its Implications for Service Quality - Evidence From German Hospitals

Roman Mennicken, Research Associate, University of Cologne, Albertus-Magnus-Platz, Cologne, 50923, Germany, mennicken@wiso.uni-koeln.de, Desdemona Hucke, Ludwig Kuntz

The impact of increasing standardization on quality in service delivery is unclear. We assess the level of standardization with variations in the service time of 70 German hospitals. In-hospital mortality for specific diagnoses is used to assess service quality. Using econometric analyses we identify a clear curvilinear relationship between service quality and level of standardization. While too much or too little worsens service quality, an optimum level can be achieved.

2 - Collaborative Healthcare using Medical Service Cyberinfrastructure

John Jung-Woon Yoo, Assistant Professor, Bradley University, 408 Morgan Hall, Peoria, IL, 61625, United States of America, jyoo@bradley.edu

Medical service providers are not active in sharing their services with other providers. Instead, they provide referrals, which often cause redundant services. In this talk, we define medical operations, examinations, or consultations as medical services and propose a cyberinfrastructure that can provide collaborative healthcare services, in which XML-based medical service description language plays an important role in defining medical services.

3 - Patient Impatience: Merging Process Analysis Techniques to Improve Healthcare Efficiency

John Dulin, Concurrent Technologies Corp, 771 Fairdale Ct, Castle Rock, CO, 80104, United States of America, dulinj@ctc.com, Dave Davis, Norm Reitter, Ashlee Knapp

If a patient's journey through a healthcare organization can be accurately modeled and analyzed with a clear vision of easing the restricting effects of limited funding, increased demand, and reduced resource availability, then various techniques can be effectively merged to establish a successful performance improvement plan. We will demonstrate a flexible general hospital model that we have developed for scenario-based comparisons using simulation software and real-world planning factors.

4 - Doctors, Health Care, and Management Science: Where do They Meet?

Steve Barrager, Publisher, BakerStreetPublishing.com, 2703 Broderick Street, San Francisco, CA, 94123, United States of America, publisher.bakerstreet@gmail.com

I am a highly trained management scientist with over thirty years of professional experience. Three years ago I was diagnosed with Multiple Myloma, a rare bone marrow cancer. Thanks to modern medicine my cancer is now in almost complete remission. To prepare for this talk, I took my patient hat off and put my management scientist hat on. I interviewed several of my doctors. I asked them what my profession could do to help them. This talk summarizes what I learned.

■ SB22

C - Room 18C, Level 4

Improving Sales Productivity

Sponsor: Service Science
Sponsored Session

Chair: Yingdong Lu, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, yingdong@us.ibm.com

1 - Analyzing the Effectiveness of a Loyalty Program: A Case Study in Automobile Industry

Hyun-Jin Kim, Pohang University of Science and Technology, Pohang, Korea, Republic of, brightst@postech.ac.kr, Kwang-Jae Kim, Ryeok-Hwan Kwon

A loyalty program is now a popular marketing tool in various industries. It typically provides customers with loyalty incentives such as membership points redeemable for discounts or prizes and free additional services to induce customers' repurchase. However, its effectiveness is not always guaranteed. In this talk, we present how the structural equation modeling (SEM) can be used to measure and analyze the effectiveness of a loyalty program. A case study on the loyalty program of an automobile manufacturing company is also presented.

2 - Dynamic Modelling of Online Consumer Decision Making Process

K. Nadia Papamichail, Senior Lecturer in Information and Decision Systems, Manchester Business School, University of Manchester, Booth Street West, Manchester, M15 6PB, United Kingdom, nadia.papamichail@mbs.ac.uk, Sahar Karimi, Christopher Holland

In this paper a dynamic model of online consumer behaviour is proposed and tested using focus groups and video-based assessments of individual online users. A multi-sector approach is taken. The results suggest that purchase decision making on the Internet is highly dynamic. It is influenced by the interaction of consumers with their online environment. In addition, online research and purchase behaviour of customers, and the factors that affect their behaviour vary across different sectors.

3 - Relationship Between Consumer Valuation Distribution and Subscription Pattern in IT Services

Hyoduk Shin, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, hyoduk-shin@kellogg.northwestern.edu, Marius Florin Niculescu, Seungjin Whang

We present an analytical relationship between consumer valuation distribution and aggregate subscription pattern over time in the information technology services industry under network externalities. We build up a microeconomics model and a theory based on consumer utility to explain the observed subscription pattern. We illustrate our results empirically using historical data for mobile data services in the Japanese market.

4 - A Framework for Sales Force Productivity Profile Estimation

Mayank Sharma, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, mxsharma@us.ibm.com, Moninder Singh, Aleksandra Mojsilovic

Salesforce productivity, defined roughly as the revenue potential of an employee, is an important metric in evaluating the profitability of a sales organization. Understanding and effectively managing sales productivity profiles would allow a business to improve its earnings without necessarily growing the salesforce. We present a framework for inferring the time-varying productivity profiles of the sales-force, based on the analysis of historical sales data from an ERP system.

■ SB23

C - Room 18D, Level 4

Service Innovation in Developing Economies II

Sponsor: Service Science
Sponsored Session

Chair: Janny Leung, CUHK, SEEM Dept, CUHK, Hong Kong, Hong Kong - PRC, janny@se.cuhk.edu.hk

1 - Handling Medical Emergency Situations in Developing Economy - An Innovative Workflow Model

Sreya Chattopadhyay, Doctoral Student, University of Rajasthan, J L Nehru Road, Gandhi Cricle, Jaipur, RJ, 302055, India, sreyaonline@gmail.com, Nilanjan Chattopadhyay

This article proposes a workflow model to prioritize critical patients in emergency situations. In developing countries, infrastructure cannot support sudden increase in demand of medical attention. This will integrate a unique easy-identifiable coding into the basic patient registration system in the hospital. The coding system helps in identifying the critical patients easily, passing on the information to a network and ensuring prompt treatment for critical patients.

2 - A Simulation Study on Patient Flows for a Hospital Emergency Department

Janny Leung, CUHK, SEEM Dept, CUHK, Hong Kong - PRC, janny@se.cuhk.edu.hk, Yong Hong KUO

In this talk, we present a staffing problem faced by the Accidents and Emergencies Department at Prince of Whales Hospital in Hong Kong. A simulation approach is adopted to analyze how the staffing decision impacts on the patient flows. Simulation techniques for incomplete data are also discussed.

3 - Prospective Surveillance of Healthcare Outcomes by False Discovery Rate Control

Yanting Li, Assistant Professor, Shanghai Jiaotong University, Dongchuan Road 800, Shanghai, SH, 200240, China, ytli@sjtu.edu.cn, Fugee Tsung

The statistical CUSUM charts have been envisaged as powerful tools for healthcare surveillance. We study the multiplicity problem caused by huge numbers of health-care units under surveillance. Multiple Binomial and Poisson CUSUM charts incorporating False Discovery Rate control is proposed to tackle such a problem. The procedures for establishing the new control schemes are presented and their performance is evaluated. The methods for obtaining the p-values of the CUSUM statistics are provided.

■ SB24

C - Room 19A, Level 4

Planning for Extreme Weather Events I

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Melike Baykal-Gursoy, Associate Professor, Rutgers, 96 Frelighuysen Rd., Piscataway, NJ, 08854-8018, United States of America, gursoy@rci.rutgers.edu

1 - Emergency Shelter Location and Allocation During Extreme Weather Events

Melike Baykal-Gursoy, Associate Professor, Rutgers, 96 Frelighuysen Rd., Piscataway, NJ, 08854-8018, United States of America, gursoy@rci.rutgers.edu, Sara Ghorbani

We present stochastic optimization models that assign vulnerable populations to health care centers based on their condition. We categorize people into three groups depending on their having; cardiovascular, respiratory, or dehydration problems. Demand for health care is random so is mortality due to the lack of treatment. Our objective is to minimize the increase in the mortality rate during extreme heat events.

2 - Vehicle Routing and Evacuations

Douglas Bish, Assistant Professor, Grado Department of Industrial and Systems Engineering, Virginia Tech, Blacksburg, VA, 24061, United States of America, drb1@vt.edu

When evacuating a region because of a threat, care must be given to consider the segment of the population that requires specialized evacuation services due to a lack of access to an appropriate vehicle. We study the use of variants of the vehicle routing problem as applied to evacuation management, including the consideration of evacuee behavior and evacuation management issues.

3 - The Use of Hospitalization Records for Assessing Effects of Extreme Weather Events

Elena Naumova, Professor, Tufts University, 136 Harrison Avenue, Boston, MA, 02111, United States of America, elena.naumova@tufts.edu

Due to extreme heat people undergo physiological adaptive processes that compromise immune function, exacerbate chronic health conditions, and increase susceptibility to infections. Failure to consider delays between timing of exposure and medical care utilization results in severe underestimation of health effects. Surge in hospitalizations, given fixed capacities, not only depends on susceptibility to exposure and heterogeneity of affected population, but also time-distributed dose-responses.

■ SB25

C - Room 19B, Level 4

Joint Session SPPSN/MIF/ TSL: Humanitarian Logistics

Sponsor: Public Programs, Service and Needs/ Minority Issues/ Transportation Science and Logistics Society
Sponsored Session

Chair: Lauren Davis, Assistant Professor, North Carolina A&T State University, 1601 E. Market St., 424 McNair Hall, Greensboro, NC, 27411, United States of America, lbdavis@ncat.edu

1 - Inventory Control Strategies for Uncertain Demand Disruptions Considering Forecasted Storms

Kandace Ballard, Auburn University, 793 Tracy Ct., Auburn, AL, United States of America, kcn0001@auburn.edu, Emmett Lodree

When retailers are faced with an uncertain demand surge, we propose that retailers should select an ordering strategy instead of a specific quantity. If a retailer chooses a reactive strategy, they will maintain their order quantity until the surge is observed, and if they are proactive, they will increase their order quantity before the surge occurs. Minimax decision criterion is used to determine which inventory ordering strategy the retailer should choose considering lead-time and lost sales.

2 - Improving Collaboration for Emergency Resource Allocation

Karl Pfeiffer, Assistant Professor, Naval Postgraduate School, Dept of Information Sciences, 1411 Cunningham Rd, Monterey, CA, 93943, United States of America, kdpfeiff@nps.edu, Man-Tak Shing, Shawn Kelly, Corey Mazcyk

In many emergencies, key resources are supplied and distributed through government agencies, businesses, charities and other organizations. While these entities may have efficient internal methods for communication and coordination, global collaboration is often hindered by political, social, and technological challenges. This research offers a framework for an open software solution enabling collaboration and coordination among suppliers, logistics organizations, and those managing need.

3 - Logistics Planning for Short-term Needs of Evacuees

Mark Turnquist, Professor, Cornell University, Civil & Environmental Eng'g, Hollister Hall, Ithaca, NY, 14853, United States of America, mark.turnquist@cornell.edu, Carmen Rawls

Natural disasters often result in large numbers of evacuees being temporarily housed in schools, churches, etc. The sudden influx of people seeking shelter creates demands for emergency supplies which must be delivered quickly. A dynamic allocation model is constructed to optimize pre-event planning for meeting short-term demands (over approximately the first 72 hours) for emergency supplies under uncertainty about what demands will have to be met and where those demands will occur.

4 - A Framework for Analyzing Uncertain Supply in a Humanitarian Supply Chain

Lauren Davis, Assistant Professor, North Carolina A&T State University, 1601 E. Market St., 424 McNair Hall, Greensboro, NC, 27411, United States of America, lbdavis@ncat.edu, Daniel Mota

During times of disaster relief supplies can come in the form of donations which vary in quantity, condition, and receipt timing. The management of these donations can be somewhat complex and hamper the relief effort. We present a framework that analyzes the impact of these donations and provide insight on how the humanitarian supply chain could benefit from improved coordination and information.

■ SB26

C - Room 4A, Level 3

Data Mining Best Student Paper Award Presentations I

Sponsor: Data Mining
Sponsored Session

Chair: Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, United States of America, jpbrooks@vcu.edu

1 - Hidden-Markov Model based Sequential Clustering for Autonomous Diagnostics

Akhilesh Kumar, Doctoral Candidate, ISE, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States of America, ax5266@wayne.edu, Finn Tseng, Yan Guo, Ratna Babu Chinnam

We present a novel approach for autonomous diagnostics that employs model-based sequential clustering with hidden-Markov models as a means for measuring similarity of time-series sensor signals. The proposed method has been tested on a CNC machining test-bed outfitted with thrust-force and torque sensors for monitoring drill-bits. Preliminary results revealed the competitive performance of the method.

2 - Interpretable Classifiers From Association Rule Conditions and Markov Boundary Pruning

Houtao Deng, Research Associate, Arizona State University, APT 16 East Orange Street 1020, Tempe, AZ, 85281, United States of America, hdeng3@asu.edu, George Runger, Eugene Tuv

Associative classifiers (ACs) attempt to integrate the simplicity of association rules with classification and their high accuracy makes them promising. However, the combination of many rules often results in models that are difficult to interpret. This research integrates rule ranking, pruning and summarizing together and generates an AC based on rule conditions. Experiments illustrate improved interpretability without loss of accuracy over a state-of-the-art AC and decision trees.

3 - Joint Estimation of Multiple Graphical Models

Jian Guo, University of Michigan, 269 West Hall, 1085 South University, Ann Arbor, MI, 48109, United States of America, guojian@umich.edu, Ji Zhu, Elizaveta Levina, George Michailidis

This paper develops an estimator appropriate for data from several graphical models that share the same variables. This model jointly estimates the graphical models corresponding to the different categories present in the data, aiming to preserve the common structure, while allowing for differences between the categories. We establish the asymptotic theory, and illustrate the superior performance on simulated networks and the term networks estimated from webpages.

4 - Tangent Hyperplane Kernel Principal Component Analysis for Denoising

Joon-Ku Im, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60208, United States of America, ijk@u.northwestern.edu, Daniel Apley

Kernel principal component analysis (KPCA) is a method that can be used for denoising multivariate data. Using geometric arguments, we demonstrate a projection operation inherent to all existing KPCA denoising algorithms can sometimes cause poor denoising, and we propose a modification to the projection operation that remedies this problem. Using toy examples and a real data set, we demonstrate that the proposed algorithm can substantially improve denoising performance.

5 - Stochastic Search with an Observable State Variable
Lauren Hannah, Postdoctoral Researcher, Dept of Statistical Science, Duke University, Box 90251, Durham, NC, 27708, United States of America, lhannah@princeton.edu

Many stochastic, convex optimization problems have behavior that depends on an observable state variable. We use machine learning to take observations from the joint state-outcome distribution and use them to infer the optimal decision for a given observed state. We propose two solution methods: function based optimization and gradient based optimization. These methods are tested on the hour ahead wind commitment problem and a multi-product newsvendor problem.

■ SB27

C - Room 4B, Level 3

Network Search and Interdiction

Sponsor: Computing Society
Sponsored Session

Chair: J. Cole Smith, Professor, University of Florida, Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, cole@ise.ufl.edu

1 - Edge Search for an Immobile Hider with Imperfect Detection Probability
Shantih Spanton, University of Florida, Department of Industrial and Systems Eng, P.O. Box 116595, Gainesville, FL, 32611, United States of America, sspanton@ufl.edu, J. Cole Smith, Joseph Geunes

We consider the problem detecting an immobile hider on a network with a single searcher. Each arc has a weight that represents the likelihood the hider may be found on the link. After traversing an arc, the weight of this arc is decreased at a rate proportional to some detection probability. We examine the problems of maximizing the probability of finding the hider within some time limit, and minimizing the expected time until the hider is detected.

2 - Interdicting a Maximum Flow Network in Two-dimensional Euclidean Space
Kelly Sullivan, University of Florida, Department of Industrial and Systems Eng, P.O. Box 116595, Gainesville, FL, 32611, United States of America, kmsullivan@ufl.edu, J. Cole Smith

We consider a maximum flow network whose nodes and arcs lie in a two-dimensional Euclidean space. An interdictor chooses a coordinate location to attack, thus reducing the capacity of surrounding arcs. A defender then solves a maximum-flow problem on the resulting network. We formulate the problem of choosing an attack location that minimizes the defender's maximum flow, and use a branch-and-cut approach to solve the problem.

3 - An Integer-programming-based Approach to the Geometric Covering Salesman Problem
Behnam Behdani, PhD Student, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, behdani@ufl.edu, J. Cole Smith

The geometric covering salesman problem (GCSP) is a generalization of the TSP in which the salesman must visit at least one point in a compact vicinity of each city. We develop an integer-programming-based scheme to solve this problem by providing a sequence of upper and lower bounds for the optimal solution. These bounds are obtained by solving instances of the covering tour problem. We develop equivalent formulations that provide better bounds and propose several groups of valid inequalities.

■ SB28

C - Room 4C, Level 3

Multivariate Analysis and Quality Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Justin Chimka, University of Arkansas, 800 W Dickson St, Fayetteville, AR, United States of America, jchimka@uark.edu

1 - The Application of Higher-order Polynomial Models to Nanoparticle Manufacturing
Paul Goethals, Clemson University, Freeman Hall 150, Clemson, SC, 29634, United States of America, pgoetha@clemson.edu, Byung Rae Cho

Unlike the traditional production process, manufacturing at the nano-level requires a greater degree of statistical control and enhanced predictive capability. The tools and methods currently used do not adequately support the level of product quality necessary in the development of nanomaterials. This research specifically addresses the implementation of new statistical techniques that are more suited for advancing the quality of nanomanufactured products and processes.

2 - Developing Quality Control Standards to Evaluate Microarray Studies
Jing Wu, University of Arkansas, 800 W Dickson St, Fayetteville, AR, United States of America, jxw067@uark.edu, Justin Chimka

We show how clustering and logistic regression can be used to establish working parameter thresholds relevant to the quality of a DNA microarray image.

3 - R&R Studies for Functional Data
Flavio Fogliatto, Professor, UFRGS - Federal University Rio Grande do Sul, Av. Osvaldo Aranha, 99 - 5o andar, Porto Alegre, RS, 90035-190, Brazil, ffogliatto@producao.ufrgs.br, Alexandre Pedott

We present a method to analyze a measurement system's (MS) performance in a functional data analysis context, based on repeatability and reproducibility (R&R) studies. Functional data are a collection of data points organized as a profile or curve. In the proposed method we adapt ANOVA to be used in MS analysis using distances between curves. Three ANOVA approaches are proposed and applied in a simulated R&R study conceived to analyze scenarios in which the MS was approved or rejected.

4 - A 0-1 Quadratic Program for the Case of Missing Data in Regression
Brian Smith, University of Arkansas, 800 W Dickson St, Fayetteville, AR, United States of America, bks07@uark.edu, Heather Nachtmann, Justin Chimka

The problem of choosing what columns and rows with missing data should be discarded before regression analysis will be mathematically formulated and shown to fit the QP description with a caveat that every variable must equal 0 or 1.

■ SB29

C - Room 5A, Level 3

Systems Reliability and Maintenance

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Zhigang Tian, Assistant Professor, Concordia University, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca

Co-Chair: Joe Alex Granado, Research Assistant, Texas State University, 601 University Drive, San Marcos, TX, United States of America, jg1509@txstate.edu

1 - Optimal Planning of Life-depleting Maintenance Activities
Anahita Khojandi, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, United States of America, anahitakhojandi@gmail.com, Lisa Maillart, Oleg A. Prokopyev

We consider a system with a known, deterministic initial lifetime that generates reward at a rate that decreases as the virtual age of the system increases. Maintenance can be performed to reduce the virtual age of the system; however, maintenance also shortens the remaining lifetime of the system. Given this tradeoff, we analyze the lifetime-reward-maximizing maintenance interval under various scenarios.

2 - Post-Pareto Optimality for Multiple Objective Problems using Self Organizing Trees
Heidi Taboada, Assistant Professor in Industrial, Manufacturing and Systems Engineering, Univeristy of Texas at El Paso, 500 W. University Ave., El Paso, TX, United States of America, hataboada@utep.edu, Oswaldo Aguirre

The solution to a multiple objective problem is usually not a single solution but a set of Pareto-optimal solutions. A new method based on self-organizing trees for reducing the size of Pareto-optimal sets is presented. The method is tested on several examples resulting from multiple objective formulations of network reliability problems.

3 - Power Systems Optimization using Genetic Algorithms
Jose Espiritu, Assistant Professor in Industrial Engineering, Univeristy of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, jfespiritu@utep.edu, Vasukumar Chenna

A new genetic algorithm is developed and applied to a radial distribution configuration to obtain optimal replacement policies over a finite time horizon subject to budget constraints. The algorithm considers two decisions to be made at the beginning of each time period which are to either keep the component in the system for one more period or replace it with a new one. The main objective is to minimize the total costs taking into account maintenance, unavailability and purchase costs.

4 - Condition Based Maintenance of Multi-component Systems using Prognostics Information
Zhigang Tian, Assistant Professor, Concordia University, 1515 Ste-Catherine Street West, EV-7.637, Montreal, QC, H3G 2W1, Canada, tian@ciise.concordia.ca, Jialin Cheng

In a multi-component system, economic dependency exists among the maintenance activities on the components. At the component level, prognostics can be performed to obtain the predicted failure time distribution for each component. In this paper, we propose a condition based maintenance of multi-component systems using component-level prognostics information. A numerical method is proposed for the cost evaluation of the proposed maintenance policy.

5 - Maintenance and Spare Provisioning for Wind Turbines with Reliability Growth and Dynamic Population
Tongdan Jin, Texas State University, 601 University Drive, San Marcos, TX, 78666, United States of America, tj17@txstate.edu, Caiwen Zhang, Joe Alex Granado

Maintenance policies are often devised based on the assumption that, after the repair, the system returns to the state as good as new, as good as old, or somewhere in between. In this study, we propose an optimal maintenance strategy for wind turbines under reliability growth with time-varying system populations. Optimal spare provisioning will be developed based on both the equipment reliability and predicted in-service size of equipment.

■ SB30

C - Room 5B, Level 3

NSF Workshop on Sensing and Prognostics Issues in Manufacturing: A Recap

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Satish Bukkapatnam, Professor, Oklahoma State University, 318, Enginnering North, School of Industrial Engineering, Stillwater, OK, 74075, United States of America, satish.t.bukkapatnam@okstate.edu

1 - Produced in the U.S. using Nano Manufacturing
Richard Wysk, Dopaco Chair, NC State University, Daniels Hall, Department of Ind and Systems Engr, Raleigh, NC, 27695, United States of America, rawysk@ncsu.edu, Rohan Shirwaiker

The world has been waiting for the onslaught of nano products but appears disappointed that there are so few. This talk presents a view of nano manufacturing from a manufactured feature-based perspective. That is, many of the products that we use every day have lots of nano scale features and tolerances. A description of the growth of these processes and features is presented.

2 - Reliability Modeling and Prediction of Ultra-thin Diodes
Elsayed Elsayed, Rutgers University, 96 Frelinghuysen Rd, Industrial and Systems Engineering, Piscataway, NJ, 08854, United States of America, elsayed@rci.rutgers.edu, Haitao Liao, Qiang Huang

We develop a reliability assessment and prediction degradation model for ultra-thin metal-insulator-metal (MIM) diodes. The relationship between applied voltage and measured current over time are utilized in estimating the reliability characteristics. Validation of the model is conducted using nanometer scale gate oxide data.

3 - In-Situ Process Control for Nanopowder Scale-up Production
Jianjun Shi, Georgia Institute of Technology, 755 Ferst Dr. NW, Atlanta, GA, United States of America, jianjun.shi@isye.gatech.edu, Chia-Jung Chang

Nanopower production scale up is an important, yet a challenging task. It is not just a straight-forward expansion of the current manufacturing system in terms of production capability, but also demands innovative in-situ process control. The potential variability sources in the system are multifold and hence increase the control complexity. In this work, we develop in-situ process control and variation reduction methodology, as well as associated tools, for the scale up nanopowder production.

4 - Group Report on Diagnostics and Prognostics
Soundar Kumara, Pearce Chair Professor, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, skumara@psu.edu

Important research problems and future research directions related to diagnostics and prognostics will be discussed. The overall recommendations of the group will be presented.

5 - NSF Workshop on Sensing and Prognostics Issues in Nanomanufacturing
Satish Bukkapatnam, Professor, Oklahoma State University, 318, Enginnering North, School of Industrial Engineering, Stillwater, OK, 74075, United States of America, satish.t.bukkapatnam@okstate.edu, Ranga Komanduri, Sagar Kamarthi, Abe Zeid

This session attempts to disseminate the outcomes from a recent workshop on Sensing and Prognostics issues in nanomanufacturing, recently held in Boston, MA. A panel discussion will follow overview presentations from domain experts.

■ SB31

C - Room 5C, Level 3

Joint Session DM/ QSR: Quality and Statistical Decision Making in Health Care Applications I

Sponsor: Data Mining/ Quality, Statistics and Reliability
Sponsored Session

Chair: Jing Li, Assistant Professor, Industrial Engineering, Arizona State University, Tempe, AZ, United States of America, jing.li.8@asu.edu

Co-Chair: Hui Yang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States of America, huiyang@usf.edu

1 - Diagnostic Monitoring of Outcomes in Healthcare
Li Zeng, Assistant Professor, University of Texas at Arlington, Industrial & Manuf. Sys. Engr. Department, Arlington, TX, 76019-0017, United States of America, lzeng@uta.edu

Outcomes in medical processes are important measures of care providers' performance. Monitoring of outcomes is critical for detecting performance changes and ensuring the delivery of high-quality care. This study presents an outcome monitoring scheme which can not only detect changes, but also indicate the types of change, which is helpful information for root cause identification.

2 - Wavelet Multifractal Analysis and Synthesis of Heartbeat Dynamics
Hui Yang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States of America, huiyang@usf.edu, Yun Chen

This paper presents a novel approach for the analysis and synthesis of multifractal heartbeat dynamics using the wavelet transformation. The new approach not only statistically characterizes but also numerically simulates the scaling properties of heart rate variability (HRV) signals with wavelet lenses. Experimental results show that the proposed approach is promising to solve forward and inverse fractal problems.

3 - An Exact Approach for Multiple Instance Classification
Mohammad H. Poursaeidi, University of Houston, E206 Engineering Bldg. 2, Houston, TX, 77204, United States of America, mhpoursaeidi@uh.edu, Erhun Kundakcioglu

We investigate the classification problem within the Multiple Instance Learning (MIL) context that can be used for drug design, identification of proteins, and content based image retrieval. We present new formulations and enhanced one formulation via a hierarchy of continuous relaxations. Experimental results show that the proposed exact approach outperforms previous methods in terms of solution time.

■ SB32

C - Room 6A, Level 3

Hybrid Methods I

Sponsor: Computing Society
Sponsored Session

Chair: John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu

1 - Faster Integer Feasibility in MIPs by Branching to Force Change
John Chinneck, Professor, Carleton University, Systems and Computer Engineering, 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.

2 - Polyhedral Results for Alldifferent Systems
David Bergman, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, bergman.david1@gmail.com, John Hooker

We study the convex hull of integer points satisfying multiple alldifferent constraints. We describe general results for the facial structure of the polytope and describe several classes of facets for particular families of alldifferent systems. We discuss how to separate the inequalities and implement the separation algorithms for a particular family of alldifferent systems. We find that the facets can significantly tighten the relaxation when the constraints have many variables in common.

3 - Logic-Based Benders Decomposition for the Home Health Care Problem
Andre Cire, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, andrecire@cmu.edu, John Hooker, Stefan Heinz

The Home Health Care problem (HHC) consists of scheduling nurse visits to patients in their homes, a growing industry due to its advantages over institutional care. The problem is well suited to hybrid approaches, naturally decomposing into an assignment (nurse/patient allocation) and a scheduling (visit times) portion. We use logic-based Benders decomposition to tackle a specific HHC faced by a German industrial partner. Experiments performed over real-world instances are presented.

■ SB33

C - Room 6B, Level 3

Joint Session ICS/ QSR: Complex Computer Models

Sponsor: Computing Society/ Quality, Statistics and Reliability
Sponsored Session

Chair: Peter Qian, University of Wisconsin-Madison, 1300 University Ave, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

1 - Designs for Data Pooling
Devon Lin, Queen's University, Department of Math and Stats, 48 University Ave, Kingston, ON, K7L 3N6, Canada, cdlin@mast.queensu.ca, Peter Qian

With the availability of similar studies, it is increasingly important to combine the results of respective studies. We refer this process to as data pooling. Although there exist many modeling methods for such a process, the issue of data collection is new. In this talk, we will address this important issue. In addition, we will introduce a new type of designs for data pooling. Statistical properties of such designs are discussed and illustrated.

2 - Fractional Brownian Random Fields for Kriging
Daniel Apley, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, apley@northwestern.edu, Ning Zhang

Fractional Brownian random fields (FBRFs) have a number of very attractive properties as spatial random process models for kriging. However, they are not as widely used as other, stationary models. We argue that FBRFs provide convenient and effective solutions to a number of problems associated with stationary spatial random process models in kriging.

3 - Reduction of Model Complexity and the Treatment of Discrete Inputs in Computer Model Emulation
Curtis Storlie, Los Alamos National Laboratory, P.O. Box 1663, MS F600, Los Alamos, NM, 87545, United States of America, storlie@lanl.gov, Brian Reich

When computer models are computationally demanding, emulator approaches to their analysis have been very useful. The input vector to many models is of very high dimension and some of the input variables can be discrete in nature (e.g., pointer variables to alternative models or different materials, etc.). We propose two new approaches that tackle the high dimensionality problem through variable selection and functional ANOVA model construction while accounting for discrete valued inputs.

4 - Weighted Space-filling Designs for Deterministic Computer Codes
Dave Woods, Lecturer in Statistics, University of Southampton, School of Mathematics, University of Southampton, Southampton, SO17 1BJ, United Kingdom, D.Woods@soton.ac.uk

We investigate methods of incorporating known dependencies between variables into design selection for computer codes. Adaptations of computer-generated coverage designs are considered, with "distance" between two input points redefined to include a weight function. The methods can include quantitative and qualitative variables, and different types of prior information. The different approaches are demonstrated through interrogation of a computer model for atmospheric dispersion.

■ SB34

C - Room 7, Level 3

Computational Advances in Freight Terminal Operations

Sponsor: Computing Society
Sponsored Session

Chair: Mihalis Golias, University of Memphis, 104 Engineering Science Bldg, 3815 Central Avenue, Memphis, TN, 38152, United States of America, mihalisgolias@yahoo.com

1 - A Network Flow Approach for Optimal Truck Assignment and Scheduling at Crossdocks
Ti Zhang, Graduate Research Assistant, UT Austin, UT Austin CTR 1 University Station C1761, ECJ 6.2, Austin, TX, 78712-0278, United States of America, tizhang@mail.utexas.edu, Travis Waller, Chi Xie

Various crossdock assignment and scheduling problems have been formulated into integer programming models, which cause solution tractability difficulties for large-scale applications. This talk presents an innovative network model for an integrated crossdock assignment and scheduling problem. In particular, we propose a multicommodity flow model, where the truck-to-door assignment is specified by a set of side constraints and the truck sequencing is fully accommodated by network flow routing.

2 - Berth Scheduling at Marine Container Terminals Under Uncertainty
Georgios Kolomvos, Research Associate, Kathikas Institute of Research and Technology, 303 Ryefield Ridge, Columbia, M0, 65203, United States of America, kolomvos@gmail.com, Stephanie Ivey, Georgios Saharidis, Mihalis Golias

We formulate the stochastic vessel handling times berth scheduling problem as a deterministic bi-objective problem. A Genetic Algorithms based heuristic and a simulation based Pareto pruning algorithm are proposed to solve the resulting problem. Computational examples show that the proposed approach provides a robust schedule and outperforms berth scheduling policies where the expected values of the vessel handling times are used.

3 - Truck Scheduling at a Cross-dock Facility: Accounting for Travel Time Variability
Jeffery Karafa, Research Assistant, University of Memphis, 112A Engineering Science Bldg, 3815 Central Ave, Memphis, TN, 38152, United States of America, jefferykarafa@yahoo.com, Georgios Saharidis, Mihalis Golias, Georgios Kolomvos

We deal with the scheduling of trucks at a cross dock facility where we assume that truck arrival times are stochastic variables with unknown distributions. A modeling framework based on the concept of games is discussed along with a number of solution algorithms.

4 - Simulating the Impact of Various Quay Operational Protocols on Container Load/Unload Efficiency
Greg Harris, Director, Center for Management and Economic Research, University of Alabama in Huntsville, Huntsville, AL, 35899, United States of America, harrisg@uah.edu, Bernard Schroer, Dietmar Moeller

A major issue facing container terminals is how to effectively and efficiently operate expensive resources. Two quay operational protocols are evaluated. A simplified and rapid approach to data collection is presented. Asking the appropriate questions through interviews with personnel directly involved with the application is very important and can be effective, time saving approach to obtaining data. Results of the different scenarios are presented.

■ SB35

C - Room 8A, Level 3

Nonparametric Methods for Learning and Stochastic Optimization

Sponsor: Applied Probability
Sponsored Session

Chair: Andrew Lim, University of California, Berkeley, 4141 Etchverry Hall, Berkeley, CA, 94720, United States of America, lim@ieor.berkeley.edu

1 - First-order Spread Information for Minimax Regret Inventory Problems

Joline Uichanco, PhD Candidate, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, uichanco@mit.edu, Retsef Levi, Georgia Perakis

We study a newsvendor whose objective is to minimize the maximum regret over all distributions with the same mean and spread. We introduce a first-order measure of spread and propose a data-driven procedure for building confidence bounds on the spread given only samples drawn from the true distribution. As the critical quantile increases, the mean-variance regret solution tends to be too conservative; whereas the mean-spread regret solution is close to the optimal solution.

2 - The Generalized Restless Bandit Problem: Algorithms and Applications

Adrian Becker, Massachusetts Instititute of Technology Operations Research Center, 77 Massachusetts Ave, Bldg E40-135, Cambridge, MA, 02139, United States of America, adrianbb@mit.edu, Xuan Vinh Doan, Dimitris Bertsimas

Motivated by applications including search-based advertising, research budgeting, sensor networks, and clinical trial development, we introduce the generalized restless bandit problem. This generalization models the ability to operate arms at various degrees under a combined budget rather than simply turning them on or off. We discuss a hierarchy of linear relaxations, develop a mixed-integer optimization based decomposition heuristic, and present promising computational results.

3 - Directed Learning for Information Retrieval

Benjamin Van Roy, Associate Professor, Stanford University, Terman 315, Stanford University, Stanford, CA, 94305, United States of America, bvr@stanford.edu, Yi-hao Kao

We will discuss a directed learning method that improves performance of information retrieval systems using a combination of similarity and diagnostic data in a coherent way.

4 - Objective Operational Learning and Applications

Andrew Lim, University of California, Berkeley, 4141 Etchverry Hall, Berkeley, CA, 94720, United States of America, lim@ieor.berkeley.edu, Ankit Jain, Lian Yu, George Shanthikumar

We introduce an approach to learning and optimization called "objective operational learning". A key feature of this approach is that it delivers good small sample behavior by incorporating (potentially incorrect) modeling assumptions when data is scarce, but guarantees convergence by correcting for these errors as data is accumulated. Applications to the newvendor problem with order-dependent demand will be discussed.

■ SB36

C - Room 8B, Level 3

Tutorial: Managing Student Projects

Sponsor: INFORM-ED
Sponsored Session

Chair: Peter Bell, Richard Ivey School of Business, UWO, London, N6A 3K7, Canada, pbell@ivey.uwo.ca

1 - Managing Student Projects

Peter Bell, Richard Ivey School of Business, UWO, London, N6A 3K7, Canada, pbell@ivey.uwo.ca

Most OR instructors assign students a 'real world' project as part of one or more of their courses. While such projects provide a powerful learning experience, they do present some management challenges. In this session we will discuss these challenges and draw on the participants for their experiences in working through the challenges to provide the strongest possible student learning experience.

■ SB37

C - Room 8C, Level 3

Design and Control of Many-Server Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Josh Reed, New York University, 44 W 4th Street, New York, NY, United States of America, jreed@stern.nyu.edu

1 - A Fluid Approximation for the Time-varying G_t/GI/s_t + GI Many-Server Queue

Yunan Liu, IEOR Department, Columbia University, 500 West 120th Street, New York, NY, 10027, United States of America, yl2342@columbia.edu, Ward Whitt

We introduce and analyze a deterministic fluid model that serves as an approximation for the G_t/GI/s_t + GI many-server queueing model. We characterize its performance over alternating intervals in which the system is overloaded and underloaded. We determine the amount of fluid that is in service (in queue) at time t and has been so for time at most y. We also determine the time-varying potential waiting time with an ordinary differential equation.

2 - Minimizing Convex Holding Costs in a Many-server Heavy-traffic Regime with Non-degenerate Slowdown

Itai Gurvich, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu, Rami Atar

We consider the problem of minimizing convex holding costs in parallel server systems operating in a many-server heavy-traffic regime with non-degenerate slowdown. In this regime the waiting time and service time are of the same order of magnitude. We establish a lower bound and devise a sequence of policies that are asymptotically optimal. Our analysis underscores the relationship between asymptotic optimality in heavy-traffic and the relative time scales of waiting time and service time.

3 - Shadow-routing Based Control of Flexible Multi-server Pools in Overload

Tolga Tezcan, Assistant Professor, University of Rochester, 305 Schlegel Hall, Rochester, NY, 14627, United States of America, Tolga.Tezcan@simon.rochester.edu, Alexander Stolyar

We consider a general parallel server system in the many-server asymptotic regime. Service of a customer brings a constant reward. The objective is to maximize the long-run reward rate. We propose a robust routing policy for overloaded systems, SHADOW-RM, which does not require the knowledge of customer input rates and prove its asymptotic optimality. We suggest another policy SHADOW-TANDEM, which automatically and seamlessly detects overload and reduces to SHADOW-RM in overload.

4 - Staffing and Dynamic Outsourcing in a Call Center Under Arrival Rate Uncertainty

Yasar Levent Kocaga, Yeshiva University, Sy Syms School of Business, New York, NY, 10033, United States of America, kocaga@yu.edu, Mor Armony, Amy Ward

Many firms that prefer to keep their call center operations in-house also use outsourcing to manage time periods of overload. Then, there is an upfront decision on the in-house staffing level that must be made when the call arrival volume is uncertain, and dynamic real-time decisions regarding which calls to outsource made after the call arrival volume has become known. We propose a staffing and outsourcing policy that minimizes costs due to staffing, outsourcing, and customer abandonment.

■ SB38

C - Room 9A, Level 3

Nonconvex Optimization: Theory and Algorithms

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Evrim Dalkiran, PhD Candidate, Virginia Polytechnic Institute and State University, 250 Durham Hall, Blacksburg, VA, 24060, United States of America, dalkiran@vt.edu

1 - Comparing Convex Relaxations for Quadratically Constrained Quadratic Programming

Kurt Anstreicher, Professor, University of Iowa, Department of Management Sciences, Iowa City, IA, 52242, United States of America, kurt-anstreicher@uiowa.edu

We consider convex relaxations for nonconvex QCQP. We show that replacing nonconvex quadratic functions with their convex envelopes is dominated by convexifying the range of the quadratic form (1,x')'(1,x'). We also show that using alphaBB underestimators is dominated by imposing semidefiniteness and diagonal constraints. Finally, we show that the use of a large class of DC underestimators is dominated by combining semidefiniteness with RLT constraints.

2 - Global Optimization Results for the Linear Complementarity Problem

Trang T. Nguyen, PhD Student, University of Florida, 450 Weil Hall, Gainesville, Fl, 32611, United States of America, trang@ufl.edu, Jean-Philippe Richard, Mohit Tawarmalani

We identify a nonconvex substructure of the linear complementarity problem. We use lifting and disjunctive programming techniques to derive families of valid inequalities for this substructure that strengthen its factorable relaxation. We describe conditions under which the inequalities are the best possible and comment on their applicability for globally solving the linear complementarity problem.

3 - SparsePOP: A Sparse Semidefinite Programming Relaxation of Polynomial Optimization Problems

Hayato Waki, The University of Elector-Communications, Chofu-gaoka 1-5-1, Chofu-shi, Tokyo, Japan, waki@cs.uec.ac.jp

SparsePOP is a MATLAB implementation of a sparse semidefinite programming (SDP) relaxation method proposed for polynomial optimization problems (POPs). The sparse SDP relaxation is based on a method proposed by Lasserre. By exploiting sparsity, we reduce the size of resulting SDP problems. As a result, SparsePOP can solve sparse POP instances up to 1000 variables and often outperforms Lasserre's method. This is a joint work with Masakazu Kojima, Kim Sunyoung and Masakazu Muramatsu.

4 - Convex Envelopes of Lower Semi-continuous Functions Generated by Finite Number of Compact Convex Set

Aida Khajavirad, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, United States of America, aida@cmu.edu, Nick Sahinidis

We formulate the problem of constructing the convex envelope of a lsc function whose generating set consists of finitely many compact convex sets as a convex optimization problem. We consider functionals which are products of nonnegative convex and component-wise concave functions and reduce the complexity of the envelope representation problem for such functions significantly. We derive closed-form expressions for envelopes of various functions that are building blocks of nonconvex programs.

5 - Reduced RLT Representations for Nonconvex Polynomial Programs

Evrim Dalkiran, PhD Candidate, Virginia Polytechnic Institute and State University, 250 Durham Hall, Blacksburg, VA, 24060, United States of America, dalkiran@vt.edu, Hanif Sherali, Leo Liberti

We explore equivalent, reduced size RLT-based formulations for quadratic and polynomial programs. Utilizing a basis partitioning scheme for an embedded linear equality subsystem, a strict subset of RLT equalities is shown to imply the remaining ones. Certain static and dynamic basis selection strategies are proposed to implement this procedure via an algorithm that assures convergence to a global optimum. Computational results are presented to demonstrate the improvement in overall effort.

■ SB39

C - Room 9B, Level 3

Advances in Combinatorial Optimization and Integer Programming I

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Andrea Lodi, DEIS, University of Bologna, Viale Risorgimento, 2, Bologna, 40136, Italy, andrea.lodi@unibo.it

Co-Chair: Andrea Tramontani, DEIS, University of Bologna, Viale Risorgimento 2, Bologna, 40136, Italy, andrea.tramontani@unibo.it

1 - An FPTAS for Optimizing a Class of Low-rank Functions Over a Polytope

Shashi Mittal, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E40-149, Cambridge, MA, 02139, United States of America, mshashi@mit.edu, Andreas S. Schulz

We present an FPTAS for optimizing a rather general class of non-linear functions of low rank over a polytope. Our approximation scheme relies on approximating the Pareto-optimal front of the linear functions that constitute the given low-rank function. Unlike existing results in the literature, our approximation scheme does not require the assumption of quasi-concavity on the objective function. Examples include optimizing a class of bi-linear functions and sums of rational functions.

2 - A Partial Characterization of the Induced K-partite Subgraph Polytope

Manoel Campelo, Professor, Federal University of Ceará, Campus do Pici, Bloco 910, Fortaleza, CE, 60455-760, Brazil, mcampelo@lia.ufc.br, Alinson Xavier

We study the maximum induced k-partite subgraph problem. We use an integer linear programming formulation based on class representatives vertices. We partially describe the facial structure of the corresponding polytope. We present two lifting procedures to generate facets. One of them lifts valid inequalities defined by subgraphs. The other one links the studied polytope to the stable set polytope of a related graph. We analize the use of these facet-defining inequalities as cutting-planes.

3 - Separation, Dimension, and Facet Algorithms for Node Flow Polyhedra

S. Thomas McCormick, Sauder School of Business, UBC, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, tom.mccormick@sauder.ubc.ca, Maren Martens, Maurice Queyranne

Consider putting non-negative flows on all source-sink paths. The flow through a node is the sum of the flows on all paths containing it. We characterize the inequalities defining such node flows, which valid inequalities are facets, we give fast algorithms for separation, validity, and dimension, and we put all the pieces together into an algorithm for separating to a facet. All algorithms are very efficient, as they are based on max flow and min-cost flow subroutines.

■ SB40

C - Room 9C, Level 3

Open-Source Software

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: Leo Lopes, Monash University Maths, Australia, leo.lopes@monash.edu

1 - On Generating Relevant Synthetic Instances for Practical Problems

Leo Lopes, Monash University Maths, Australia, leo.lopes@monash.edu, Kate Smith-Miles

The features of instances arising from practice are jointly distributed in complex ways that are hard for synthetic generators to replicate. Using the wrong instances to test solvers has led to deployment disasters. To address this, we present a methodology that helps improve instance generators and a statistic that summarizes the generator's ability to produce realistic and discriminating instances. The methodology is supported by an implementation in R available as a Coin-OR project.

2 - OpenSolver - An Open Source Solver-compatible CBC-based Excel Optimizer

Andrew Mason, Dept of Engineering Science, University of Auckland, Private Bag 92019, Auckland, New Zealand, a.mason@auckland.ac.nz

As part of a project on staff scheduling, we have developed OpenSolver, an open-source Excel addin that allows users to optimise their spreadsheet-based Solver models using the Coin-OR CBC integer programming solver. OpenSolver also provides tools for viewing an optimization model directly on a spreadsheet, and for quickly solving related models that differ only in the values of their right hand sides.

3 - Rima: An Experiment in Composing Mathematical Models From Parts

Geoff Leyland, Director, Incremental Limited, 17 Bridgens Ave, Te Atatu Peninsula, Auckland, 0610, New Zealand, geoff_leyland@fastmail.fm

Rima (http://code.google.com/p/rima/) is a yet-another tool for formulating mathematical models implemented in a scripting language. Rima's goal is to make it easy to compose a model from parts, and to create generic parts. To this end, models are defined symbolically, problem data is late bound, models and data can be overloaded, and there are constructs for easy data transformation. Rima is implemented in Lua, binds to CLP, CBC and lpsolve, and is awaiting review to become part of COIN.

4 - Impact of Design Architecture and Developer Networks on Software Project Success

Michelle Liu, Assistant Professor of IT, Marymount University, 2807 N. Glebe Rd., Arlington, VA, 22207, United States of America, xiangl2001@gmail.com

In this study, the author seeks to understand the factors differentiating successful open source software projects from unsuccessful ones. Using data gathered from SourceForge.net, the author empirically tests several hypotheses about the impact of architecture and developer's access to knowledge on a project's success. Theoretical and practical implications are discussed, and several future research directions are outlined.

■ SB41

C - Room 10A, Level 3

Recent Advances in Mixed-Integer Nonlinear Optimization II

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Sven Leyffer, Computational Mathematician, Argonne National Laboratory, Mathematics & Computer Science, 9700 South Cass Ave, Argonne, IL, 60439, United States of America, leyffer@mcs.anl.gov

1 - Separating Cuts for Quadratic Programs

Samuel Burer, Associate Professor, University of Iowa, S346 Pappajohn Business Building, Iowa City, IA, 52242-1994, United States of America, samuel-burer@uiowa.edu, Hongbo Dong

The convex and concave envelopes for the product of two variables over a rectangle have been known since the early 1980s, and recent research has extended these results to quadratic forms of two variables. We discuss further extensions to three variables over a box. For (linearized) quadratic programs of any size, this allows one to separate cuts involving triples of bounded variables.

2 - A Mixed-integer Optimization Model for Air Traffic Conflict Resolution

Sonia Cafieri, Assistant Professor, Ecole Nationale de l'Aviation Civile, 7, avenue Edouard Belin, Toulouse, 31500, France, sonia.cafieri@enac.fr, Pascal Brisset, Nicolas Durand

The problem of detecting and solving aircraft conflicts, that occur when the distance between two aircraft sharing the same airspace is less than a given safety distance, is crucial in Air Traffic Management. We propose a mixed-integer nonlinear model for air conflict avoidance, where conflicts are avoided allowing aircraft to only accelerate or decelerate in a time window, and velocity changes are minimized together with time windows when they occur. We present some computational experiments.

3 - Comparisons of the Relative Strength of Relaxations for Bilinear Functions in Global Optimization

James Luedtke, University of Wisconsin-Madison, 1513 University Av., Madison, WI, United States of America, jrluedt1@wisc.edu, Jeff Linderoth, Mahdi Namazifar

Bilinear functions appear in many optimization problems, including blending and electricity transmission. A classical approach for relaxing such functions is to construct McCormick envelopes for each product term. We show that in some cases the relaxations obtained from this approach are provably close to the convex and concave envelopes of these functions. To our knowledge, these are the first approximation-ratio results for the strength of relaxations in global optimization problems.

4 - MINLPBB Algorithm Performance for Convex Reformulations in a MINLP with Complementarity Constraints

Andres Guerra, Adjunct Assistant Professor, Colorado School of Mines, Division of Economics and Business, Golden, CO, 80401, United States of America, aguerra@mines.edu, Sven Leyffer, Alexandra Newman

We study a concrete building design problem for a MINLP with complementarity constraints, in which some of the nonconvex constructs can be formulated using Convex Hull and Big-M formulations. We present the mathematical structures and compare MINLPBB performance and solution quality for convex reformulations of two sets of nonlinear equality constraints and three bilinear terms in the objective function.

■ SB42

C - Room 10B, Level 3

Stochastic Integer Programming Algorithm Development

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, United States of America, nkong@purdue.edu

1 - Algorithm Study for Two-stage Stochastic Quadratic 0-1 Recourse Problem

Zhen Zhu, Purdue University, Department of Computer Science, LWSN, 305 N University Street, West Lafayette, IN, 47907, United States of America, zzhu@purdue.edu, Nan Kong, Oleg A. Prokopyev

The difficulties in solving stochastic quadratic binary programming (SQBP) problems are three folds: stage-wise coupling constraints, binary decision variables on both stages, and quadratic objective function. In this research, we explore methods that can effectively deal with the above difficulties and thus efficiently solve the SQBP problems. We also consider the general case with cross-stage quadratic terms in the objective functions.

2 - On Greedy Approximation Algorithms for a Class of Stochastic Assignment Problems

Serdar Kardemir, Research Assistant, University of Pittsburgh, 3700 O'hara St., Benedum Hall, 1077B, Pittsburgh, PA, 15261, United States of America, sek73@pitt.edu, Oleg A. Prokopyev, Nan Kong

In this talk we discuss a two-stage stochastic extension of the classical linear assignment problem. The considered problem can be shown to be NP-hard. We discuss some necessary optimality conditions, which are subsequently utilized to develop a greedy approximation algorithm for the problem. Analytical observations as well as extensive computational results show that our approach outperforms two other greedy approximation algorithms from the literature.

3 - A Computational Study of Decomposition Algorithms for Stochastic Programs with Mean-Risk Objectives

Tanisha Cotton, Doctoral Student, Texas A& M University, 3131 TAMU, College Station, TX, 77843, United States of America, tanbgreen05@neo.tamu.edu, Lewis Ntaimo

To introduce risk into linear stochastic programs, convexity preserving dispersion statistics, quantile- deviation and absolute semideviation can be used to represent mean-risk objectives. In this talk, we present a computational study of decomposition algorithms for this class of SPs. We consider both stage-wise and scenario-wise decomposition algorithms.

4 - Stochastic Optimization of Power Supply System in Isolated Islands with Renewable Energy

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

Supplying energy to isolated islands can be very expensive using diesel generators or transmission equipment from mainland. In this work, to meet the demand in one island, we consider a hybrid system with diesel generators, a wind farm, and the transmission line from the mainland. A stochastic mixed integer programming model is developed to account for variability in demand and wind speed. An algorithm utilizing Benders' Decomposition is developed and the computational performance is presented.

■ SB43

C - Room 1, Level 2- Mezzanine

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 - Optimal Stopping in Radiotherapy

Minsun Kim, University of Washington, Department of Radiation Oncology, Seattle, WA, 98195, United States of America, mk688@u.washington.edu, Archis Ghate, Mark Phillips

We recently proposed Adaptive Biologically Conformal Radiation Therapy (ABCRT), a mathematical framework that incorporates a patient's biological response into the planning process to adaptively compute spatiotemporally optimal plans. In line with conventional IMRT, the number of sessions was fixed a priori in ABCRT. In this talk, we present infinite horizon extensions of ABCRT where an optimal treatment stopping point is determined on the fly. Benefits to treatment efficacy are explored.

2 - Exact Method for Volume Metric Modulated Arc Therapy (VMAT) Treatment Plan Optimization

Fei Peng, PhD 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 treatments, VMAT machine delivers radiation in a non-stop fashion while the gantry moves continuously during the treatment. Due to the complex setting of VMAT, most literature uses heuristics to design treatment plans. We propose an exact large-scale IP model for VMAT treatment plan optimization under uniform gantry speed and monitor unit output, and use branch-and-price for the IP produced using column generation. Results on real patient data are presented.

3 - A Novel Aperture-based Algorithm for Treatment Plan Optimization of Volumetric Modulated Arc Therapy

Chunhua Men, University of California, San Diego, 3855 Health Sciences Dr. #0843, La Jolla, CA, 92093, United States of America, cmen@ucsd.edu, Xun Jia, Steve Jiang, Edwin Romeijn

This work is to develop a novel aperture-based algorithm for VMAT treatment plan optimization. The problem is formulated as a large-scale convex programming problem and a column generation approach is used to deal with its extreme large dimensionality. Tests on clinical cases showed that the very high quality clinical deliverable treatment plans can be genrated in 5~8 minutes on CPU and in 20~30 seconds on GPU, which is much faster than any existing algorithms on a similar platform.

4 - Optimization Methods for Volumetric Modulated Arc Therapy Planning

Shabbir Ahmed, Associate Professor, Georgia Institute of Tech, 765 Ferst Drive NW, Atlanta, GA, United States of America, sahmed@isye.gatech.edu, Martin Savelsbergh, Ozan Gozbasi

Volumetric Modulated Arc Therapy (VMAT) is a recent radiation technology where the radiation is delivered continuously during the rotation of the radiation source around the patient. This paradigm has the potential to provide treatments in less time compared to other delivery techniques, thereby enhancing patient comfort. We describe an integer programming based solution approach for VMAT planning. Computational studies on a spinal tumor and a prostate tumor case will be discussed.

■ SB44

C - Room 2, Level 2- Mezzanine

Supply Chains in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Ronald Rardin, Distinguished Professor, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, rrardin@uark.edu

1 - Automating Operating Room Logistics Processes with RFID

Nebil Buyurgan, Associate Professor, University of Arkansas, Industrial Engineering, Bell 4207, Fayetteville, AR, 72701, United States of America, nebilb@uark.edu, Sylvain Landry, Richard Philippe

RFID's successes in industrial logistics sector could translate into a quantum leap in the evolution of materiel management practices in the hospital environment. RFID is able to automate the data collection activities at the point of use, while allowing for proactive inventory management, unit traceability and charge capture. This study presents impacts of the technology on materiel management processes in hospitals, implementation results, and further research areas in healthcare institutions.

2 - Data Standards Adoption in Healthcare Supply Chain Financial Management: Opportunities

Vijith Varghese, Postdoctoral Fellow, University of Arkansas, Industrial Engineering, Bell 4207, Fayetteville, AR, 72701, United States of America, vvarghe@uark.edu, Ronald Rardin, Raja Jayaraman, Nebil Buyurgan

Data Standards in the context of product and location identification, refers to unique, unambiguous, and universal representation of a product or a location ID. This presentation discusses the healthcare financial-management-system efficiency achieved through data standards adoption in contract management and sales tracing enabling higher accuracy in pricing, rebates and chargeback among healthcare providers, group purchasing organizations, manufacturers and distributors.

3 - Factors Affecting the Identification Standards Adoption Process in the Healthcare Supply Chain

Angelica Burbano, Graduate Research Assistant, University of Arkansas, Industrial Engineering, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, aburbano@uark.edu, Ronald Rardin, Ed Pohl

This research project reports on the findings related to the factors affecting the adoption of product and location identification standards. This adoption process is compared with the adoption of EHR and EDI; main conclusions from the identification standard's literature are presented. These findings contribute to the elaboration of a causal loop diagram which is fundamental in the development of the second phase of the modeling effort which will allow the test of interventions in the system.

■ SB45

C - Room 6, Level 2- Mezzanine

Surgery Scheduling and Planning

Sponsor: Health Applications
Sponsored Session

Chair: Bjorn Berg, North Carolina State University, Raleigh, NC, 27695, United States of America, bpberg@ncsu.edu

1 - Operating Room Rescheduling Under Uncertainty

Sakine Batun, University of Pittsburgh, Pittsburgh, PA, United States of America, sab79@pitt.edu, Brian T. Denton, Andrew J. Schaefer, Todd R. Huschka

Operating room (OR) scheduling is an important operational problem for most hospitals. Due to contingencies (such as surgeries that last shorter/longer than their expected duration or emergent cases) that cannot be fully anticipated beforehand, planned schedules should be revised during the day. In our study, we consider a stochastic programming based approach to formulate this problem and to estimate the benefit of rescheduling.

2 - State Discharge Abstract Data to Identify Competitors - Similar Distribution of Operative Procedures

Franklin Dexter, Professor, University of Iowa, Department of Anesthesia, 6JCP, Iowa City, IA, 52242, United States of America, franklin-dexter@uiowa.edu

Surgical scheduling often focuses on assigning cases to staffing (allocated time) planned months in advance (e.g., based on maximizing efficiency of use of operating room time). Extra capacity is sometimes used to encourage growth, but rarely formally linked to marketing as in other industries. Data envelopment analysis forecasts current growth potential by specialty for a hospital. A similarity index identified competition by many hospitals and an unexpected quantitatively important competitor.

3 - Dynamic Appointment Sequencing and Scheduling Under Uncertainty

S. Ayca Erdogan, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, United States of America, saerdoga@ncsu.edu, Brian T. Denton, Alex Gose

We propose a new stochastic programming model for a single-server on-line appointment scheduling problem with uncertain service times. We analyze the structure of the model and discuss computationally efficient solution methods. Finally, we present the results of numerical experiments that illustrate the nature of optimal sequencing and arrival time scheduling decisions for multiple classes of patients.

4 - Stochastic Sequencing of Surgeries for a Single Surgeon Operating in Parallel ORs

Robert H. Storer, Professor, Lehigh University, 200 West Packer Ave., Industrial Engineering Department, Bethlehem, PA, 18015, United States of America, rhs2@lehigh.edu, Camilo Mancilla

We develop algorithms for a stochastic two-machine one-server sequencing problem with waiting time and overtime costs. Scheduling surgeries for a single surgeon in two parallel operating rooms motivates the work. The problem is formulated as an integer stochastic program. A decomposition method is proposed that solves real problems to optimality. We further gain insight as to when parallel operating rooms is cost effective.

■ SB46

C - Room 7, Level 2- Mezzanine

Joint Session APS/ MIF: Applied Probability Models for Smart Transportation

Sponsor: Applied Probability/ Minority Issues
Sponsored Session

Chair: Robert Hampshire, Professor, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, hamp@andrew.cmu.edu

1 - Fleet Redistribution for Shared-vehicle Systems

Rahul Nair, Graduate Research Assistant, University of Maryland, Civil & Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu, Robert Hampshire, Elise Miller-Hooks

A chance-constrained stochastic optimization program is presented for management of shared-vehicle systems. These systems involve a fleet of vehicles (cars, bicycles, or electric vehicles) positioned at stations across the network which are used to complete trips. Since there are flow imbalances between stations, the program provides anticipative, corrective actions for operators. The value of accounting for demand uncertainty in demand is demonstrated.

2 - A Dynamic Rate Closed Queueing Network Model of Vehicle Sharing

Robert Hampshire, Professor, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, hamp@andrew.cmu.edu

In the talk, we present asymptotic approximations for a large closed queueing network model with time varying rates. This model is motivated by car sharing services, bike sharing services and person-2-person car sharing services. A decomposition technique and a quasi-steady state assumption lead to accurate and tractable algorithms for the system performance measures.

3 - A Parking Queue Network Model with a Perspective of Behavioral Economics

Kats Sasanuma, PhD Student, Heinz College, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, ksasanum@andrew.cmu.edu, Richard Larson, Robert Hampshire

We analyze parking-induced cruising behavior quantitatively using a queueing model with reneging. We extend our model to a queueing network and investigate the stationary distribution of the system. We further extend the model to include garage parking and non-parking drivers, and argue their impact on the necessary congestion price. Finally, we apply Behavioral Economics to parking congestion problem and evaluate how risk-seeking behavior exacerbates parking congestion.

■ SB47

C - Room 8, Level 2- Mezzanine

Joint Session Computational Bio/ ICS: Optimization in Bioinformatics

Cluster: Computational Biology and Bioinformatics/Computing Society
Invited Session

Chair: W. Art Chaovalitwongse, Rutgers University, 96 Frelinghuysen Rd, Piscataway, NJ, 08854, United States of America, wchaoval@rci.rutgers.edu

Co-Chair: Chun-An Chou, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, United States of America, joechou@rci.rutgers.edu

Co-Chair: Oleg A. Prokopyev, University of Pittsburgh, 1048 Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15261, United States of America, droleg@pitt.edu

1 - Optimizing Interaction Code Parameters for Zinc Finger - DNA Recognition

Andrew Trapp, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, act25@pitt.edu, Oleg A. Prokopyev, Nuri A. Temiz, Carlos J. Camacho

We decode protein/DNA interactions using a nonlinear mixed-integer programming model. We remove nonlinearities with multiple reformulations, making it amenable to standard MIP solvers. The solutions highly correlate with empirical data, and modest runtimes allow us to iteratively remove extra parameters to avoid over-fitting training data, yet maintain high R2 values. Our results yield insights into how transcription factors identify and bind their targets with high affinity and specificity.

2 - A Spectral Clustering Based Algorithm for Dimensionality Reduction of Biological Datasets

Petros Xanthopoulos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, petros.xanthopoulos@gmail.com, Georgios Pyrgiotakis, Vera Tomaino, Panos Pardalos, Mario Guarracino

The main idea of dimensionality reduction is to reduce the initial features into a sufficiently smaller subset that retains all information needed to solve a data mining problem. In this talk we discuss a novel dimensionality reduction technique for reducing highly correlated features in biomedical datasets. The performance of the algorithm is evaluated on a multi class cell death discrimination problem.

3 - Modeling Microtubule Dynamics Inside the Plant Cell

Ezgi Eren, Industrial and Systems Engineering, Texas A&M University, College Station, TX, United States of America, ezgieren@tamu.edu, Ram Dixit, Natarajan Gautam

Microtubules are polymers which regulate critical processes inside living cells. In plant cells, microtubules are created in arbitrary locations on the cell wall with a random orientation. Both ends of a microtubule are dynamic with transitions between different states of growth, shortening and pause. The dynamics become more complex due to interactions caused by collision of microtubules with different directions of growth. We model this dynamic pattern and predict the behavior.

4 - A Branch-and-price Approach for Optimal Sibling Reconstruction

Chun-An Chou, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, United States of America, joechou@rci.rutgers.edu, W. Art Chaovalitwongse

We propose a branch-and-price approach for sibling reconstruction problem that is formulated as a combinatorial optimization problem. The objective is to find a minimal set of sibling groups subject to combinatorial constraints derived from Mendelian rules. The proposed approach permit to generate only improving sibling groups to be candidate groups in the subproblem. We test it on real biolgical data sets and better results are shown compared to other existing methods.

■ SB48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Salford Systems-Real-World Data Analysis

Mikhail Golovnya, Salford Systems, 4740 Murphy Canyon Rd., Ste. 200, San Diego, CA, 92108, United States of America, golomi@salford-systems.com

This tutorial, intended for the modeler wanting to apply data mining methodology, will emphasize real-world data analysis. The main concepts behind 3 well-known data mining algorithms will be discussed: CART®, MARS®, TreeNet®. Additionally, the course will discuss what is novel in the software, cover implementation, and show where the software fits in terms of other data mining software

2 - GAMS Development Corporation-Application Prototyping with GAMS

Steven Dirkse, Director of Optimization, GAMS Development Corp., 1217 Potomac St. 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.

■ SB49

C -Room 10, Level 2- Mezzanine

Electronic Auctions and Markets

Sponsor: Information Systems
Sponsored Session

Chair: De Liu, Assistant Professor, University of Kentucky, 455Y Gatton B&E Building, Lexington, KY, United States of America, de.liu@uky.edu

1 - The Role of Organic Lists in Search Advertising
Lizhen Xu, The University of Texas at Austin, 1 University Station B6500, Austin, TX, 78712, United States of America, lizhen.xu@PhD.mccombs.utexas.edu, Jianqing Chen, Andrew Whinston

We set up a game-theoretic model in which firms with different market preference are placed at different organic slots and bid for sponsored advertising slots. We aim to answer three questions related to the unexplored role of organic list in search advertising: (1) Should advertisers already at top organic slots bid actively for sponsored positions? (2) Does organic list benefit or harm search engine revenue, social welfare, and overall sales diversity? (3) How can organic ranking be improved?

2 - Bundle Auction Market Design and Implementation
Zhiling Guo, University of Maryland-Baltimore County, 1000 Hilltop Circle, Baltimore, MD, 21044, United States of America, zguo@umbc.edu, Andrew Whinston, Gary J. Koehler

This study focuses on a market-based resource allocation mechanism in which self-interested agents iteratively trade bundled resources in a double auction market run by a dealer. We first present a robust, flexible, and scalable algorithmic implementation of the market framework. We further investigate how various market design factors including the dealer's inventory policies, market communication patterns, and agent learning strategies affect the computational market efficiency and operations.

3 - Outsourcing Competition with Cost Uncertainty and Asymmetric Information
Xia Zhao, Assistant Professor, University of North Carolina-Greensboro, Bryan 479, P.O. Box 26165, Greensboro, NC, 27402, United States of America, X_ZHAO3@uncg.edu, Ling Xue, Fuqiang Zhang

This paper uses a common-value auction to examine a service outsourcing problem where two providers compete for a service contract from a client in presence of cost uncertainty and information asymmetry. We characterize when the decrease in information asymmetry between providers intensifies or softens the provider competition. We find that the client may not always strive to reduce the information asymmetry between providers or reduce service cost of providers.

4 - Payment Schemes for Internet Advertising
De Liu, Assistant Professor, University of Kentucky, 455Y Gatton B&E Building, Lexington, KY, United States of America, de.liu@uky.edu, Siva Viswanathan

This paper examines publishers payment scheme choice (pay-per-sale, pay-per-click, and pay-per-sale) in keyword auctions with two sided information asymmetry. We find that the high-type publisher may use pay-per-sale to signal its type at the cost of lowered allocation efficiency. High-type publishers may not want to offer multiple payment formats to screen advertisers because they invite mimicry from low-type publishers.

■ SB50

C -Room 11, Level 2- Mezzanine

Crowdsourced Markets and Communities

Sponsor: Information Systems
Sponsored Session

Chair: Vandana Ramachandran, University of Utah, Operations and Information Systems, Salt Lake City, UT, 84112, United States of America, vandana@business.utah.edu

1 - Online Social Investing and the New ROI - Return on Influentials
Abrar Al-Hasan, Student PhD Information Systems, Robert H. Smith School of Business, University of Maryland, College Park, United States of America, aalhasan@rhsmith.umd.edu, Siva Viswanathan

We study the online market for social stock investing where individuals follow other investors in the community for their investment decisions. We investigate how various aspects of an individual's social network affects her investment performance; and how different modes of herding strategies impact performance. We find that the structure of a network is a contributory factor that impacts performance, and that different herding strategies lead to different performance outcomes.

2 - Crowdfunding the Next Hit: Microfunding Online Experience Goods
Chris Ward, PhD Student, University of Utah, 1645 E Campus Center Dr., Salt Lake City, UT, 84112, United States of America, chris.ward@business.utah.edu, Vandana Ramachandran

Crowdfunding combines wisdom of the crowd and microinvestments, offering a new way for raising funds in markets for experience goods. Yet many projects never reach full funding, giving anecdotal evidence of market inefficiencies. The combination of limited individual information and costly information gain suggests that peer effects drive investment decisions. We study the role of network structure to determine funding success and speed, controlling for outside popularity and unobserved quality.

3 - Crowdsourcing Contests and Internet-based Labor Markets
Arun Sundararajan, New York University, 44 West 4th Street, New York, NY, United States of America, asundara@stern.nyu.edu

I analyze some mechanism design issues relating to the crowdsourcing contests and discuss their long-run labor economic implications as the use of large decentralized Internet markets becomes more widespread.

4 - Forward-looking Reputation Building in an Online P2P Lending Network
Hossein Ghasemkhani, PhD Student, University of Washington, Box 353200, Seattle, WA, 98195, United States of America, hossein@uw.edu, Arvind Tripathi, Yong Tan

The study aims to model, analyze and test the strategies of forward-looking agents in an online peer to peer lending market. In particular, we explore the reputation management and its effect on the utility of agents in this market. Reputation of agents is updated as a result of their actions-borrowing, repayment and lending. We explore how agents can manage their reputation over time to maximize their payoffs. Agents with higher reputation are more likely to get loans with lower interest rates.

■ SB51

C -Room 12, Level 2- Mezzanine

Military Manpower and Human Performance

Sponsor: Military Applications
Sponsored Session

Chair: Warren Sutton, Research Analyst, CNA, 4825 Mark Center Dr., Alexandria, VA, 22311, United States of America, suttonw@cna.org

1 - An Exploration into the Complexity of Navy Manpower, Personnel, Training, & Education (MPT&E)
Warren Sutton, Research Analyst, CNA, 4825 Mark Center Dr., Alexandria, VA, 22311, United States of America, suttonw@cna.org

The Navy operates a complex MPT&E enterprise with many decision having unplanned and/or unknown consequences in the long-term planning horizon. This research studies the interactions of the complex dynamics of Navy manpower planning and presents a simulation based approach to forecast future Navy personnel needs.

2 - Modeling and Simulation of Engagement Decision-making Processes and Soldier Encumbrance
Daniel Rice, Director R&D, Technlology Solutions Experts, 209 W. Central St., Suite 300, Natick, MA, 01760, United States of America, daniel.rice@tseboston.com

This research investigates the modeling and simulation of Ground Soldier behavior to represent engagement choices made by the individual Soldier in the battlespace. We describe current and ongoing research including representation of stressors on a Soldier's perception, attention, psychomotor, physical, and cognitive abilities and methodologies to represent the impact of stressors on Soldier task and decision-making performance.

3 - Military OR in the Iraq Theater of Operations
Greg Parlier, Institute for Defense Analyses, Madison, AL, United States of America, gparlier@ida.org

This presentation provides an overview and observations on the organization, applications, challenges, and contributions of military operations research in the Iraq Theater of Operations (ITO) as United States Forces-Iraq (USF-I) transitions from a focus on counter-insurgency operations to stability operations, foreign internal defense, economic development, and governance capacity.

■ SB52

C -Room 13, Level 2- Mezzanine

Homeland Security

Sponsor: Military Applications
Sponsored Session

Chair: Vicki Bier, Professor, University of Wisconsin-Madison, Department of Industrial Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, bier@engr.wisc.edu

1 - Applying Target-oriented Utility Theory to Homeland Security
Vicki Bier, Professor, University of Wisconsin-Madison, Department of Industrial Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, bier@engr.wisc.edu, Fuat Kosanoglu

Many game-theoretic models of homeland security assume that the defender wishes to minimize some quantity like the expected damage from an attack. However, these models can result in wasted resources if less investment would be sufficient to deter an attack. We formulate this in terms of target-oriented utility, with the defender uncertain about the level of investment needed to deter attacks.

2 - Maritime Terrorist Attacks Against Ports 1968-2007
Risto Talas, Research Fellow, Hull University Logistics Institute, Cottingham Road, Hull, United Kingdom, R.Talas@hull.ac.uk, David Menachof

The paper examines worldwide terrorist attacks in ports and against shipping in ports from 1968 to 2007 from the RAND database of terrorist attacks and following Gleason (1980) concludes, using the Kolmogorov-Smirnov test that they follow a Poisson distribution. A subsequent model for port security risk is proposed with a new coefficient of terrorist threat.

3 - Decision Making in a Dynamic Multi-stage Attacker-defender Game
Yi Luo, PhD Candidate, Department of Systems and Industrial Engineering, the University of Arizona, 1127 E James E. Rogers Way, P.O. Box 210020, Tucson, AZ, 85721-0020, United States of America, luo1@email.arizona.edu, Ferenc Szidarovszky

In a dynamic non-cooperative multi-stage game, the defender's payoffs at each stage of the game depend on the attacker's and the defender's accumulative efforts, and are considered as random variables due to the uncertainty. These random variables can be approximated by their certain equivalents based on the first and second moments. The best strategies of the defender can be found by solving an optimal control problem. A convergent algorithm is developed based on dynamic programming.

■ SB53

C -Room 14, Level 2- Mezzanine

Distributed Algorithms and Optimization

Cluster: New Trends in Wireless Networks: A Large-scale Systems Perspective
Invited Session

Chair: R Srikant, Professor, University of Illinois at Urbana-Champaign, University of Illinois, CSL, 1308 W. Main St., Urbana, IL, 61801, United States of America, rsrikant@illinois.edu

Co-Chair: Lei Ying, Assistant Professor, Iowa State University, Department of Electrical and Computer Enginee, 3219 Coover Hall, Ames, IA, 50011, United States of America, leiying@iastate.edu

1 - Energy-aware Scheduling in Wireless Networks: When Speed Scaling Meets Multiuser Diversity
Lijun Chen, Research Scientist, California Institute of Technology, Pasadena, CA, United States of America, chen@cds.caltech.edu, Steven Low

Speed Scaling is a widely adopted power management technique. In this talk, we discuss speed scaling in wireless communications, which corresponds to an exponential power function, in a multiuser and time-varying setting such as a downlink in cellular networks. We present a speed scaling algorithm that achieves a competitive ratio of 2. Furthermore, we show that no algorithm can achieve better than 2-competitive.

2 - Function Computation Over Networks via Subspace Coding
Massimo Franceschetti, Professor, University of California, San Diego, San Diego, CA, United States of America, massimo@ece.ucsd.edu

We consider the problem of computing functions in a network where multiple sources are connected to a single sink via multiple relays. The relay nodes are constrained to perform the same operation on the incoming vector codewords, irrespective of the target function to be computed at the sink. The objective is to design codebooks which minimize the number of symbols that the sources need to transmit. We follow the the vector-subspace coding approach of Koetter and Kschischang.

3 - Performance Bounds of Distributed CSMA Scheduling
Jean Walrand, Professor, University of California-Berkeley, Berkeley, CA, United States of America, walrand@berkeley.edu, Libin Jiang, Jian Ni, R Srikant

CSMA-based scheduling is recently shown to achieve the maximal throughput. Central to this algorithm is a Markov chain that produces samples from a desired distribution. In this work, we discuss the relationships of the achievable throughput, queueing delay and the mixing time of the Markov chain in the algorithm. This result suggests that a small mixing time is desirable for low delay. We then discuss how a generic bound on the mixing time can be tightened in specific topologies.

4 - Scheduling in Multichannel Wireless Networks with Flow-Level Dynamics
Lei Ying, Assistant Professor, Iowa State University, Department of Electrical and Computer Enginee, 3219 Coover Hall, Ames, IA, 50011, United States of America, leiying@iastate.edu, R Srikant, Shihuan Liu

This presentation considers scheduling in multichannel wireless networks with flow-level dynamics. We consider a downlink network with a single base station, M channels, and multiple mobile users. We also assume mobiles dynamically join/leave the network. We introduce a joint channel-assignment and workload-based scheduling algorithms for multichannel downlink networks with dynamic flow arrivals/departures, and prove that the algorithm is throughput-optimal.

■ SB54

C -Room 15, Level 2- Mezzanine

Knowledge, Learning, Intellectual Capital

Sponsor: Technology Management/New Product Development
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, charles.weber@etm.pdx.edu

1 - Building Theories During Scenario Planning
Nitin Joglekar, Boston University, 595 Commonwealth Ave., Boston, MA, United States of America, joglekar@bu.edu, Leonardo Santiago

We review the literature on scenario planning processes to argue that these processes offer a nexus for building theory. The epistemological aspects of such efforts are examined in terms of trend based, contrast based and normative outcomes. We close by comparing the nature of scenario planning based theories, and their validity, against conventional theory building processes.

2 - Impact of Demand Distribution on Capacity Management in Knowledge - Based Organizations
Senay Solak, University of Massachusetts Amherst, Isenberg School of Management, Amherst, MA, United States of America, solak@som.umass.edu, Zhuoxin Li

Many knowledge-based firms build a portfolio of capacities to meet uncertain demand from multiple classes of customers and projects. A high capacity level increases the firm's probability of winning project orders, but this happens at the expense of high investment and holding costs. We study this trade-off and analyze the impact of the properties of the demand distribution on optimal capacity management policies using a dynamic programming approach. Several analytical results are presented.

3 - Motivating Organizational Search: The Power of Low-Powered Incentives
Oliver Baumann, Ludwig-Maximilians-University, Munich, Germany, baumann@bwl.lmu.de, Nils Stiglitz

We simulate the effects of incentives on organizational search, and we identify reasons for why low-powered incentives denote the most effective stimulus for innovation. First, the marginal gains from higher-powered incentives decrease with an increasing rate, while the costs of the incentive system increase linearly. Second, in the presence of resource constraints, good projects that fail to get selected further amplify competition and, in turn, lower the agents' motivation for search.

4 - Designing Knowledge Networks for For-Profit Open Innovation
Charles Weber, Associate Professor, Portland State University, P.O. Box 751, Engineering and Technology Management, Portland, OR, 97207, United States of America, charles.weber@etm.pdx.edu, Nitin Mayande

Recent advances in Web2.0 technologies are enabling for profit peer production and open innovation. This paper discusses an approach that allows firms to design knowledge networks for this purpose.

■ SB55

C -Room 16, Level 2- Mezzanine

Industry Architecture, Technology Forecasting and NPD Performance

Sponsor: Technology Management/New Product Development
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 - On the Impact of Technological Changes. Multivariate Time Series Analysis with Interventions
Eric Bentzen, Associate Professor, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-2000, Denmark, eb.om@cbs.dk

Many economic time series are besides seasonality also affected by external events either as known or as unknown events. Inclusion of seasonality and external events in a multivariate analysis is investigated in this paper. Because of the presence of simultaneous relationships the identification is not straghtforward, and modeling the structural relationships is similar complex. The impact of technological changes is modelled and a systematic process is being considered.

2 - Addressing R&D Target-setting Through Technology Forecasting using Data Envelopment Analysis
Ann-Marie Lamb, ajlamb@pdx.edu, Timothy Anderson, Tugrul Daim

While the literature has indicated organizations face a wide variety of difficulties in setting R&D targets, few studies have been found which delve deeper into what those difficulties are as well as how to overcome them. The objective of this presentation will be to showcase the continued evolution of an emerging technology forecasting method, Technology Forecasting using Data Envelopment Analysis (TFDEA), and how it can be applied to improve decision-making in R&D target-setting.

3 - Hierarchy in Industry Architecture: Transaction Strategy Under Technological Constraints
Jianxi Luo, PhD in Technology, Management, & Policy, Massachusetts Institute of Technology, 77 Mass Ave, E38-448, Cambridge, MA, 02139, United States of America, luo@mit.edu, Carliss Baldwin, Daniel Whitney, Christopher Magee

We conduct network analysis to analyze how firms are organized at the sector level in terms of hierarchy (one-way flow of transactions), in order to understand how industrial transaction choices of single firms may shape industry architectures, and meanwhile be constrained by technologies. Based on the results, we argue high power technologies constrain transaction strategies, while lower power technologies enable a larger option space of transaction choices, for firms to explore and exploit.

4 - Back-loading the Frontend
Sebastian Fixson, Babson College, Babson Park, MA, United States of America, sfixson@babson.edu, Tucker Marion

Our study investigates the effect of CAD use on changes in process structure (i.e., frontloading) of PD projects, and ultimately on project performance. In addition to positive frontloading we also observe a form of unintended back-loading of work from initial concept development to detail design with detrimental effects for PD performance.

■ SB56

C - Room 1, Level 1

Efficient Simulation Optimization Techniques

Sponsor: Simulation Society
Sponsored Session

Chair: Loo Hay Lee, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, iseleelh@nus.edu.sg

1 - A Minimally Conservative Indifference Zone Policy
Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

We construct a fully sequential indifference-zone (IZ) policy for independent normal ranking and selection that is minimally conservative, in the sense that its worst-case probability of correct selection is exactly equal to the target probability. To the author's knowledge, this is the first fully sequential IZ policy that is minimally conservative for more than two alternatives. Surprisingly, the proof of minimal conservatism involves Bayesian methods, linking IZ and Bayesian approaches.

2 - Optimal Computing Budget Allocation for Subset Selection
Loo Hay Lee, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, iseleelh@nus.edu.sg, Ek Peng Chew, Si Zhang, Chun-Hung Chen

In this talk, we will present a new computing budget allocation algorithm for subset selection problem, i.e., OCBAm+. We will show the conditions on when this new algorithm will be better than the existing OCBAm algorithm.

3 - A Class of Assignment Problems with Feasibility Constraints
Qianchuan Zhao, Tsinghua University, Dept Automation, Tsinghua University, Beijing, China, zhaoqc@tsinghua.edu.cn, Chaobo Yan

In a industrial process containing many steps, limited tools or workers are often required to allocated so that key requirements are satisfied. Finding feasible assignments is not trivial especially when the amount of resource is tight. In this talk, we will present some conditions under which this class of problem can be addressed based on simulation based sequential random search with backtracking.

4 - Application of Splitting Methods to Rare-event Problems in Power Grids
John Shortle, George Mason University, 4400 University Dr., Fairfax, VA, United States of America, jshortle@gmu.edu, Chun-Hung Chen

Splitting is a rare-event simulation technique that "splits" a simulation into separate copies whenever it gets "near" the rare event. We give a method that extends splitting to the evaluation of two different alternatives. The method attempts to optimize the computing budget among the alternatives and splitting levels to improve the efficiency of the simulation. We apply the method to the evaluation of rare-event blackout probabilities in power grids.

■ SB57

C - Room 2, Level 1

Risk Management in Supply Chains

Cluster: Risk Management
Invited Session

Chair: Jian Li, Assistant Professor, Northeastern Illinois University, College of Business and Management, Chicago, IL, 60625, United States of America, JLi@neiu.edu

1 - Inviting Selective Early Orders for Informational Gains
Aditya Jain, Assistant Professor, Indian School of Business, Hyderabad, India, aditya_jain@isb.edu, Milind Sohoni, Sridhar Seshadri

Manufacturers often invite few retailers to place orders early to get indication of the demand in market. The operational effect of such early orders are well understood. Using a simple model in which a single manufacturer supplies to multiple competing retailers endowed with private information, we illustrate strategic effect of this practice. We examine incentives of manufacturer and supplier to engage in such practice under various conditions, and its implication on supply chain profit.

2 - Specification Vagueness and Supply Quality Risk
Yimin Wang, Arizona State University, W. P. Carey School of Business, Tempe, AZ, United States of America, Yimin_Wang@asu.edu

We study the effect of a manufacturer's quality specification policy on the supplier's quantity provision decision and the resulting expected delivery quality when the supplier's production process is subject to inherent quality risk. We prove that the manufacturer may benefit from a vague quality specification, and we characterize conditions under which a vague quality specification can be attractive.

3 - Supplier Competition Under the Dual-sourcing Setting
Lian Qi, Rutgers Business School, 1 Washington Park, Newark, NJ, 07059, United States of America, lianqi@business.rutgers.edu, Xiaowei Xu

We study a supplier competition problem in which two suppliers are serving a same retailer. The retailer uses a newsvendor model to determine the order quantity from each supplier, while considering the price and reliability differences of these two suppliers. Based on the retailer's ordering policy, the suppliers adjust their reliability factors and the whole sale prices in order to maximize their own profits. We model this problem as a supplier game and investigate its Nash equilibrium.

4 - Inaccuracy of Inventory and Optimal Stocking Policy: Application of RFID
Jiang Zhang, Adelphi University, 1 South Ave, Garden City, NY, 11539, United States of America, zhang@adelphi.edu

This paper looks three areas of deficiency in an inventory system, namely, inventory inaccuracy, demand distortion, and supply uncertainty, and argues that these issues co-exist and interrelate in practice. We propose a joint model which accounts for these issues simultaneously.

5 - Optimal Operational Versus Financial Hedging for a Risk-averse Firm

Adam Zhu, Assistant Professor, Singapore Management University, 50 Stamford #0401, Singapore, Singapore, adamzhu@smu.edu.sg, Roman Kapuscinski

A Multinational Risk-averse firm produces goods at home country and sells in both home and foreign countries, facing the risks of both demand and exchange rate uncertainty. This paper uses utility function to capture the firm's risk attitude, and to evaluate the impact of operational hedging and financial hedging on the firm value under both exogenous and endogenous price settings. Our study shows that the operational hedging generally outperforms the financial hedging.

■ SB58

C - Room 3, Level 1

Portfolio Credit Risk: New Directions

Cluster: Quantitative Finance
Invited Session

Chair: Kay Giesecke, Stanford University, 414 Terman Center, Stanford, CA, United States of America, giesecke@stanford.edu

1 - Unified Multi-name Credit-equity Modeling: A Multivariate Time Change Approach

Rafael Mendoza-Arriaga, Assistant Professor, McCombs School of Business, University of Texas at Austin, IROM, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu, Vadim Linetsky

We develop a new class of multiname unified credit-equity models that jointly model the stock prices of multiple firms, as well as their default events, by a multi-dimensional Markov semimartingale constructed by multivariate subordination of JDCEV diffusions. Each of the stock prices experiences state-dependent jumps with the leverage effect, including the possibility of a jump to zero (jump to default). We model idiosyncratic and systematic jumps.

2 - Large Deviations and Rare Events in Large Credit Portfolios

Richard Sowers, University of Illinois, Urbana, IL, 61801, United States of America, r-sowers@illinois.edu

Large deviations theory is designed to formalize the study of rare events in random systems. We discuss the application of this theory to several problems in credit risk in large portfolios. We in particular are interested in nonlinear interactions between different sources of risk. We give both theoretical results and some numerical insights.

3 - Diversity and Arbitrage in a Regulatory Breakup Model

Jean-Pierre Fouque, Professor, UC Santa Barbara, Statistics and Applied Probability, South Hall 5504, Santa Barbara, CA, 93106 3110, United States of America, fouque@pstat.ucsb.edu, Winslow Strong

We explore a method of imposing diversity on market models by a type of antitrust regulation that is compatible with EMMs. The regulatory procedure breaks up companies that become too large, while holding the total number of companies constant by imposing a simultaneous merge of other companies. As an example, regulation is imposed on a market model in which diversity is maintained via a log-pole in the drift of the largest company.

4 - Economic Default and Arcsine-law

Adrien De Larrard, Universite Pierre et Marie Curie, Laboratoire de Probabilites, Paris, France, larrard@clipper.ens.fr, Xin Guo, Robert Jarrow

Recently, an investigation by Guo, Jarrow and Lin (2009) of the distressed debt prices led to a surprising finding about the nature of default, and a new concept of "economic default" was coined. In this talk, we propose a mathematical model for "economic default" and apply fluctuation theory in probability to analyze the model. Consistent with the empirical analysis in GJL (2009), we identify an Arcsine-Law type of distributions for the distance between the economic default and the traditional default date.

■ SB59

H - Salon A, 4th Floor

Combinatorial Optimization II

Contributed Session

Chair: Burcu Aydin, Research Scientist, HP Laboratories, 1501 Page Mill Road, Mail Stop 1040, Palo Alto, CA, 94304, United States of America, aydin@hp.com

1 - Creating Contiguous Political Districts using a Scalable Graph Partitioning Model

Douglas King, University of Illinois at Urbana-Champaign, Department of Industrial and Enterprise Systems Engineering, 117 Transportation Building, 104 S. Mathews Ave., Urbana, IL, 61801, United States of America, dmking@illinois.edu, Wendy Tam Cho, Edward Sewell, Sheldon Jacobson

Geographic zoning is often modeled as a graph partitioning problem with contiguity constraints. For large problems, enforcing these constraints in local search imposes a computational burden. This talk presents a new geographic zoning model that allows scale-invariant enforcement of contiguity constraints without restricting the form of other constraints and objectives.

2 - A Bistellar Flips Approach to Bounding Polytope Diameter

Anand Kulkarni, Department of Industrial Engineering and Operations Research, 4174 Etcheverry Hall, University of California, Berkeley, CA, 94720-1777, United States of America, anandk@berkeley.edu

We present a method for induction over a set of combinatorial types of polytopes via techniques from simplicial topology as a new means to establish their combinatorial properties. In particular, we show how sequences of bistellar flips can be used to generate a superset of all polytopes, and discuss application of this technique to the problem of determining upper bounds on the diameter of polytopal graphs and the related Polynomial Hirsch Conjecture.

3 - On the Expected Value of the Bottleneck Assignment Problem

Michael Spivey, University of Puget Sound, 1500 N. Warner St., Tacoma, WA, United States of America, mspivey@pugetsound.edu

We give a method by which one can find the asymptotic moments of a random bottleneck assignment problem in which costs are chosen from a variety of continuous distributions. Our method uses the time to first matching in a random bipartite graph process and the Maclaurin series for the distribution's inverse cdf. Our results improve on the previous best-known expression for the expected value of a random bottleneck assignment problem and yield the first results on other moments.

4 - A Branch and Bound Algorithm for K-tree-lines

Burcu Aydin, Research Scientist, HP Laboratories, 1501 Page Mill Road, Mail Stop 1040, Palo Alto, CA, 94304, United States of America, aydin@hp.com

This work is a part of a larger study aiming to develop methods to statically analyze populations of tree structured objects. The methods suggested are the use of tree-lines, k-tree-lines and tree-curves. The focus of the talk, the k-tree-line problem, is solved via a branch-and-bound type algorithm to optimality. The results of the method on a real life data set of brain vessel systems of 98 subjects will be presented. A discussion on the running time of the algorithm will also be given.

■ SB60

H - Salon B, 4th Floor

One-Switch Independence, Lifetime Consumption, and Communication of Trade-Offs

Sponsor: Decision Analysis
Sponsored Session

Chair: Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61801, United States of America, aliabbas@uiuc.edu

1 - One-Switch Conditions for Multiattribute Utility Functions

Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61801, United States of America, aliabbas@uiuc.edu, David Bell

We introduce a variety of new independence conditions for multiattribute utility functions which provide simple, easily assessable functional forms that nevertheless permit utility dependence among the attributes. The conditions are stronger than one-switch independence (Abbas and Bell 2008), and vary in the degree to which they specify the functional form, ranging from the more general solutions, with weaker constraints, to the more specific solutions, with stronger constraints.

2 - Habit Formation From Correlation Aversion
Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, P.O. Box 6550, Charlottesville, VA, 22906, United States of America, lichtendahlc@darden.virginia.edu, Raul Chao, Samuel Bodily

Making lifetime consumption and investment plans is a fundamental economic challenge. The leading models use either correlation neutral or correlation seeking preferences. We consider correlation averse preferences and find exact solutions to this planning problem. Our solutions recommend that a decision maker form and follow a consumption habit. While such habits have traditionally been associated with correlation seekingness, in our model, habit formation follows from correlation aversion.

3 - Decision-focused Transformation: Automated Communication of Tradeoffs as Alternatives are Removed
Rob Dees, Assistant Professor, US Army, 314A South Moore Loop, West Point, NY, 10996, United States of America, Robert.Dees@usma.edu, Matthew Dabkowski

Introduced at INFORMS 2008, the Decision-Focused Transformation (DFT) of additive value models is intended to improve communication. DFT removes common/unavailable value from globally-scaled models, thus highlighting tradeoffs in the discriminatory value space. As the alternative set is reduced, DFT provides a mechanism to iteratively focus on tradeoffs in the reduced space. We offer that DFT, automated in software, is particularly useful in practice to display tradeoffs in real time.

■ SB63

H - Room 404, 4th Floor

Implementing New Ideas in Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Larry Neal, Manager, DA Consulting, Chevron, 3667 Cantelow Rd, Vacaville, CA, 95688, United States of America, LarryNeal@chevron.com

1 - Value of Information with Conditional Outcomes
Brian Putt, Manager Decision Analysis, Chevron, Vacaville, CA, United States of America, bhpu@chevron.com

Value of Information with Conditional Outcomes: VOI Analysis of imperfect information for Appraisal wells or 3D/4D seismic is typically analyzed using conditional probabilities. However, assigning conditional probabilities to various appraisal outcomes given a reality state is often difficult and may not be intuitive based on the assumed appraisal outcomes. This presentation will explore an alternative approach that utilizes conditional outcomes, builds on the Subject Matter Experts (SME's) thought process and maintains the principle that when all possible outcomes of the "test" are considered the distribution should correspond to reality.

2 - Adopting and Integrating Game Theory in Your Organization
Paul Papayoanou, President, SGG, 6700 Woodlands Pkwy, Suite 230-267, The Woodlands, TX, 77382, United States of America, paul@stratgaming.com

Game theory has not realized the level of adoption and integration that decision analysis has in the decision-making processes of many large companies, yet game theory is applicable to a wide range of interactive business situations. This presentation reviews why, and what can be done, showing there is a need to build the market within organizations with concerted education, diagnostic tools, and a practical game-theoretic approach that complements existing DA capabilities and processes.

3 - Employing Traded Markets as Experts
Robert Stibolt, Managing Director, Galway Group LP, 3050 Post Oak Blvd., Suite 1300, Houston, TX, 77056, United States of America, bob.stibolt@stanfordalumni.org

For the decision analyst, information quality is a critical element of decision quality. Skepticism about information quality, especially the reliability of expert assessments, remains a significant source of objection by decision-makers to implementing a more disciplined decision quality framework. This paper investigates possibilities for making use of traded markets as a source of information that in many cases can supplement or even replace expert assessments.

4 - Introducing a Unique Approach to Optimization VOI - using a Case Example of an Gas Field Interference
Ellen Coopersmith, President, Decision Frameworks, L.P., 9821 Katy Freeway, Suite 550, Houston, TX, 77024, United States of America, ellen@decisionframeworks.com

This presentation introduces an optimization VOI framing and valuation workflow, using a gas field interference test case example. Soon after a field discovery, the decisions which may be affected by gathering more information transition from typical "go/no go" decisions to "how to go" or optimization decisions. When this occurs it is important to frame the decision problem differently-to understand the decision impact of uncertainty reduction that may occur as a result of new information.

■ SB68

H - Room 415, 4th Floor

Market Segmentation and Demand Management in eBusiness

Sponsor: eBusiness
Sponsored Session

Chair: Subodha Kumar, Mays Business School, 320 Wehner Building 4217 TAMU, Texas A&M University, College Station, TX, United States of America, subodha@tamu.edu

1 - Competition and Coordination in Online Marketplaces
Xuying Zhao, University of Notre Dame, 361 MCOB, Notre Dame, IN, United States of America, xzhao1@nd.edu, Jennifer Ryan, Daewon Sun

Online market places have seen rapid growth in recent years. A marketplace firm such as Amazon may sell products and compete with other retailers selling through its marketplace. We study the cooperation and competition among the marketplace firm and those retailers selling on the marketplace. We provide guidance on whether or not to sell similar products on the marketplace and if so, the optimal price to sell them, for the marketplace firm and the retailers.

2 - Impact of Inventory Status on the Recommender System for DVD Rentals
Emre Demirezen, Texas A&M University, 320 Wehner Building 4217 TAMU, College Station, TX, United States of America, edemirezen@mays.tamu.edu, Subodha Kumar, Milind Dawande, Vijay Mookerjee

We consider a subscription based DVD rental organization, where the satisfaction of customers depends on the availability of requested movies. Hence, it is important to satisfy as much demand as possible. Recommendation systems are being used to help customers in finding the right movie. However, the recommendations can also be used to influence the demand. We address this issue by optimizing the recommendation system based on the inventory status, and show that this approach is more beneficial.

3 - Market Segmentation with Risk: Applications for Electronic Commerce
Ori Marom, Assistant Professor, RSM Erasmus University, Burgemeester Oudlaan 50, Rotterdam, 3062PA, Netherlands, omarom@rsm.nl, Abraham Seidmann

We characterize an optimal scheme for the sale of multiple identical items by a monopolist in a market comprising risk-averse buyers. We establish that a seller may obtain segmentation benefits by randomizing prices in one channel while also offering a risk-free alternative in another. The optimal vehicle of such randomization is a draw from a discrete two-point probability distribution function. We use the model to offer explanations for observed behavior of online sellers.

■ SB69

H - Salon F, 6th Floor

RAS Problem Solving Competition - 2010

Sponsor: Railrway Applications
Sponsored Session

Chair: Shankara Kuppa, Systems Engineer, Union Pacific Railroad, 1400 Douglas St, Mailstop 0580, Omaha, NE, 68179, United States of America, skuppa@up.com

Co-Chair: Homarjun Agrahari, Sr. Operations Research Specialist, BNSF Railway, 6308 Kristen Dr., Fort Worth, TX, 76131, United States of America, homarjun.agrahari@bnsf.com

1 - RAS Problem Solving Competition
Shankara Kuppa, Systems Engineer, Union Pacific Railroad, 1400 Douglas St, Mailstop 0580, Omaha, NE, 68179, United States of America, skuppa@up.com

The objective of this competition is to spread awareness about these interesting problems in OR community that includes students, academicians and practitioners. In this session, we will have two/three finalists present their approaches to address the problem for this year's competition. Abstracts of the papers will be updated after the finalists are identified. For more information regarding the competition, please visit http://www.informs.org/Community/RAS/Problem-Solving-Competition.

■ SB70

H - Salon G, 6th Floor

Joint Session AAS/ TSL: Advances in Airline Scheduling

Sponsor: Aviation Applications/ Transportation Science and Logistics Society
Sponsored Session

Chair: Gizem Keysan, Senior Analyst, United Airlines, 1200 E Algonquin Rd., Elk Grove Village, IL, 60007, United States of America, gizem.keysan@united.com

1 - A Decomposition Technique for Itinerary-based Airline Fleet Assignment

Gizem Keysan, Senior Analyst, United Airlines, 1200 E Algonquin Rd., Elk Grove Village, IL, 60007, United States of America, gizem.keysan@united.com, Bala Srinivasan

Airline fleet assignment problem involves maximizing profitability while assigning aircraft types to flight legs. Although itinerary-based airline fleet assignment problem incorporates network considerations, the resulting solutions are often suboptimal due to the high computational complexity in practical settings. We introduce a decomposition technique that solves the itinerary-based fleet assignment efficiently without sacrificing solution quality.

2 - Strategic Planning in the Airline Industry Under Jet Fuel Price and Demand Uncertainty

Marc Naumann, Decision Support & Operations Research Lab - University of Paderborn, Warburger Str. 100, Paderborn, 33098, Germany, naumann@dsor.de, Leena Suhl, Achim Koberstein

Fuel costs are a growing part of airlines' costs and their fluctuations become higher. We connect schedule design and fleet assignment in a new strategic planning model under fuel price uncertainty. We present a SP-model that determines the optimal offered flights, passenger routes and aircraft types. To counteract uncertainty, financial hedging is considered. We show that the optimal decisions depend on the fuel price and that the integration of hedging improves profit at given risk levels.

3 - A Gate Assignment Model (GAP) for Schedule Planning and Operations

Kumar Abhishek, Sr. Analyst, United Airlines, 1200 E Algonquin Road, Elk Grove Village, IL, 60007, United States of America, Kumar.Abhishek@united.com, Vikrant Sharma

A gate assignment model is developed for the schedule planning group and stations for assigning gates to aircraft turns subject to gate resource availabilities and restrictions including gate rests. The model can also re-time flights to create feasible solutions while accounting for network effects. An integer programming model is formulated to solve this problem. Because of run time considerations, a heuristic decomposition approach is taken that solves the problem an order of magnitude faster.

4 - Multicommodity Gate Flow Network Model Solving Flight-gate Assignment Problem for Hub-spoke Airline

Binod Maharjan, Texas Tech University, 2500 Broadway, Box 43061, Lubbock, TX, 79409, United States of America, b.maharjan@ttu.edu, Timothy Matis

Binary integer (BI) multi-commodity gate flow network model is formulated to find the optimum flight-gate assignment. The objective is to minimize the taxi-in/out fuel burn cost and connecting passengers walking distance from arrival gate to departure gate through judicious assignment policy. BI programs are very difficult to solve due to non-polynomial computational time and high RAM requirements. Therefore, the gate zoning approach is used by grouping certain available gates in an airport to zones and sub-zones reducing the big problem into smaller problems then solved to find optimal solution. Model is tested for the scheduled flight data of Continental Airlines to seek the optimal flight-gate assignment policy at IAH.

■ SB71

H - Salon H, 6th Floor

Strategic Perspectives Through DEA

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Indranil R. Bardhan, Associate Professor, University of Texas-Dallas, School of Management, SM 41, Richardson, TX, 75080, United States of America, bardhan@utdallas.edu

1 - Strategic Efficiency and Innovation as Determinant of Selection and Competition: Insights From a Pareto Efficiency Frontier Analysis

Arie Y. Lewin, Duke University, The Fuqua School of Business, Durham, NC, United States of America, ayl3@duke.edu, Lawrance Seiford, Silvia Massini, Joe Zhu, H. R. Greve

This paper analyzes 23 years of data on the Japanese cement industry. The data has details about inputs such as staffing levels, kiln capacity and outputs of cement production. In addition during that time period the Japanese cement industry introduced four new cement making technologies. The starting assumption was that in a commodity industry firms will minimize costs to achieve cost leadership and those firms on the Pareto efficient production frontier would be the ones to introduce successive technological innovations. The empirical DEA analysis did not support this initial hypothesis. A re-analysis of the data revealed that no firm was consistently on the Pareto efficient production frontier and that the introduction of new technologies was a form of leapfrogging strategy. It involved a small number of firms who were competing for cost leadership but no firm had been able to achieve a sustained cost leadership position. In one case the strategy the firm introducing a new technology is consistent with hyper-competition theory of firm that it is verge of being selected out being the one introducing a new cement making technology. The key finding of the paper is that introduction of new cement making technologies is affected by firm specific strategic considerations which is consistent with other empirical studies of heterogeneity of performance within industries.

2 - Returns to Scale in Public Accounting Firms

Hsihui Chang, Drexel University, Philadelphia, PA, hc336@drexel.edu, Hiu Lam Choy, Benjamin Lev, Iny Hwang

This paper employs DEA to evaluate the returns to scale patterns of public accounting firms in the post Sarbanes-Oxley Act (SOX) period. Analyzing operations data on top 100 public accounting firms over the period 2003-2007, our statistical test results indicate that public accounting firms exhibit decreasing returns to scale in the post SOX period, suggesting that public accounting firms should consider either downsizing and/or divestitures in order to improve their efficiency.

3 - Productivity Differences Between US and Chinese Manufacturing Plants: A Non-parametric Analysis

Indranil R. Bardhan, Associate Professor, University of Texas-Dallas, School of Management, SM 41, Richardson, TX, 75080, United States of America, bardhan@utdallas.edu, Zhiqiang Zheng, Sezgin Ayabakan

Explore differences in productivity between US and Chinese manufacturing plants. Using data from 2007, we use a two-stage DEA approach to identify the determinants of manufacturing efficiencies among Chinese and US plants. We evaluate plant characteristics as well as technology spending in terms of their impact on productivity.

■ SB72

H - Salon J, 6th Floor

Innovations in Pricing of Transportation Systems: II

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Siriphong Lawphongpanich, University of Florida, Gainesville, FL, 32607, United States of America, lawphong@ise.ufl.edu

1 - Congestion Pricing Under Travel Time Uncertainty: A Game Theory Perspective

Qian Wang, Assistant Professor, University at Buffalo, the State University of New York, 231 Ketter Hall, UB North Campus, Buffalo, NY, 14260-4300, United States of America, qw6@buffalo.edu, Jun Zhuang, Peng Zhang

This paper develops a game-theoretic framework to solve the optimal toll design problems given travelers' different attitudes to travel time unreliability. The conceptual framework is a sequential game in which the road authority chooses toll schemes and then travelers determine their routes accordingly. The modeling framework is tested on a small network. As found, tolls work efficiently if and only if the travel time reliability of the tolled roads can be ensured.

2 - Self-Adaptive Tolling Strategy for Optimal Operations on High Occupancy Toll Lanes

Guohui Zhang, University of Texas-Austin, Center for Transportation Research, Austin, TX, 78701, United States of America, guohui.zhanguw@gmail.com, Yinhai Wang

A Self-Adaptive Tolling Strategy (SATS) is formulated for systematically optimizing High Occupancy Toll (HOT) lane system operations dynamically. This strategy aims at fully utilizing the HOT lane capacity while maintaining high speed and/or reliability of travel time for HOT lane traffic to enhance the overall system performance of both HOT and General Purpose (GP) lanes. The test results demonstrate that the proposed tolling strategy performs reasonably well.

3 - Pareto-improving Toll and Subsidy Schemes for Network Optimization

Feng Xiao, Postdoc, UCDavis, Engr III, One Shield's Ave, Room 1001, Davis, CA, 95616, United States of America, evan.fxiao@gmail.com, Michael Zhang

This paper proposes an arc-based toll plus subsidy scheme to improve the system performance in a transportation network. We demonstrate that on a one-origin network, a pareto-improving, system-optimal and revenue-neutral scheme always exists and can be obtained by solving a set of linear equations. For multi-origin network, we define the maximum-revenue problem with pareto-improving constrains (MRPI). We discover that the dual of MRPI is equivalent to a typical Transportation Problem.

4 - Design of More Equitable Pricing Schemes by Capturing Their Distributional Effects

Di Wu, University of Florida, Gainesville, FL, United States of America, wudi@ufl.edu, Yafeng Yin, Siriphong Lawphongpanich

This paper develops a pricing model to determine more equitable pricing schemes for multimodal urban transportation networks. The schemes alleviate congestion or improve social benefit while leading to a more uniform distribution of effects across population groups with different income levels and at different geographic locations. A numerical example is presented to demonstrate the proposed model and the impact of a more equitable pricing scheme.

■ SB73

H - Salon K, 6th Floor

Vehicle Routing I: Vehicle Routing Applications

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Sushant Sharma, Research Associate, Purdue University, B100, 2700 Kent Avenue, West Lafayette, IN, 47906, United States of America, sharma57@purdue.edu

1 - Routing Problems with Commercial Electric Vehicles

Miguel Figliozzi, Portland State University, P.O. Box 97207-0751, Portland, OR, United States of America, figliozzi@pdx.edu, Ryan Conrad, Brian Davis

We present routing models for electric commercial vehicles. In this problem customers can have time windows or other typical routing constraints. In addition charging and energy use constraints are required to adequately represent the limitations of electric vehicles. We present a detailed discussion the modeling approach. In addition, experimental results from a realistic problem in Portland are presented and discussed.

2 - Logistics of Clinical Testing: Heuristics for Routing and Scheduling of Specimen Collection

Lerzan Ormeci, Associate Professor, Department of Industrial Engineering, Koç University, Koç University, Sariyer, Istanbul, 34450, Turkey, lormeci@ku.edu.tr, Eda Yucel, Esma Gel, Sibel Salman

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.

3 - A Case Study Comparing Two Fleet Routing Algorithms

Douglas A. Popken, Principal Consultant, Systems View, 2127 Mountain Maple Ave., Highlands Ranch, CO, 80129, United States of America, dpopken@systemsview.com

A distributor supplying grocery stores within a major metropolitan area needed to determine efficient, time-window constrained delivery routes. Two algorithmic approaches were compared: a territory-based clustering algorithm with a generalized TSP solver, and a tabu-search based algorithm with insertion heuristics. We examine the practical implications of the approaches and show how a hybrid approach can provide good routes that also appeal to dispatchers and drivers.

■ SB74

H - Room 602, 6th Floor

Advances in Network Equilibrium Models

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Doan Kien, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, United States of America, dtkient@gmail.com

1 - Experimental Analysis of User Equilibrium with Real-time Information in Randomly Disrupted Networks

Xuan Lu, University of Massachusetts,Department of Civil and Environmental Engineering, Amherst, MA, xlu@engin.umass.edu, Song Gao, Eran Ben-Elia

The research is the first attempt to study the effectiveness of real-time information and its interactions with route choice behavior in a hypothetic network under uncertain disruptions, using data collected from human subjects who simultaneously make route choices in controlled PC-based laboratory experiments.

2 - Linear Complementarity Formulation for Dynamic Network Equilibirum

Doan Kien, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, United States of America, dtkient@gmail.com, Satish Ukkusuri

This paper focuses on the dynamic traffic assignment at the network-wide level. Embedding the cell transmission model, this paper proposes an analytical formulation using the linear complementarity techniques. In this model, the trade-off between travel time and schedule delay is also taken into consideration. Thus, the objective is to find the user equilibrium condition for the whole network in which the commuters could choose the time to depart as well as the path to use. The existence of the solution are discussed. After studying the single OD pair, this paper will extend the formulation for the more complicated network. Extensive computational results are conducted to demonstrate the finding in this paper.

3 - Dynamic Traffic Information Generation using Vehicle-to-vehicle Communications

Yong Hoon Kim, Purdue University, West Lafayette, IN, United States of America, kim523@purdue.edu, Srinivas Peeta

We address the problem of generating reliable dynamic traffic information in a road traffic network when vehicles have a capability for V2V communications. The study focuses on the data quality and the spatio-temporal coverage enabled by the V2V communication capability. Insights will be illustrated by comparing the data obtained through the V2V communications and the field data using numerical experiments.

4 - An Improved Traffic Assignment Algorithm that Inherits the Concept of Social Pressure and Slope

Amit Kumar, Research Scholar, Indian Institute of Technology, Department of Mechanical Engineering, Delhi, New Delhi, India, akumar@icfi.com, Srinivas Peeta

We develop a path-based algorithm to solve the static user equilibrium traffic assignment problem, in which the flow update technique inherits some insights from the social pressure algorithm developed by Kupiszewska and Vliet (1998) and the SMPA algorithm developed by Kumar and Peeta (2010). The solution methodology is discussed and computational results are presented for the test network.

Sunday, 1:30pm - 3:00pm

■ SC01

C - Ballroom D1, Level 4

Economics of Renewables Integration and Smart Grid Technologies

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 - Regulating Local Monopolies in Electricity Transmission: A Real-world Application of the StoNED Method

Andrew Johnson, Texas A&M University, Department of Industrial and Systems Eng, College Station, TX, 77840, United States of America, ajohnson@tamu.edu, Timo Kuosmanen

The Finnish electricity market has a competitive energy market in a monopolistic transmission system. To regulate the local monopoly power of network operators, the government regulator uses frontier estimation methods (e.g., DEA, SFA) to identify excessive transmission costs, taking into account outputs and the operating environment. We describe the new regulatory system developed for the Finnish regulator, which utilizes panel data to detect the excessive costs from random noise.

2 - Assessing the Cost and Reliability Impacts of Stochastic Wind Power Through Network Simulation

Lindsay Anderson, Adj. Assistant Professor, Cornell University, 320 Riley Robb Hall, Ithaca, NY, 14853, United States of America, cla28@cornell.edu, Judith Cardell, Chin Yen Tee

It is commonly accepted that wind energy will comprise a significant proportion of total electricity generation in the future, and that systems will be significantly impacted by its intermittent nature. In this work, we quantify the impact of multiple correlated wind farms on a model network, in terms of system costs and reliability metrics. Wind forecast errors are introduced to the economic dispatch methodology using a Monte Carlo approach.

3 - Increasing the Value of Wind with Energy Storage

Ramteen Sioshansi, Assistant Professor, The Ohio State University, 240 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu

We examine the use of energy storage to mitigate price-suppressive effect of high wind penetrations by shifting wind generation from periods with low prices to periods with higher prices. We show that storage can significantly increase the value of wind generation but that this use of storage can reduce both consumer surplus and the profits of other non-wind generators. We also examine the sensitivity of this value of storage to a number of parameters.

4 - Optimal Transmission Switching: When Economic Efficiency and FTR Markets Collide

Kory Hedman, PhD Candidate, University of California, Berkeley, 4124 Etcheverry Hall, Berkeley, CA, 94720, United States of America, kwh@berkeley.edu, Richard O'Neill, Shmuel Oren

The current push to create a smarter grid has brought to the forefront the possibility of co-optimizing generation along with the network topology. Unfortunately, such co-optimization, while improving social welfare, may be incompatible with prevailing market design practices. We will discuss various market implications resulting from co-optimizing the network topology with generation and, in particular, we examine its affect on the FTR markets.

■ SC02

C - Ballroom D2, Level 4

Reliability, Investment and Restructuring in Electricity Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Golbon Zakeri, University of Auckland, 70 Symonds St., Auckland, New Zealand, g.zakeri@auckland.ac.nz

1 - Electricity Markets with Breakdowns

Eddie Anderson, Professor, University of Sydney, Faculty of Economics and Business, Sydney, Australia, edward.anderson@sydney.edu.au, Carlos Ruiz Mora

We model electricity markets with uncertainty in supply as well as demand. There is a two settlement process with a day-ahead market followed by a real time balancing market. Generators may suffer unit outages without warning in which case they buy power in the balancing market to meet their sales in the day-ahead market. We find the two stage equilibrium behaviour and investigate how the equilibrium varies with changes in reliability, and whether there could be an advantage in being unreliable.

2 - Capacity Expansion in the Integrated Supply Network for an Electricity Market

Shan Jin, Iowa State University, Industrial & Mfg. Sys. Engineering, Ames, IA, United States of America, shanjin@iastate.edu, Sarah Ryan

Constraints in fuel supply, electricity generation and transmission interact to affect the welfare of strategic generators and price-sensitive consumers. We use a mathematical program with complementarity constraints to optimize expansions in each level of the electricity supply network. Challenges posed by the discreteness of transmission expansions are mitigated using bounds obtained from a centrally-coordinated version of the model.

3 - Real and Virtual Asset Swaps in the Retail and Wholesale Electricity Sectors

Anthony Downward, University of Auckland, Level 3, 70 Symonds Street, Auckland, 1010, New Zealand, a.downward@auckland.ac.nz, Golbon Zakeri, David Young

In 2009 Prof. Frank Wolak carried out a review of the New Zealand electricity market. In this report he noted that there is a lack of competition in the NZEM, particularly during dry years and suggested that competition could be improved by reallocating generation assets amongst the market participants. We have designed an equilibrium model that encompasses both the retail and wholesale electricity sectors. We consider a variety of reallocation scenarios and analyze their effects on prices.

4 - Path Dependency in Power Sector Investments

Janne Kettunen, Assisstant Professor, University of Calgary, Calgary, Canada, jskettun@ucalgary.ca, Derek Bunn

We analyze the resource-based path dependency in new risk-averse power generation investments under carbon policy uncertainty. Modeling the investment decision making via stochastic dynamic optimization and operations and financing decisions via stochastic optimization, we demonstrate that the investment decision is significantly impacted by the (i) scale effects that are manifested by the number of similar power plants and (ii) diversity effects stemming from the existing power plant mix.

■ SC03

C - Ballroom D3, Level 4

Supply Chain and Production Operations

Sponsor: Energy, Natural Resources and the Environment/ Mining Sponsored Session

Chair: Juan Pablo Vielma, IBM Research and University of Pittsburgh, PO Box 218, Yorktown Heights, NY, United States of America, jvielma@pitt.edu

1 - Synchronization of Planning and Production Processes in a Large Mine

M. Mustafa Kahraman, The University of Arizona, kahraman@email.arizona.edu, Sean Dessureault

Planning and the production processes have different considerations in large coal mines. The critical point between these two processes is 'if the plans are compatible with production'. Production plan could include many concerns; however, these concerns might conflict with production capabilities or in some cases could be very costly. This paper offers approaches that would help improve coordination through engineered processes enabled through data warehousing and OLAP cube analysis.

2 - A Model-Based Decision Support System for Supervision of Coal Blending and Load-Out Processes

Victor Tenorio, Graduate Research Assistant, University of Arizona, 1502 E 10th St Apt 232, Tucson, AZ, 85719, United States of America, vtenorio@email.arizona.edu, Sean Dessureault

A decision support system is designed and implemented in the largest coal mine in North America, to supervise operations and achieve coal quality requirements while maximizing benefits. Operators can adjust parameters to reduce the risk of production variability, blending and shipping processes. Simulators and 5 algorithms take into account key decisions such as; real-time pit-grade assay reconciliation and mining costs, planned train quality valuation and the cost of over/undermining pits.

3 - Simulation-based Planning Framework for Material Handling Network in Mining

Sai Srinivas Nageshwaraniyer, The University of Arizona, Tucson, AZ, ngsaisrinivas@gmail.com, Young-Jun Son, Sean Dessureault

The operations of the largest coal mine in North America are simulated in detail, where major entities include trucks, shovels, silos, conveyors and train load-outs. The functioning of these entities is synchronized using timely shift data from a data warehouse. The model is coupled with a meta-heuristic used to schedule future operations to achieve customer specified train-by-train coal blends over a period of time to maximize the mine's profit. Simulation-based control is also addressed.

4 - Data-Driven Health Management of Mining Equipments
Zhenrui Wang, University of Arizona, Tucson, AZ, United States of America, zrwang@email.arizona.edu, Jian Liu, Sean Dessureault

Maintenance is typically approximately half of all operating costs in an open pit operation. Taking advantage of machine operating and health data stored in large scale data warehouse, this research applies generalized linear regression and statistic process control techniques to identify oversensitive equipments and abusing operators in a real operating mine.

■ SC04

C - Ballroom D4, Level 4

Joint Session Clean/ ENRE Energy: Policy/Incentives for Promoting Renewable Energy

Cluster: Clean Energy/ Energy, Natural Resources and the Environment
Invited Session

Chair: Gireesh Shrimali, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, AP, 500032, India, Gireesh_Shrimali@isb.edu

1 - Comparing the Cap-and-trade and Carbon Taxes Policies in Generation Expansion Planning
Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50014, United States of America, lzwang@iastate.edu, Jianhui Wang, Yanyi He

We compare the effectiveness of cap-and-trade and carbon taxes in the context of generation capacity expansion. Policies are compared with respect to five criteria: carbon price and subsidy, renewable portfolio, total energy generation, generation companies' and grid owner's total profit, and government revenue. Numerical experiments show the relative advantages, disadvantages, similarities, differences, and limitations of the policies.

2 - Carbon Capture by Fossil Fuel Power Plants: An Economic Analysis
Ozge Islegen, PhD Candidate, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States of America, oislegen@stanford.edu, Stefan Reichelstein

This study projects the changes in electricity prices if fossil fuel power plants are regulated for their CO2 emissions. We focus on carbon capture and storage (CCS) technology that new power plants may adopt either because of a mandate or because the market price of CO2 emission permits is sufficiently high. We forecast the resulting changes in wholesale electricity prices and identify the break-even price of CO2 emission permits that makes adopting the CCS technology economically attractive.

3 - Performance-based Contracting for Energy Efficiency Projects
Sam Aflaki, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, sam.aflaki@insead.edu, Paul R. Kleindorfer

An Energy Service Company (ESCO) implements energy efficiency projects for customers, which generate positive net cash flows from resulting energy and carbon savings. We characterize Pareto optimal ESCO contracts with the following structure: an upfront payment, ex-post sharing of the realized savings and ex-ante guarantee of customer savings. Extensions of the basic model include joint contracting and investment decisions, moral hazard and allocation of carbon credits.

4 - Optimal Feed-in Tariff Schedules
Gireesh Shrimali, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, AP, 500032, India, Gireesh_Shrimali@isb.edu

We examine least cost feed-in tariff schedules in a two-period model that focuses on bringing down the cost of renewable technologies to a predefined target under two dynamics: learning-by-doing (LBD) and returns to scale (RTS). When the target is stringent, subsidies are required in both periods, regardless of the dynamic. However, when the target is moderate, subsidies are required only in one of the two periods, and under LBD (RTS) it is optimal to subsidize as early (late) as possible.

■ SC05

C - Ballroom D5, Level 4

Sports Scheduling

Sponsor: SpORts
Sponsored Session

Chair: Dirk Briskorn, University of Cologne, Cologne, Germany, briskorn@wiso.uni-koeln.de

1 - Scheduling Softball Games in the Rocky Mountain Athletic Conference
Marjorie Cone Saur, Colorado Schoo of Mines, Division of Economics and Business, Golden, CO, United States of America, mcone@mymail.mines.edu, Mark Husted, Kaleigh Starr

The RMAC is a Division II NCAA athletic conference that offers women's softball. Conference games are played against every other conference team according to a temporally constrained schedule. Manually generated schedules result in imbalances such as unequal numbers of home games, strings of multiple home or away games, and away-game season openers and closers for the same team. Our integer programming-based schedules eliminate these imbalances while ensuring that all requisite games are played.

2 - The Quality of Major Sports League Schedules in Finland
Cimmo Nurmi, Research Director, Satakunta University of Applied Sciences, Tiedepuisto 3, Pori, 28600, Finland, cimmo.nurmi@samk.fi, Markus Leinonen, Jari Kyngas

Generating a schedule for a professional sports league is an extremely demanding task. Good schedules have many benefits for the league, such as higher incomes, lower costs and more interesting and fairer seasons. This talk/paper gives an analysis of the quality of schedules. We analyze five major sports leagues in Finland: ice-hockey, soccer, baseball, floorball and basketball. We also share our experiences in scheduling the Finnish Major Ice Hockey Leagues in the past three years.

3 - Team Assignments and Scheduling for the NCAA Basketball Tournament
Sharif Melouk, University of Alabama, Operations Management, Tuscaloosa, AL, 35487, United States of America, smelouk@cba.ua.edu, Burcu Keskin

There are growing concerns of dwindling actual attendance and increasing financial burden with regard to the NCAA tournament. In this paper, we develop an assignment model aimed at minimizing the distance traveled by teams to game sites and the corresponding travel costs. The goal is to increase tournament accessibility to fans and lessen the financial impact to the NCAA while maintaining tournament integrity. We test our model against actual tournament assignments from the past five years.

4 - The Relaxed Traveling Tournament Problem
Michael Trick, Carnegie Mellon, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, trick@cmu.edu

In many sports leagues, off days are built in to the schedule. We extend the Traveling Tournament Problem to include such off days and provide some initial computational results. For some approaches, such as constraint and integer programming, the relaxed version of the problem becomes more difficult. Other approaches, including a Benders approach, are much more promising.

■ SC06

C - Ballroom E, Level 4

Tutorial: Simulation Input Modeling

Cluster: Tutorials
Invited Session

Chair: James Wilson, North Carolina State University, 400 Daniels Hall, College of Engineering, Raleigh, NC, 27695, United States of America, jwilson@ncsu.edu

1 - Introduction to Modeling and Generating Probabilistic Input Processes for Simulation
James Wilson, North Carolina State University, 400 Daniels Hall, College of Engineering, Raleigh, NC, 27695, United States of America, jwilson@ncsu.edu, Mary Ann Wagner, Natalie M. Steiger, Michael E. Kuhl, Emily K. Lada, Julie Ivy

We discuss modeling, fitting, and generating the univariate probabilistic input processes that drive many discrete-event simulation experiments. We emphasize the generalized beta distribution family, the Johnson translation system of distributions, and the Bezier distribution family. Also discussed are techniques for modeling and simulating time-dependent arrival streams using nonhomogeneous Poisson processes. Public-domain software implementations and current applications are presented.

■ SC07

C - Ballroom F & G, Level 4

Joint Session JFIG/ INFORM-ED: Panel Discussion: Improving Teaching Effectiveness: Tips From Seasoned Faculty

Sponsor: Junior Faculty Interest Group/ INFORM-ED
Sponsored Session

Moderator: Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa, AL, United States of America, bkeskin@cba.ua.edu

Moderator: Matthew Bailey, Bucknell University, School of Management, Taylor Hall, Lewisburg, PA, United States of America, matt.bailey@bucknell.edu

1 - Joint JFIG/ INFORM-Ed: Panel on Teaching Effectiveness
Panelists: Matthew Bailey, Bucknell University, School of Management, Taylor Hall, Lewisburg, PA, United States of America, matt.bailey@bucknell.edu, Jeffrey Ohlmann, University of Iowa, S210 John Pappajohn Business Building, Iowa City IA 52242, United States of America, jeffrey-ohlmann@uiowa.edu, Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa AL, United States of America, bkeskin@cba.ua.edu, Stephen G. Powell, Professor, Dartmouth College, Tuck School, Dartmouth College, Hanover NH 03748, United States of America, Stephen.G.Powell@tuck.dartmouth.edu, James Cochran, Louisiana Tech University, Department of Marketing & Analysis, P.O. Box 10318, Ruston LA 71272, United States of America, jcochran@cab.latech.edu, Jill Hardin, Associate Professor, Virginia Commonwealth University, jrhardin@vcu.edu, Jeff Camm, Professor, University of Cincinnati, QAOM Dept, Mail Location 0130, Cincinnati OH 45221, United States of America, jeff.camm@uc.edu

This panel is open for all faculty interested in promoting quality teaching in OR/MS courses at all levels: undergraduate, masters, MBA, and PhD. Recognizing the need for diversity of various teaching styles, the panel of experts will share their experiences and tips for improving teaching effectiveness. The panelists will also discuss important topics such as "Transition from a Grad Student to Instructor, "Balancing Research and Teaching", "Teaching methods in Business and Engineering schools", and "Resources for Best Teaching Practices".

■ SC08

C - Room 11A, Level 4

Location Models in Healthcare

Sponsor: Location Analysis
Sponsored Session

Chair: Yue Zhang, Assistant Professor, The University of Toledo, 2801 West Bancroft Street, Toledo, OH, 43606, United States of America, Yue.Zhang@sauder.ubc.ca

1 - User-equilibrium Models for Facility Network Design in Healthcare
Yue Zhang, Assistant Professor, The University of Toledo, 2801 West Bancroft Street, Toledo, OH, 43606, United States of America, Yue.Zhang@sauder.ubc.ca, Derek Atkins

Motivated by a real case study, this talk describes a methodology for optimizing the facility network of a health service provider to maximize its market share in a competitive environment. Facility locations and capacities are the main determinants. With two different assumptions about patient choice behavior of where to obtain service, we formulate the problems as mathematical programs with equilibrium constraints and develop a location-allocation framework to solve them.

2 - Impact of Model Choice, Aggregation, and Data Preparation for an EMS Station Location Model
Erik Rolland, University of California Riverside, 900 University Ave., Riverside, CA, 92521, United States of America, erik.rolland@ucr.edu, Armann Ingolfsson, Raymond Patterson, Geoff Holmes

We investigate the impact of three modeling choices on solution quality for planning ambulance station locations to maximize covered demand: (1) A deterministic maximum coverage model or a model with probabilistic coverage, (2) the level of demand aggregation, and (3) how distances and probabilities of coverage are determined for aggregated demand regions. Preliminary results indicate that using the probabilistic model greatly increases solution quality, even if demand is highly aggregated.

3 - Facility Location Models for Infectious Disease Outbreak Response
Sean Carr, PhD Student, North Carolina State University, 5406 Silver Moon Lane, Raleigh, NC, 27606, United States of America, smcarr2@ncsu.edu, Reha Uzsoy, Stephen Roberts

This work uses facility location models to aid in the decision to locate disaster or infectious disease outbreak response facilities, such as mass vaccination, antiviral, medical supply, or other provision dispensing and efficiently allocate the population and healthcare resources. Several capacitated facility location problems will be discussed, with various objective functions and constraints. Example scenarios are provided for infectious disease outbreaks in Wake County, NC.

4 - A Novel Probabilistic Ambulance Location Model
Yongke Yuan, Associate Professor, Beijing University of Technology, University of South Florida, 4202 E. Fowler Ave., Tampa, FL, 33620, United States of America, yyuan@usf.edu, Michael Weng, Bo Zeng

Most ambulance location models are to maximize population coverage with consideration of ambulance availability. In this talk, we present a novel location model that minimizes the expected service time with two types of ambulances (servers) and their availabilities. As it is a large-scale mixed integer programming model, a Lagrangian relaxation method is developed to obtain the solution. Numerical results will be presented to show the effectiveness of the model and the solution method.

■ SC09

C - Room 11B, Level 4

Strategic Sourcing/Procurement

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Damian Beil, Associate Professor, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, dbeil@umich.edu

1 - Contracting for Capacity: Partner Preferences and the Value of Anticipating Renegotiation
Eda Kemahlioglu-Ziya, University of North Carolina-Chapel Hill, CB#3490, Chapel Hill, NC, United States of America, Eda_KemahliogluZiya@unc.edu

We study contract renegotiation in a stylized supply chain model. Two original equipment manufacturers reserve capacity at a contract manufacturer prior to demand realization. Contract renegotiation allows the OEMs to use and pay for capacity that is more or less than what they reserved. We aim to understand how an OEM's expected post-renegotiation profit is affected by her ability to negotiate a low wholesale price in the initial contract as well as the ability of the other OEM to do the same.

2 - Asymmetric Information and Enforcement in Supply Contract Design
Fuqiang Zhang, Washington State University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, fzhang22@wustl.edu, Ehsan Bolandifar, Tianjun Feng

This paper studies a supply contracting problem for a buyer who sources a product from a supplier to satisfy uncertain market demand. The buyer faces two issues when designing the supply contract: asymmetric information (i.e., the supplier's cost structure is private information) and enforcement (i.e., supply chain firms may shirk from their responsibilities for capacity risks). We derive the buyer's optimal contracting strategies in such a problem setting and analyze their properties.

3 - Auctions and Ambiguity Within Auto Insurance Markets
Wedad Elmaghraby, Robert. H Smith School of Business, Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, Wedad_Elmaghraby@rhsmith.umd.edu, Ali Pilehvar, Canan Savaskan

It is a common practice for car insurance companies to run auctions in order ot dispose of cars that have been damaged beyond repair. Buyers of these damaged cars, Parts disassemblers, must bid on cars in the hopes that there are salvageable components that can later on be sold to downstream repair shops. We investigate the role of auctions within this ambiguous procurement environment.

4 - Strategic Price Quotation by a Tier-two Supplier
Bin Hu, Doctoral Candidate, Ross School of Business, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, hub@umich.edu, Damian Beil, Izak Duenyas

We study price quotation decisions made by a tier-two supplier. The tier-two supplier's customers compete in a reverse auction for an OEM's contract, and use the supplier's price quotes as cost inputs when determining their auction price bids. By quoting higher prices the supplier increases its potential profits but reduces the chance that one of its customers will win the OEM's contract. We characterize the supplier's optimal pricing decisions and optimal quoting mechanism.

5 - Group Buying with Endogenous Quantity
Cuihong Li, University of Connecticut, School of Business, Storrs, CT, 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, and reveals the impact of the group size and buyer asymmetry on the outcomes.

■ SC10

C - Room 12A, Level 4

Multi-Echelon Inventory Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Tim Huh, Assistant Professor, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, V6T1Z4, Canada, tim.huh@sauder.ubc.ca

1 - A Capacitated Assembly Problem
Alexandar Angelus, Singapore Management University, 50 Stamford Road, #04-90, Singapore, Singapore, angelus@smu.edu.sg

We formulate an inventory system with an assembly structure and stochastic demand for the final product. We introduce production capacity limits throughout the assembly, and allow those limits to vary with each component type and stage in the system. We assume backlogging of unsatisfied demand, and carryover of inventory. We find conditions under which such a capacitated assembly system can be reduced to an equivalent (capacitated) series system, thus extending the work of Rosling (1989).

2 - Single-stage Bounds for Optimal Policies in Finite-horizon, Serial Inventory Systems
Kevin Shang, Fuqua School of Business, Duke University, Durham, NC, United States of America, khshang@duke.edu

We consider a two-stage inventory system in a finite horizon. It is well known that echelon base-stock policies are optimal. We show that the optimal upstream base-stock level is bounded above and below by the optimal base-stock level obtained from a single-stage system in each period. A simple heuristic is proposed by employing an average of the solution bounds. Our results can be extended to general stage systems with Markov modulated demand.

3 - Newsvendor or Not? That is the Question
Ton de Kok, Professor of Operations Planning and Control, Eindhoven University of Technology, School of Industrial Engineering, P.O. Box 513, Pav. E4 NL-5600 MB, Eindhoven, Netherlands, A.G.d.Kok@tue.nl

We consider multi-item multi-echelon systems under periodic review and stationary stochastic demand. We assume linear holding and penalty costs. Several authors have derived generalized newsvendor equations for such systems. We discuss these results, and their underlying assumptions. We show that in general newsvendor equations do not hold by deriving related cost-balance equations. We discuss the consequences of this results for the relation between costs structures and service measures.

4 - A Framework for Revenue Sharing Contract Implementation
Mehmet Sekip Altug, Visiting Assistant Professor, George Washington University, School of Business, Washington, DC, 20052, United States of America, maltug@gwu.edu, Garrett Van Ryzin

Revenue sharing is a popular approach to supply chain coordination. It has had some remarkable successes (ala Blockbuster), but also some notable failures. What accounts for these differences? In this talk, we present a framework for understanding the added value and added costs of revenue sharing contracts that helps explain its implementation success and failure in various industries.

■ SC11

C - Room 12B, Level 4

Advances in Inventory and Risk Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Rene Caldentey, New York University, Leonard N. Stern School of Business, New York, NY, United States of America, rcaldent@stern.nyu.edu

1 - Managing Capacity and Inventory Jointly in Large-Scale Manufacturing Systems
Bo Zhang, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States of America, bozhang@gatech.edu, Josh Reed

We consider a single-product, parallel-server, make-to-stock manufacturing system under a base-stock policy. We apply first-order diffusion approximations to the joint optimization of production capacity and the base-stock level. We further develop corrected diffusion approximations that enable us to refine the capacity-inventory prescription. The refined prescription achieves a strong form of asymptotic optimality and is accurate even under moderate or low demand.

2 - A Cournot-stackelberg Model of Supply Contracts with Financial Hedging
Rene Caldentey, New York University, Leonard N. Stern School of Business, New York, NY, United States of America, rcaldent@stern.nyu.edu

We study a supply chain where multiple budget-constrained retailers and a single producer compete in a Cournot-Stackelberg game. At time 0 the retailers order a state-contingent quantity of a single product from the producer and, upon delivery at time T, they sell it in a retail market at a stochastic clearance price. This price depends in part on the realization of some financial market in which the retailers can trade dynamically. We solve for the Nash equilibrium.

3 - New Product Introductions: Improving Demand Information and Supply Responsiveness
Zeina Loutfi, INSEAD, Boulevard de Constance, Fontainebleau, France, zeina.loutfi@insead.edu, Nils Rudi, Aditya Jain

This study addresses the challenge of matching demand and supply in the product introduction phase. We model the effects of prepositioning strategies destined to increase responsiveness and adopt a dynamic approach which permits linking to management of products that have reached steady state. Empirical calibration and evaluation of this strategy is made possible using data from a major cosmetics company marketing their own products in the Middle East and where the approach has been implemented.

4 - Optimal Pricing Under Uniform Allocation Policy: A Model for Online Advertising
Victor Araman, American University of Beirut, Olayan School of Business, Beirut, Lebanon, va03@aub.edu.lb, Kristin Fridgeirsdottir

We consider a web host that generates revenues from displaying advertisements on its website. Each class of advertiser brings a set of requirements including number of hits and length of the ad campaign. We suggest a simple tactical model that depicts the main characteristics of the online problem. One objective we have is to analyze the impact of uncertainty on such system driven on one hand by advertisers demand and on the other by number of viewers visiting the website. The webhost seeks to effectively match demand with supply through pricing and allocating capacity in order to maximize revenues and meet advertisers requirements.

■ SC12

C - Room 13A, Level 4

Supply Chains in Healthcare

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Kevin Taaffe, Associate Professor, Clemson University, 130-A Freeman Hall, Clemson, SC, 29634, United States of America, taaffe@clemson.edu

1 - Analysis of Healthcare Supply Chain Systems Exposed to Random Capacity Disruptions
Alex Savachkin, Assistant Professor, University of South Florida, 4202 E. Fowler Avenue ENB 118, Tampa, FL, 33620, United States of America, alexs@usf.edu, Andres Uribe

Capacity disruption is a profound risk factor for lean health care supply chain systems. We examine capacitated health care supply chain systems using a paradigm of feed—forward flow—matching networks with multiple points of delivery. Two models of stochastic capacity trajectories are analyzed. Our analysis serves as a foundation for decision support for design of resilient health care supply chains.

2 - Routing for Blood Supply Management
Okan Ozener, Assistant Professor, Ozyegin University, Istanbul, Turkey, Orsan.Ozener@ozyegin.edu.tr, Ali Ekici

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 - Selecting Facilities While Managing Pharmaceutical Manufacturing Risks
Kevin Taaffe, Associate Professor, Clemson University, 130-A Freeman Hall, Clemson, SC, 29634, United States of America, taaffe@clemson.edu, AliReza Madadi, Mary Beth Kurz, Scott J. Mason, Ed Pohl, Sarah Root, Mustafa Sir

In this research, we consider a pharmaceutical supply chain where the firm must select facilities to manufacture a product. These facilities are unreliable, and inspection can be done to reduce the level of tainted materials that reach the marketplace. We use a Conditional Value-at-Risk approach to understand the characteristics of facilities that lead to being selected for operation. Our models allow users to balance operational costs with the risk of catastrophic healthcare delivery.

■ SC13

C - Room 13B, Level 4

Selected Topics in Supply Chain Management

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Osman Alp, Bilkent University, Bilkent University, Industrial Engineering Department, Turkey, osmanalp@bilkent.edu.tr

1 - Exact Optimal Policies for Joint Inventory and Outbound Shipment Decisions
Liqing Zhang, Texas A&M University, Industrial & Systems Engineering Department, 3131 TAMU, College Station, TX, 77843, United States of America, liqing@tamu.edu, Sila Cetinkaya

We consider a periodic review, two-echelon, stochastic inventory problem arising the in the context of VMI. We formulate the problem using stochastic dynamic programming, and examine the optimal joint inventory replenishment and outbound dispatch policies under private fleet transportation. We prove the structure of the optimal policy.

2 - Supply Side Story: Risks, Guarantees, Competition and Information Asymmetry
Mehmet Gumus, Assistant Professor, McGill University, 1001 Rue Sherbrooke West, Montreal, Canada, mehmet.gumus@mcgill.ca, Saibal Ray, Haresh Gurnani

The risk of supply disruption has increased as firms have started procuring more from cheaper, but unreliable, suppliers. In this paper, we model a supply chain comprising a single buyer and two suppliers. The risk level of the unreliable supplier might be private information for her. In such settings, the unreliable supplier often offers a price and quantity guarantee. Our objective is to understand the effects such an offer have on the performance of the chain partners.

3 - Coordination of Inventory Distribution and Price Markdowns at Zara
Felipe Caro, UCLA Anderson School of Management, 110 Westwood Plaza, Suite B-420, Los Angeles, CA, 90095, United States of America, fcaro@anderson.ucla.edu

Each year Zara sells inventory during clearance sales accounting for approximately thirteen percent of total revenues. One of the biggest challenges Zara faces in preparation for the clearance season is determining how to distribute 11,000 different fashion designs to over 1,200 stores worldwide. In this talk we describe an ongoing project to distribute merchandise to stores with the highest potential of sale in order to maximize revenues during the clearance period.

4 - Improved Inventory Control in Supply Chains Under Loss Sales and Incomplete Information
Osman Alp, Bilkent University, Bilkent University, Industrial Engineering Department, Turkey, osmanalp@bilkent.edu.tr, Alper Sen, Yasar Altunoglu

Consider a supplier and a retailer operating in a single item, loss sales environment. To maintain the competitive position of the item, supplier imposes penalty costs to the retailer to prevent loss sales and attain high service levels. The retailer makes the ordering decisions accordingly. Supplier has incomplete information of the retailer's observed demand. We propose a new policy that would lead the retailer to make ordering decisions so that the supplier's operating targets are attained.

■ SC14

C - Room 14, Level 4

Panel: Perspectives on Women and Men in the Profession

Sponsor: Women in OR/MS
Sponsored Session

Moderator: Eva Regnier, Naval Postgraduate School, Monterey, CA, 93943, United States of America, eregnier@nps.edu

Moderator: Feryal Erhun, Stanford University, 380 Panama St, Stanford, CA, 94305, United States of America, ferhun@stanford.edu

1 - Panel Discussion: Perspectives on Women and Men in the Profession
Panelists: Eva Regnier, Naval Postgraduate School, Monterey, CA, 93943, United States of America, eregnier@nps.edu, Stephen Graves, Abraham Siegel Professor of Managment, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Ave E53-347, Cambridge MA 02139, United States of America, sgraves@MIT.edu, Paul Griffin, Professor and Department Head, Penn State University, Department of Industrial Engineering, 310 Leonhard Bldg, University Park PA 16802, United States of America, pmg14@engr.psu.edu, Karen Donohue, Associate Professor, University of Minnesota, Carlson School of Management, Minneapolis MN, United States of America, donoh008@umn.edu, Feryal Erhun, Stanford University, 380 Panama St, Stanford CA 94305, United States of America, ferhun@stanford.edu, Brenda Dietrich, IBM, T.J. Watson Research Center, Yorktown Heights NY, United States of America, dietric@us.ibm.com

In the era of Computer Engineer Barbie, how are experiences, work styles, and challenges in the OR/MS profession different for women and men? How can the community support and encourage men and women to enter the profession and excel together?

■ SC15

C - Room 15, Level 4

Tutorial on How to Conduct Human Subject Experiments in Behavioral Operations Management

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Elena Katok, Professor, Penn State University, Smeal College of Business, University Park, PA, 16802, United States of America, ekatok@psu.edu

1 - Tutorial on Designing and Conducting Laboratory Experiments in Behavioral Operations Management
Elena Katok, Professor, Penn State University, Smeal College of Business, University Park, PA, 16802, United States of America, ekatok@psu.edu

I will discuss the state-of-the-art issues in designing and conducting laboratory experiments in BOM. Some of the topics I will cover will include incentive alignment, subject pool, and the logistics involved in designing and conducting a study.

SC16

C - Room 16A, Level 4

Applications of Operations Research in Semiconductor Manufacturing

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Mehmet Candas, Sr. IT Architect / OR Analyst, Advanced Micro Devices, 7171 Southwest Pkwy, Building 200, 2B.833, Austin, TX, 78735, United States of America, mfcandas@gmail.com

Co-Chair: Yiwei Cai, Freescale Semiconductor, 3501 Ed Bluestein Blvd, Austin, TX, 78721, United States of America, Yiwei.Cai@freescale.com

1 - Reducing Manufacturing Cost by Idling-machine Model in Freescale Semiconductor

Yiwei Cai, Freescale Semiconductor, 3501 Ed Bluestein Blvd, Austin, TX, 78721, United States of America, Yiwei.Cai@freescale.com

Most companies are struggling to reduce cost to feather against the economic recession. Keeping machines running in a semiconductor fab incurs great cost. Determining which tools to idle can be complicated. Idling-Machine Model (IMM) is an integer programming model created in Freescale's ATMC fab to identify the machine candidates to be idled. The IMM greatly improves the speed and accuracy of the decision process of idling machines, and is considered a very useful tool by the management team.

2 - Integrated Wafer Procurement Planning and Back-end Planning at AMD

Mehmet Candas, Sr. IT Architect / OR Analyst, Advanced Micro Devices, 7171 Southwest Pkwy, Building 200, 2B.833, Austin, TX, 78735, United States of America, mfcandas@gmail.com, Javad Ahmadi

After separation from the Global Foundries, AMD started purchasing the wafer products instead of producing them. Having a simplified procurement process with very few operational decisions (wafer-bump and wafer-sort) instead of a very complex production process enabled us to develop an integrated "wafer procurement planning" and "back-end planning" (Assembly-Test-Mark-Pack) system for AMD.

3 - Method for Capable to Promise

Javad Ahmadi, SMTS Operations Research Analyst, AMD, 7171 Southwest Pkwy, Austin, TX, 78735, United States of America, javad.ahmadi@amd.com, Mehmet Candas

AMD utilizes an internally developed production planning system for management of production activities across its supply chain. The planning process is a regenerative weekly process. Regardless of the level of effort in demand forecasting, frequent changes to demand, mostly mitigated by order inquires or order changes occur. We discuss our approach for a better alternative to the ATP or regenerative planning.

4 - Scheduling Back-end Operations in Semiconductor Manufacturing

Yumin Deng, Research Scientist, Amazon, 10352 Stone Ave N APT 6, Seattle, WA, 98133, United States of America, ydeng@amazon.com, Jonathan Bard

The importance of back-end operations in semiconductor manufacturing has been growing steadily in the face of higher customer expectations and stronger competition in the industry. This paper presents a new model and solution methodology aimed at maximizing the weighted throughput of lots undergoing assembly and test, while ensuring that critical lots are given priority.

SC17

C - Room 16B, Level 4

The Role of Forecasting in Optimization

Cluster: Practice of OR/MS
Invited Session

Chair: Brian Lewis, Vice President, Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

1 - Forecasting and Optimizing Long-Range Plans

Brian Lewis, Vice President, Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

The link between forecasting and optimization is critical in long-range planning. We will explore this link in the context of our work to build a drug development pipeline model for Novartis Vaccines & Diagnostics which forecasts long-range R&D performance and optimizes the acquisition schedule for new drugs. We will discuss the practical lessons learned and our modeling methodology, which included Monte Carlo simulation-based forecasting, simulation optimization, and grid computing.

2 - Accounting for Forecast Shift in Estimating the Value Added of Demand Planning

Oscar Rosen, The Procter & Gamble Company, 2 Procter and Gamble Plaza, Cincinnati, OH, 45202, rosen.o@pg.com, Ross Yurovski

Here we show how traditional forecast error metrics can significantly undervalue the changes to the statistical forecast that demand planners make by using their business knowledge about promotions and initiatives. If the magnitude of a promotion is accurately forecasted but the expected timing is slightly off it can lead to a significant forecast error which does not account for the value to manufacturing of knowing the size of upcoming promotions. We call this a Forecast Error Shift Paradox.

3 - Pricing Optimization using Market Simulation in Medical Devices

Michael Kubica, President, Applied Quantitative Sciences, Inc., 1460 South Ocean Boulevard, Suite 1403, Lauderdale-by-the-Sea, FL, 33062, United States of America, mkubica@aqs-us.com

Pricing strategy can be vexing under even the simplest of circumstances. When confronted with the possibility of multiple competing technologies and complex economic pressures among potential consumers the problem becomes even more complex. Using a case study in the medical device arena, this session will explore the utility of combining simulation forecasting with stochastic optimization to identify the launch pricing strategy for a novel medical device.

SC18

C - Room 17A, Level 4

Optimization for a Smarter Planet

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Parijat Dube, IBM TJ Watson Research Center, Yorktown Heights, NY, United States of America, pdube@us.ibm.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

Co-Chair: Laura Wynter, IBM, Yorktown Heights, NY, United States of America, lwynter@us.ibm.com

1 - Evacuation Route Planning: Novel Spatio-temporal Network Models and Algorithms

Shashi Shekhar, Mcknight Distinguished University Professor, University of Minnesota, 200 Union St. SE #4192, Minneapolis, United States of America, shekhar@cs.umn.edu

Scalable tools are needed for evacuation-route planning in emergency response. Challenges include non-stationary ranking of alternative routes, etc. Time-expanded graphs based mathematical programming does not scale up to large cities due to excessive network duplication. Proposed Capacity Constrained Route Planner (CCRP) uses novel Time-Aggregated Graph. DHS case-studies show that CCRP is much faster than alternatives.

2 - Smarter Transportation Analytics

Laura Wynter, IBM, Yorktown Heights, NY, United States of America, lwynter@us.ibm.com

We will present the optimization work behind some of the Smarter Transportation Analytics developed at IBM Research. We shall discuss the Data Expansion Algorithm which combines least squares estimation with bilevel programming to fill in the gaps in real-time traffic data over a road network. We present also the Traffic Prediction Tool and the Bus Arrival Prediction algorithm that make use of time series-based models to provide real-time forecasts of road traffic and bus arrivals at bus stops.

3 - Routing Optimization for Holidays and Planned Events

Sambit Sahu, Research Staff Member, IBM Research, 19 Skyline Drive, Hawthorne, NY, 10532, United States of America, sambits@us.ibm.com, Jing Dai, Milind Naphade, Chang-Tien Lu

Holidays and planned special events can affect not only the traffic towards the events, but also the normal commuters using the adjoining roadways. Accurately predicting traffic during holidays and planned events can support optimized routing for trip planning, and contribute to better roadway performance and safety. This paper proposes an approach to optimize the routing for holiday and planned events based on traffic flow estimation using spatial-temporal information.

■ SC19

C - Room 17B, Level 4

New Directions in Revenue Management and Pricing I

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Marc Dudey, Rice University, 5109 Mimosa Dr., Bellaire, TX, 77401, United States of America, dudey@rice.edu

1 - Tractable Markdown Optimization (MDO) using Uncertainty
Georgia Perakis, William F. Pounds Professor of Operations Research and Operations Management, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA, United States of America, georgiap@mit.edu, Pavithra Harsha

We study the MDO problem faced by a vendor selling a seasonal item with fixed inventory. Our work bridges the gap between practice and theory in addressing the MDO problem where the former addresses a deterministic demand MDO problem with several business rules (BR) and the latter addresses a stochastic demand MDO problem more or less in the absence of BR. We provide analytical bounds, approximate closed loop-pricing policies and discuss experimental results.

2 - Two-stage Procurement and Price Competition for Short Life Cycle Products
Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, ming.hu@rotman.utoronto.ca, Philipp Afeche, Yang Li

We study the equilibria of a two-period price-inventory game between duopolists who sell differentiated short life cycle products. Both firms choose their initial inventory prior to resolving the demand uncertainty and have the option to later make inventory adjustment and pricing decisions.

3 - Competition with Partially Refundable Fares
Guillermo Gallego, Columbia University, New York, NY, United States of America, gmg2@columbia.edu

Gallego and Sahin (2009) show that a capacity provider with monopoly power can improve revenues over advance selling by selling partially refundable fares, and such fares are socially optimal. This paper studies a Stackelberg duopoly and shows the benefits of partially refundable fares prevail under competition. The equilibrium is not socially optimal, but our computational results show solutions with partially refundable fares are close to being socially optimal.

4 - Capacity Choice with Equilibrium Price Outcomes
Roger Lederman, Columbia University, New York, NY, United States of America, rlederman13@gsb.columbia.edu, Garrett Van Ryzin, Nicolàs E. Stier Moses

Capacity expansion may impact the product mix and pricing decisions of a firm's competitors, and thus alter prevailing market conditions. To account for this effect, we study capacity investment by firms that compete in multiple markets. The allocation of resources and prices obtained are determined as the equilibrium of a game amongst capacity-constrained producers. We analyze flexibility of capacity and competitive positioning as factors that can influence the optimal capacity configuration.

5 - Quantity Precommitment and Price Competition Yield Bertrand Outcomes
Marc Dudey, Rice University, 5109 Mimosa Dr., Bellaire, TX, 77401, United States of America, dudey@rice.edu

This paper studies a dynamic duopoly wherein firms decide how much to produce before engaging in multi-period price competition. The market becomes perfectly competitive as parameters approach their Bertrand values. This "irrelevance theorem" links Cournot-style outcomes with price inflexibility.

■ SC20

C - Room 18A, Level 4

Revenue Management in Internet Advertising

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Hamid Nazerzadeh, Microsoft Research, One Memorial Dr., Cambridge, MA, United States of America, hamidnz@stanfordalumni.org

1 - Competing Auctioneers
Mallesh Pai, Department of Economics, University of Pennsylvania, Philadelphia, PA, United States of America, mallesh.pai@gmail.com

We study a model where multiple sellers with limited supply choose mechanisms to compete for a fixed pool of buyers. We show that inefficiency in this setting arises both because sellers withhold the good and because they misallocate the good. This contrasts with the findings of the literatures on monopolistic and competing sellers, which suggest that the only form of inefficiency that arises is from sellers withholding the good. Both types of inefficiencies vanish as the market grows large.

2 - Dynamic Revenue Management for Online Display Advertising
Guillaume Roels, Assistant Professor, University of California-Los Angeles, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, guillaume.roels@anderson.ucla.edu, Kristin Fridgeirsdottir

In this talk, we propose a dynamic optimization model to maximize a web publisher's online display advertising revenues. Our model dynamically selects which advertising requests to accept and dynamically delivers the promised advertising impressions to viewers so as to maximize revenue. After characterizing the structural properties of our model, we propose a Certainty Equivalent Control heuristic and then illustrate our approach with a real case study.

3 - Simultaneous Ad Auctions
Itai Ashlagi, Massachusetts Institute of Technology, 27 Everett St., Cambridge, MA, United States of America, itai.ashlagi@gmail.com

We discuss two models for a pair of simultaneous ad auctions, A and B: (i) single-campaign advertisers and (ii) multi-campaign advertisers. We prove the existence and uniqueness of a symmetric equilibrium in the first model. When click-through rates in A are point-wise higher than those in B, we prove that the expected revenue in A is greater than the expected revenue in B in this equilibrium. In contrast higher click-rates do not necessarily imply higher revenues in the second model.

4 - Optimal Dynamic Mechanism Design for Internet Advertising
Hamid Nazerzadeh, Microsoft Research, One Memorial Dr., Cambridge, MA, United States of America, hamidnz@stanfordalumni.org, Sham Kakade, Ilan Lobel

Currently, most of online advertisement space are sold through auctions. However, these auctions do not usually take advantage of the repeated interactions of the advertisers with publishers which results in loss of revenue and efficiency. To address this, we design a revenue-optimal dynamic mechanism for online advertising which is built upon multi-armed bandits. Our mechanism balances the trade-off among maximizing revenue, elicitation of information, and incentives of the advertisers.

■ SC21

C - Room 18B, Level 4

Improving Healthcare Productivity

Sponsor: Service Science
Sponsored Session

Chair: Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

1 - Effective Management of the Quality and the Supply Chain Drivers in Healthcare Industry
Gangaraju Vanteddu, Assistant Professor, Southeast Missouri State University, One University Plaza MS 5815, Harrison College of Business, Cape Girardeau, MO, 63701, United States of America, gvanteddu@semo.edu

In this research an attempt has been made to study the relationship between the quality drivers and the supply chain drivers in healthcare industry. It is observed that the simultaneous control/management of the quality and the supply chain drivers will lead to a coherent approach that results in avoiding the duplication of effort and cost overruns because of the positive effect quality related goals and the necessary enabling factors will have on different supply chain drivers.

2 - Measuring Healthcare Productivity - From Processes to System Level
Antti Peltokorpi, Aalto University, P.O. Box 15500, Espoo, 15500, Finland, antti.peltokorpi@tkk.fi, Paulus Torkki, Vesa Kamarainen

Healthcare costs are rising rapidly. The current trend can be changed only by doing radical improvements in productivity at process, organization and system levels. In all levels, productivity consists of same elements: doing right things, doing things efficiently and at the right quality level. However, applications for productivity measurement should be different. This presentation demonstrates how to develop productivity measures for different levels and give some practical case examples.

3 - Five Facets of Healthcare Mass Customization
Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, Boston, MA, 02115, United States of America, sagar@coe.neu.edu, Emanue Melachrinoudis, Abe Zeid

This paper presents five possible models of health care mass customization, namely, make to stock, assemble to order, make to order, engineer to order, and develop to order mass customization. In practice, health care mass customization requires a combination of these models to varying proportions depending on the focus and specialty of health care providers. The paper also presents the factors influencing each of these models.

SC22

C - Room 18C, Level 4

Service Operation Management

Sponsor: Service Science
Sponsored Session

Chair: Eunji Lim, Assistant Professor, University of Miami, University of Miami, Coral Gables, United States of America, lim@miami.edu

Co-Chair: Murat Erkoc, Assistant Professor, University of Miami, Miami, FL, United States of America, merkoc@miami.edu

1 - Simulation-based Optimization for Vehicle Routing Problems with Stochastic Demands and Travel Times

Yao Luo, University of Miami, 1251 Memorial Drive, Coral Gables, FL, 33146, United States of America, ly1987510@gmail.com, Eunji Lim

When dispatching vehicles to different locations, the uncertainty in demands or travel times has to be incorporated into one's operational decisions to prevent stock-outs or long travel times. We formulate the vehicle routing problem with stochastic demands and travel times as constrained simulation optimization, and propose an efficient method that converts the original problem to a minimax problem. We will discuss the potential impact of the proposed method and present numerical examples.

2 - Lumpy Demand Management with Pricing in the Service Sector

Murat Erkoc, Assistant Professor, University of Miami, Miami, FL, United States of America, merkoc@miami.edu, Salvador Romo-Fragoso

We consider a contractor who bids for proposals for "big deals" that are relatively long term service projects. The demand for such requests are lumpy and wining the proposals are contingent upon the price bids and available capacity. We investigate optimal pricing policies under a Markov Decision Process Model. Further we study demand acceptance policies and their impact on pricing when the contractor also carries out "regular jobs" that require short term commitments.

3 - Sustainable Capacity Management in Service Operations

Mehmet Bayram Yildirim, Associate Professor, Wichita State University, 1845 N Fairmount, Wichita, KS, 67260-0035, United States of America, bayram.yildirim@wichita.edu, Mehmet Barut, Timur Keskinturk

Utilization of a system, service or production, can be enhanced significantly by managing the capacity intelligently. In this study, we focus on improving the profitability of limited resources in service operations. Considering different customer segments we utilize revenue management concept in developing guidelines helping manager differentiate the incoming requests. The performance is benchmarked to classical fairness approach and compared to the optimum for effectiveness.

4 - Stochastic Inventory Model for Health Care Supply Chain Under Regular Demand and Surge Demand

Mingzhou Jin, Associate Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, mjin@ise.msstate.edu, Md Roni

Irregular event such as natural disaster, multiple-car accidents, terrorist attacks, causes sudden huge demand for medicine in health care supply chain system. Hence, demand process in health care can be seen as a combination of regular demand and surge demand. This paper appliers the level crossing theory to derive stationary distribution of the inventory level and furthermore heuristically develop the optimal inventory policy with regular order and emergency order.

SC23

C - Room 18D, Level 4

Panel Discussion: Modeling Inter-Cultural Service Encounters

Sponsor: Service Science
Sponsored Session

Moderator: Alexandra Medina-Borja, Assistant Professor, University of Puerto Rico at Mayaguez, II-205 Industrial Engineering Building, Mayaguez, PR, 00680, United States of America, alexandra.medinaborja@upr.edu

1 - Panel Discussion: Modeling Inter-cultural Service Encounters

Panelists: Alexandra Medina-Borja, Assistant Professor, University of Puerto Rico at Mayaguez, II-205 Industrial Engineering Building, Mayaguez, PR, 00680, United States of America, alexandra.medinaborja@upr.edu, William Hefley, Clinical Associate Professor, University of Pittsburgh, Katz Graduate School of Business, Mervis Hall, Pittsburgh PA 15260, United States of America, wehefley@katz.pitt.edu, Kalyan Pasupathy, Assistant Professor, University of Missouri- Columbia, United States of America, pasupathyk@health.missouri.edu, Paul Maglio, Clinical Associate Professor, University of Pittsburgh, Katz Graduate School of Business, Mervis Hall, Pittsburgh PA 15260, United States of America, wehefley@katz.pitt.edu, John Ruggiero, Edmund B. O'Leary Professor of Economics, University of Dayton, Department of Economics and Finance, 300 College Park, Dayton OH 45469-2251, United States of America, John.Ruggiero@notes.udayton.edu, Kostas Triantis, Professor, Virginia Tech, triantis@vt.edu

This panel presents a summary of a 2009 research workshop in Puerto Rico sponsored by NSF's Service Enterprise Systems. The goal of the workshop was to hasten the development of modeling frameworks that include inter-cultural considerations by fostering interdisciplinary research among a variety of fields, academic disciplines and technical clusters.

SC24

C - Room 19A, Level 4

Planning for Extreme Weather Events II

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Melike Baykal-Gursoy, Associate Professor, Rutgers, 96 Frelighuysen Rd., Piscataway, NJ, 08854-8018, United States of America, gursoy@rci.rutgers.edu

1 - Planning for Extreme Heat Events

Endre Boros, Professor, Rutgers University, Rutcor, 640 Bartholomew Road, Piscataway, NJ, United States of America, boros@rutcor.rutgers.edu, Christie Grewe Nelson, Randyn Bartholomew

We present a robust OR model for deciding about locations of and assigning resources to cooling centers to help to cope with extreme heat events. We present numerical results with data from Newark, NJ.

2 - Health Care Needs Planning for Extreme Heat Events

Sara Ghorbani, PhD Candidate, Rutgers, IE Deparment, Piscataway, NJ, United States of America, saraghorbani21@gmail.com, Pooyan Kazemian

We study the shelter location problem in urban environment. Meta-heuristic simulation optimization method is employed to minimize the expected number of extra deaths due to extreme heat. The algorithm decides on where to set up triage and shelters, assigning patients to triage centers, and then to health care centers.

3 - Component Criticality in Disease Spreading Networks with Limited Network Information

David Fajardo, Graduate Research Assistant, University of Texas at Austin, Earnest Cockrell Jr. Hall, 6.204, Austin, TX, 78712, United States of America, davidfajardo2@gmail.com, Travis Waller, Lauren Gardner

We derive estimates of network component criticality in the spread of disease along a human social network based on different degrees of network information. We estimate the impact of removing specific network components on the pattern and magnitude of the disease spreading process. We will further explore the impact that network structure information has on the quality of these estimates.

SC25

C - Room 19B, Level 4

Joint Session SPPSN/ TSL: Surveys and Models for Logistics Management in Disasters

Sponsor: Public Programs, Service and Needs/ Transportation Science and Logistics Society
Sponsored Session

Chair: Burak Eksioglu, Associate Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, beksioglu@ise.msstate.edu

1 - Optimizing the Use of Transit Systems with Information Updates During No-notice Evacuations

Huseyin Tunc, Mississippi State University, P.O. Box 9542, Industrial & Systems Engineering Department, Mississippi State, MS, 39762, United States of America, ht100@msstate.edu, Burak Eksioglu

Evacuation of transit dependent population during a disaster is necessary in order to minimize casualties and losses. This paper presents a mixed integer model for evacuating transit dependent citizens during a no-notice disaster. The paper also

introduces a framework for using the proposed mathematical model in real-time. Furthermore, a heuristic algorithm is proposed and it is evaluated in a rolling horizon manner.

2 - Development of an Intermodal Transportation Training Program for Disaster Relief Agencies

Han Zhang, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, hz71@msstate.edu, Lesley Strawderman, Kylie Nash, Henry Leggett, Burak Eksioglu

This presentation will provide a demonstration of a training program created for disaster relief agencies. Training content includes information on transportation modes used to provide humanitarian relief, as well as guidance for selecting modes that minimize cost and travel time. The benefits of intermodal transportation are also highlighted. The training program features interactive scenarios and customized trainee feedback through the use of a computer-based self-led training module.

3 - Scarce Resource Allocation in Humanitarian Logistics Systems with Individual Decision Making

Jessica Heier Stamm, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, jheier@isye.gatech.edu, Julie Swann, Nicoleta Serban, Ozlem Ergun

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 an emergency response product. We compare the two allocations and use spatial statistics to explain service inequity as a function of factors such as income, minority population, and availability of shipment locations.

■ SC26

C - Room 4A, Level 3

Data Mining Best Student Paper Award Presentations II

Sponsor: Data Mining
Sponsored Session

Chair: Paul Brooks, Virginia Commonwealth University, P.O. Box 843083, Richmond, VA, United States of America, jpbrooks@vcu.edu

1 - Robust Kernel Based Regression with Bounded Influence for Outliers

Sangheum Hwang, KAIST, 335 Gwahak-ro , Yuseong-gu, Daejeon, Korea, Republic of, sangheum.hwang@gmail.com, Norman Kim, Myong Jeong, Bong-Jin Yum

Kernel based regression method is a well-established methodology for estimating nonlinear functional relationship between response variable and predictor variables. We propose a new robust KBR method which gives reliable results even if the training data set is contaminated with both Y-space and X-space outliers. We develop an efficiently kernelized training algorithm for the parameter estimation based on iteratively reweighted least squares (IRLS) method.

2 - Dependence Maps, a Dimensionality Reduction with Dependence Distance for High-dimensional Data

Kichun Lee, Postdoctoral Researcher, ECE Georgia Tech, Van Leer Building, 777 Atlantic Drive NW, Atlanta, GA, 30332-0250, United States of America, skylee1020@gmail.com, Alexander Gray

We introduce the dependence distance, a new notion of the intrinsic distance between points, derived as a pointwise extension of statistical dependence measures between variables. We then introduce a dimension reduction procedure for preserving this distance, which we call the dependence map. We explore its theoretical property, connection to other methods, and empirical behavior on real data sets.

3 - Follow the Money: Monitoring Cost in Claims Data for Drug Safety Surveillance

Yihan Guan, PhD Candidate, Stanford University, Huang Engineering Center 212F, Stanford, CA, 94305, United States of America, yihan@stanford.edu, Margret Bjarnadottir

We present a novel method for post-marketing drug surveillance. Our method compares post-treatment costs of populations using alternative drugs based on risk-adjusted sequential analysis. The results of monitoring cost in claims data from 2.4 million individuals indicate that our method outperforms traditional methods by raising the alarm considerably earlier. Our model also achieves a balance between the risk of high false positive rate and the risk of delaying the discovery of true signals.

4 - A Novel Distance Measure for Time Series Data Mining

Youngseon Jeong, Rutgers, Camden, NJ, United States of America, ysjeong@eden.rutgers.edu, Myong Jeong, Olufemi A. Omitaomu

This talk presents a penalized dynamic time warping (WDTW) technique, which penalizes more a point with higher phase difference between a reference point and a testing point to prevent minimum distance distortion by outliers. The experimental results show that the proposed distance measures can achieve the improved accuracy for time series classification and clustering problems compared to existing approaches.

5 - Solving the Order-Preserving Submatrix Problem via Integer Programming

Andrew Trapp, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, act25@pitt.edu, Oleg A. Prokopyev

In this talk we consider the Order Preserving Submatrix (OPSM) problem, which is known to be NP-hard. Although in recent years some heuristic methods have been proposed to solve OPSMs, they lack the guarantee of optimality. We present exact solution approaches based on linear mixed 0-1 programming formulations, and develop algorithmic enhancements to aid in solvability. Encouraging computational results are reported both for synthetic and real biological data.

■ SC27

C - Room 4B, Level 3

Nicholson Student Paper Prize Competition, I

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Sigrun Andradottir, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, sa@gatech.edu

1 - Primal-Dual Schema and Lagrangian Relaxation for the k-Location Routing Problem

Timothy Carnes, MIT, 77 Massachusetts Avenue, E62-389, Cambridge, MA, 02139, United States of America, tac45@cornell.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 - Stochastic Search with an Observable State Variable

Lauren Hannah, Postdoctoral Researcher, Dept of Statistical Science, Duke University, Box 90251, Durham, NC, 27708, United States of America, lhannah@princeton.edu, Warren Powell, David Blei

Many stochastic, convex optimization problems have behavior that depends on an observable state variable. We use machine learning to take observations from the joint state-outcome distribution and use them to infer the optimal decision for a given observed state. We propose two solution methods: function based optimization and gradient based optimization. These methods are tested on the hour ahead wind commitment problem and a multi-product newsvendor problem.

3 - An Unintended Incentive Problem Concerning the Use of Dialysis Treatment in Kidney Allocation Policies

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

Policymakers in the United States have recently proposed to modify the kidney allocation system by assigning higher priority to patients who are on dialysis. We examine how this change may create an incentive for physicians to start their patients on dialysis prematurely. We find that (1) kidneys may have to be wasted in order for allocation to be both fair and to discourage premature dialysis initiation and (2) all patients may be better off if policymakers could perfectly observe their health.

SC28

C - Room 4C, Level 3

Interpolation and Approximation: Theory and Applications

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Yu Ding, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843-3131, United States of America, yu-ding@tamu.edu

Co-Chair: Peter Qian, University of Wisconsin-Madison, 1300 University Ave, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

1 - Domain Decomposition Approach for Fast Gaussian Process Regression of Large Spatial Datasets
Chiwoo Park, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843-3131, United States of America, chiwoo.park@tamu.edu, Yu Ding, Jianhua Huang

We propose a faster computation method for Gaussian process regression with a focus on large spatial datasets. The method splits the domain of a regression function into subdomains and infers a local piece of the function for each subdomain. We explicitly address mismatch of the local ones on boundaries by imposing continuity and smoothness. The method is as fast as competing methods, but easily parallelized for faster computation. It is adaptive to non-stationary data. We show real examples.

2 - Modeling Large Computer Experiments: More Data Can Be Better!
Peter Qian, University of Wisconsin-Madison, 1300 University Ave, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu, Ben Haaland

A large computer experiment produces many observations. While intuitively more data should provide more information, a large number of observations numerically induce inherent singularity in fitting an interpolator. To reconcile this contradiction, we propose a numerically stable and accurate approach to modeling large computer experiments. The driving forces of the proposed method are nested space-filling designs and multi-scale function approximations.

3 - PDE-constrained GP Model for Thickness Profile Modeling and Optimization in Slicing Processes
Ran Jin, Georgia Institute of Technology, 755 Ferst Dr. NW, Atlanta, United States of America, jinr@gatech.edu, Jianjun Shi, Hongxu Zhao, Su Wu

Thickness uniformity of wafers is a critical quality measure in a wire slicing process. However, it is hard to get analytical solution from engineering models, or determine the basis functions in Gaussian process (GP) models to predict the thickness profile. In this paper, we develop a PDE-constrained Gaussian Process model by deriving the basis functions of a GP model. We use the model to predict the thickness profile and optimize the process variable to improve uniformity.

4 - Fast Calibration of Complex Computer Models
Derek Bingham, Associate Professor, Simon Fraser University, Department of Statistics, 8888 University Drive, Burnaby, BC, V3B6X5, Canada, dbingham@stat.sfu.ca

Computer models enable investigation of real-world phenomena. Statistical calibration enables estimation unknown constants governing the system. Calibration of large, non-stationary model output is not well addressed. We present a new approach that measures the discrepancy between the computer model and field data. One can then construct empirical distributions for the parameters and perform sequential design. The strength of this approach is its simple computation using existing algorithms.

SC29

C - Room 5A, Level 3

Statistical Modeling in Production/Service Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Li Zeng, Assistant Professor, University of Texas at Arlington, Industrial & Manuf. Sys. Engr. Department, Arlington, Tx, 76019-0017, United States of America, lzeng@uta.edu

1 - Event Log Modeling and Analysis for System Failure Prediction
Yuan Yuan, UW-Madison, 1513 University Ave, Madison, United States of America, yyuan4@wisc.edu, Shiyu Zhou

Event logs, commonly available in mechatronic systems, contain rich information on working conditions of the system. This article proposes an effective method to build a statistical model using event logs to predict failures. Prescreening and statistical variable selection are adopted to select best predictor events. In-depth discussion of prediction power in terms of false alarm and misdetection rate is presented. The effectiveness of the proposed method is confirmed by real world examples.

2 - Surrogate Modeling of Multistage Assembly Processes using Integrated Emulation
Qiang Zhou, ISyE Dept, UW-Madison, 1513 University Ave, Madison, WI, United States of America, qzhou3@wisc.edu, Shiyu Zhou, Peter Qian

For the design of multistage assembly processes, a cheap mathematical model that links design parameters with the product quality is highly desirable. We propose a systematic approach to build a surrogate model of multistage assembly processes based on computer simulation. In this paper, a multiple-input-multiple-output surrogate modeling framework is developed using a recently developed integrated emulation technique. Various specific issues in the design of experiments are addressed.

3 - A Hierarchical Space-time Varying Coefficient Model: The Equity of Service Distribution
Nicoleta Serban, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States of America, nserban@isye.gatech.edu

Research in service distribution equity has emerged as economic and social equity advocates recognized that where people live influences their opportunities for economic and social development. In this research paper, service distribution equity is concerned with where and when services have been and are accessed by different population groups. The underlying modeling approach is a (hierarchical) varying coefficient model where the coefficients vary both in time and space.

4 - Quality Bottlenecks in Flexible Manufacturing Systems with Batch Productions
Jingshan Li, Associate Professor, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, 53706, United States of America, jingshan@engr.wisc.edu

In this talk, we introduce a Markovian model to study product quality in a flexible manufacturing system with batch productions. Using this model, we present methods to identify the sequences and transitions that impede the quality in the strongest manner, i.e., the so-called quality bottleneck sequence (QBN-s) and transitions (QBN-t). Moreover, indicators to identify such bottlenecks based on the data collected on the factory floor are proposed.

SC30

C - Room 5B, Level 3

Panel Discussion: Research on the Interface of Statistics and OR

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Moderator: Jing Li, Assistant Professor, Industrial Engineering, Arizona State University, Tempe, AZ, United States of America, jing.li.8@asu.edu

Moderator: John Fowler, Arizona State University, School of Computing, Informatics, and Decision Systems Engineering, Tempe, AZ, United States of America, john.fowler@asu.edu

1 - Application of OR in Statistics
Panelist: Roshan Vengazhiyil, Coca-Cola Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, roshan@isye.gatech.edu

I will discuss some examples of operations research techniques used in statistical research.

2 - Recent Research in System Informatics, Prognostics, and Health Management
Panelists: Kwok Tsui, Georgia Institute of Technology, Atlanta, GA, United States of America, ktsui@isye.gatech.edu, Steve Pollock, University of Michigan, Ann Arbor, Michigan 48109-2117, pollock@umich.edu

Motivated by (i) concerns in public health safety, product reliability, system safety and failure prevention, and (ii) latest advancement in data collection technologies and modeling tools, this talk will address the quantitative modeling research in system informatics (SI) and system prognostics and health management (PHM).

■ SC31

C - Room 5C, Level 3

Data Mining for BioMedical Informatics

Sponsor: Data Mining
Sponsored Session

Chair: Hyunjung Helen Shin, Professor, Ajou University, San 5 Wonchun-dong Yeoungtong-gu, Suwon, 443-749, Korea, Republic of, shin@ajou.ac.kr

1 - Empirical Comparison on Heterogeneous Genomic Data: CNV, Methylation, miRNA, and Gene Expression

Do Kyoon Kim, PhD Student, Seoul National University Biomedical Informatics (SNUBI), Div. of Biomedical Informatics, SNU College of Medicine, Seoul, 110-799, Korea, Republic of, dkkim@snu.ac.kr, Young Soo Song, Hyunjung Helen Shin, Ju Han Kim

Thanks to the recent collaborative initiative against cancer, heterogeneous types of genomic data from cancer patient become available. The aim of the present study is to compare different types of genomic data for Glioblastoma multiforme (GBM) recurrence prediction. The four types of genomic data, Copy Number Variation (CNV), methylation, miRNA, and gene expression data, are employed and tested on 159 GBM patients using the state-of-the-art machine learning algorithm, semi-supervised learning.

2 - Evolution: A Guide to Protein Function and its Rational Redesign

Olivier Lichtarge, Professor, Department of Molecular & Human Genetics, Baylor College of Medicine, One Baylor Plaza, Houston, 77030, United States of America, lichtarg@bcm.tmc.edu

Protein interactions create networks that determine cell fate in health and disease. This work will present new algorithms for Evolutionary Tracing (ET), a method to compare proteins and identify their functional sites in order to guide experiments that selectively block, recode, or mimic their amino acid determinants. In principle, this suggests a scalable approach to perturb individual links in protein networks and to help interpret the impact of amino acids variations in human health.

3 - A New Method for Bi-directional Semantic Similarity of Gene Products Based on Gene Ontology

Ju Han Kim, Professor, M.D., PhD, Seoul National University Biomedical Informatics (SNUBI), Div. of Biomedical Informatics, Seoul National University College of Medicine, Seoul, 110-799, Korea, Republic of, juhan@snu.ac.kr

Wang's semantic similarity utilizes ontology structures to complement Resnik's WordNet-based semantic similarity that is based on information content (or annotation frequency). Wang's measure, however, shows poor distance resolution when both terms are near the root sharing a few terms and poor consistency when both terms share much of their descendents. Here we propose a bi-directional semantic similarity measure of gene products based on Gene Ontology with results from evaluation studies.

4 - A Multiscale Approach to Biological Networks: From Proteome Annotation to Cell Cycle Control

Andreas Martin Lisewski, PhD, Department of Molecular & Human Genetics, Baylor College of Medicine, One Baylor Plaza, Houston, 77030, United States of America, lisewski@bcm.edu, Olivier Lichtarge

Biological systems are difficult to analyze because of their large number of molecular actors, their interactions, and the multitude of phenotypes. Here we present techniques for the analysis of complex networks inspired through semi-supervised machine learning and statistical mechanics to tackle two problems: the propagation of functional information in proteomic networks, and the control of the cell cycle. The techniques are general and can also be applied to other types of complex networks.

■ SC32

C - Room 6A, Level 3

Hybrid Methods II

Sponsor: Computing Society
Sponsored Session

Chair: John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu

1 - Bridging Constraint Reasoning and Machine Learning for Unsupervised Labeling and Decomposition

Ashish Sabharwal, Research Associate, Cornell University, 5160 Upson Hall, Ithaca, NY, 14853-7501, United States of America, sabhar@cs.cornell.edu, Ronan LeBras, John Gregoire, Carla Gomes, Theodoros Damoulas, R. Bruce van Dover

We present a framework for bridging constraint programming (CP) and machine learning methods in order to tackle challenging unsupervised labeling and decomposition problems, particularly in the setting of a phase detection problem arising in material discovery. We demonstrate a clear benefit from combining the strengths of these approaches: handling noise and uncertainty through a global machine learning view while incorporating detailed hard constraints and domain knowledge locally through CP.

2 - Combining Column Generation and Logic-Based Benders' Decomposition for Multi-Machine Scheduling

J. Christopher Beck, University of Toronto, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, jcb@mie.utoronto.ca, Ti Kan Feng

We combine column generation (CG) and logic-based Benders' decomposition (BD) to solve a multi-machine scheduling problem. Jobs are assigned to machines using CG, and subsequently scheduled using BD. Using this combination (CGBD), we solve two variations of the unrelated parallel machine problem. Based on these problems, we perform experiments to examine the performance of CGBD, CG, and BD. Finally, we investigate the roles of each component in its overall contribution towards CGBD.

3 - Single-Facility Scheduling Over Long Time Horizons by Logic-Based Benders Decomposition

Elvin Coban, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, ecoban@andrew.cmu.edu, John Hooker

We use logic-based Benders decomposition to combine mixed integer programming (MIP) and constraint programming (CP) to solve single-facility scheduling problems with time windows and long time horizons that are decomposed into segments. The Benders master problem assigns jobs to segments using MIP, and the subproblems use CP to schedule jobs on each segment. A job can overlap two segments. The objective is to find feasible solutions, minimize makespan, or minimize total tardiness.

4 - Grammar-Based Column Generation for Personalized Multi-Activity Shift Scheduling

Louis-Martin Rousseau, Ecole Polytechnique de Montreal, 6079, Succ. Centre-ville, Montreal, Canada, louis-martin.rousseau@polymtl.ca, Bernard Gendron, Marie-Claude Coté

We introduce a new branch and price formulation to solve personalized multi-activity shift scheduling problems, using column generation with grammar-based subproblems, which are solved with dynamic programming. This approach, which uses the expressiveness of context-free grammars to model restrictions over shifts and benefits from the branch and price methodology is able to prove optimality for many instances.

■ SC33

C - Room 6B, Level 3

Computations & Software for Monte Carlo Sampling Methods for Stochastic Programming

Sponsor: Computing Society
Sponsored Session

Chair: Guzin Bayraksan, Assistant Professor, University of Arizona, Systems & Industrial Engineering, Tucson, AZ, 85721, United States of America, guzinb@sie.arizona.edu

1 - The Sample Approach for Chance Constraint Programming: A Computational Study

Daniel Reich, Postdoc, Universidad Adolfo Ibáñez, School of Business, Diagonal Las Torres 2640, Oficina 516 C, Peñalolén, Santiago, Chile, daniel.reich@uai.cl, Marco Campi, Bernardo Pagnoncelli

We consider a naive portfolio optimization model with a single chance constraint and review an established sampling approach that can be used to identify feasible solutions. To improve solution quality while maintaining feasibility, we propose and compare two constraint removal procedures: one greedy and the other randomized. We present detailed computational results and discuss how and why these results may be generalizable to other chance constraint models.

2 - A Branch-and-price Algorithm for Multistage Stochastic Unit Commitment

Ali Koc, Postdoctoral Researcher, IBM TJ Watson Research Center, Yorktown Heights, NY, 10598, United States of America, akoc@us.ibm.com, Jayant Kalagnanam

Grid operators typically solve a unit commitment problem to minimize total start-up and fuel cost of generating units over a planning horizon, making sure that total generation amount in each time period exceeds the demand. Multistage stochastic programming approach is sometimes preferred when some of the problem parameters, such as the demand, are uncertain. We present a branch-and-price algorithm for a multistage stochastic unit commitment problem, and display some computational results.

3 - Computational Experience with Confidence Intervals on the Optimality Gap

David Woodruff, Professor, University of California Davis, Davis, CA, United States of America, dlwoodruff@ucdavis.edu, Jean-Paul Watson

Recently Mak, Morton and Wood proposed a method of computing bounds on the optimality gap along with confidence intervals. In this talk, we describe our computational experience computing confidence intervals on a variety of problems, many of which are mixed integer. Somewhat surprising to us was the large number of samples needed to achieve intervals that are what we consider to be reasonably narrow.

4 - Bundling and Solution Quality Estimation for Stochastic Programming: Implementation and Results

Jean-Paul Watson, Sandia National Laboratories, jwatson@sandia.gov, David Woodruff

We discuss two largely ignored, but critical in practice, issues arising when solving large-scale stochastic mixed-integer programs: scenario bundling and solution quality estimation. We describe our open-source implementations of bundling and techniques for obtaining confidence bounds on solution quality, including multiple replication and sequential sampling procedures. Experimental results on stochastic wind farm network design and unit commitment problems are reported.

■ SC34

C - Room 7, Level 3

Approximate Dynamic Programming in Transportation

Sponsor: Computing Society
Sponsored Session

Chair: Hugo Simao, Reserch Staff, CASTLE Lab - Princeton University, 112 Sherrerd Hall, Princeton, NJ, 08540, United States of America, hpsimao@princeton.edu

1 - Approximate Dynamic Programming for Empty Container Repositioning Problem

Ning Shi, Dr., Sun Yat-sen University, No. 135 Xin Gang Xi Road, Haizhu Distinct, Guangzhou, China, shning@mail.sysu.edu.cn

In this work, we study an empty container repositioning problem in a cyclic route where the ports face uncertain demands. We formulate this problem as a stochastic dynamic programming problem, but this encounters the classic curse of dimensionality. To overcome this problem, we propose an approximate dynamic programming algorithm which is based on an optimal policy for a simple special case. We conduct numerical experiments to illustrate the efficiency of this algorithm.

2 - Stochastic Programming Models for Certain Air Traffic Flow Management Problems

Charles N. Glover, Research Assistant, University of Maryland, 3117 A.V. Williams, College Park, MD, 20742, United States of America, cnglover@math.umd.edu, Michael Ball

Convective weather is a major contributor to air traffic delays. There is much uncertainty associated with weather predictions, so stochastic models are necessary to assign ground delay and route adjustments to flights. We describe a two-stage stochastic integer program for this problem. We show that under certain conditions the LP-Relaxation yields integer optimal solutions. This model is then used to develop and compare heuristics, which seek solutions that are both equitable and efficient.

3 - Approximate Dynamic Programming in the Strategic Planning of a Fleet of Business Jets

Hugo Simao, Reserch Staff, CASTLE Lab - Princeton University, 112 Sherrerd Hall, Princeton, NJ, 08540, United States of America, hpsimao@princeton.edu, Warren Powell

A fleet of executive jets of varied sizes serves a global business market. Though demand is segmented by specific-size jets, operational constraints require aircraft substitution. Approximate dynamic programming is used to help plan aircraft disposal/acquisition over a multi-year horizon. We will show how the ADP model performs comparatively with a near-optimal approach on a simplified, reduced scope problem. We will then show how the ADP approach scales to larger, more realistic problems.

4 - Learning in Approximate Dynamic Programming for Managing a Multi-Attribute Driver

Martijn Mes, Assistant Professor, University of Twente, School of Management and Governance, Department OMPL, Enschede, 7500AE, Netherlands, m.r.k.mes@utwente.nl

A well known problem in Approximate Dynamic Programming (ADP) is the exploration versus exploitation trade-off, and more specifically how to cope with the downstream bias in the sampling decisions. To overcome this, we propose a way to estimate the value function limits and to use these limiting values in our sampling decisions. We demonstrate how this approach can efficiently be used to improve the rate of convergence of an ADP algorithm for managing a single multi-attribute driver.

■ SC35

C - Room 8A, Level 3

Large Scale Dynamic Stochastic Games

Sponsor: Applied Probability
Sponsored Session

Chair: Gabriel Weintraub, Columbia Business School, New York, NY, United States of America, gyw2105@columbia.edu

Co-Chair: Ramesh Johari, Stanford University, Terman Engineering Center, Room 319, 380 Panama Mall, Stanford, CA, United States of America, ramesh.johari@stanford.edu

1 - Phase Transition in Mean-field Games: An Application to Synchronization of Coupled Oscillators

Prashant Mehta, Assistant Professor, University of Illinois, 1206 W. Green Street, Urbana, IL, 61801, United States of America, mehtapg@illinois.edu

This talk is concerned with phase transition in non-cooperative dynamic games with a large number of nonlinear oscillators. A variant of the Kuramoto model is used in a novel game-theoretic setting. The main conclusion is that the synchronization of the coupled oscillators can be interpreted as a solution of a non-cooperative dynamic game. Using approximate dynamic programming techniques, the classical Kuramoto control law is shown to be an approximation of the game-theoretic solution.

2 - Mean Field Stochastic Dynamic Games with Egoistic, Altruistic and Massive Agents

Peter Caines, Professor, McGill University, Dept ECE, 3480 University Street, Montreal, QC, H3A 2A7, Canada, peterc@cim.mcgill.ca, Roland Malhame, MinYi Huang

This work analyses Mean Field LQG problems with cost coupling. In the altruistic-egoistic stochastic dynamic LQG games under study, the cost of each agent is a convex combination of its own cost and the social cost. Decentralized equilibrium strategies for all agents are generated using techniques based upon the Mean Field (Nash Certainty Equivalence) (MF(NCE)) methodology. The Social Optimality Theorem for purely altruistic populations is presented along with the theory of Massive agents.

3 - Mean Field Equilibrium in Dynamic Stochastic Games with Complementarities

Ramesh Johari, Stanford University, Terman Engineering Center, Room 319, 380 Panama Mall, Stanford, CA, United States of America, ramesh.johari@stanford.edu, Sachin Adlakha

We study mean field equilibrium for stochastic games with complementarities, such as dynamic games with network effects. We find necessary conditions for the existence of a mean field equilibrium in such games. Furthermore, we show that there exist a "largest" and "smallest" equilibrium among all those where the equilibrium strategy used by a player is nondecreasing. We also show that natural best response dynamics converge to each of these equilibria.

4 - Dynamic Oligopoly Models in Concentrated Industries

Gabriel Weintraub, Columbia Business School, New York, NY, United States of America, gyw2105@columbia.edu

Dynamic oligopoly models are used to study strategic dynamic interactions in many industries. Their applicability is limited, however, by the curse of dimensionality involved in the equilibrium computation. In this talk we discuss several new approaches that alleviate this difficulty. Our focus is on industries in which there are few large dominant firms and many small firms; this is a commonly observed market structure. The methods greatly increase the applicability of this class of models.

■ SC36

C - Room 8B, Level 3

Case Competition I - INFORM-ED's Annual Case Competition is an Opportunity for INFORMS Members to Showcase Their Efforts in the Classroom

Sponsor: INFORM-ED
Sponsored Session

Chair: Mike Racer, University of Memphis, 334 Fogelman, Memphis, TN, United States of America, mracer@memphis.edu

1 - PriceMax

Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, P.O. Box 6550, Charlottesville, VA, 22906, United States of America, lichtendahlc@darden.virginia.edu, Yael Grushka-Cockayne

Angela Morella is the CFO of PriceMax. Tasked to find a way to better forecast 2010 earnings per share, Morella sets out to find a good forecast of gross domestic product, which she believes is related to sales. Morella asks her analyst, to find such a forecast. Using forecasts from the Survey of Professional Forecasters, and data on realized GDP change, Gabriel evaluates the 2000-2009 forecasts of six professional panelists.

2 - Flexible Capacity Planning for Real Estate Development

Yun Shin Lee, PhD Candidate, University of Cambridge, Judge Business School, Cambridge, CB2 1AG, United Kingdom, ysl27@cam.ac.uk, Stefan Scholtes

Current practices in real estate development challenge planners and designers to build the most appropriate capacity against a fixed demand forecast. Planners and designers therefore focus much of their attention on producing the most "accurate" demand forecasts and decide on a cost-minimal capacity design that meets these forecasts. Communication of uncertainty in forecasts is all too often a second thought or even ignored.

■ SC37

C - Room 8C, Level 3

Resource Allocation in Stochastic Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Mark Squillante, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com

1 - Performance Bounds for Large Scale Queueing Systems

David Goldberg, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, dag3141@mit.edu, David Gamarnik

We resolve several questions related to a certain heavy traffic scaling regime (Halfin-Whitt) for parallel server queues, used recently in the modeling of call centers. We derive the asymptotics of the steady-state queue length, and bound the large deviations behavior of the limiting steady-state queue length. Our proof technique involves bounding the multiserver queue between two simpler systems, which exhibit an interesting duality and may be useful in many related settings.

2 - Improved Approximations for the Erlang Loss Model

Mayank Sharma, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, mxsharma@us.ibm.com, Mark Squillante, Yingdong Lu, Jonatha Anselmi

We propose two new methods for loss probability calculation in stochastic loss networks. The first is a refined slice method which is exact in a certain scaling regime and is therefore ideally suited to the asymptotic analysis of large loss networks. The latter borrows from volume computation methods for convex polytopes to provide approximations for the loss probability in an unscaled network with error bounds as a function of the computational costs.

3 - An Integrated Model for Capacity Planning and Dynamic Control in Call Center Networks with General SLAs

Santiago Balseiro, PhD Candidate, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, srb2155@columbia.edu, Assaf Zeevi, Awi Federgruen

We address the following problems that arise in the management of call center operating under certain Service Level Agreements (SLAs): (1) setting the capacity levels of the agent pools; (2) constructing a routing scheme for arriving customers; and (3) devising a dynamic priority rule for customers waiting at each pool. We develop a mathematical programming approach to simultaneously solve the above integrated planning problem and discuss some of its salient features.

4 - On Approximations for Multiple Multidimensional Stochastic Knapsacks

Mark Squillante, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com, Yingdong Lu

We consider a generalization of the classical knapsack problem in which the items and knapsacks have multiple dimensions, the per-dimensional size of each item is stochastic, and the per-dimensional size of every knapsack is fixed. Using detailed probabilistic analysis and results, we improve upon the recent results of Dean, Goemans and Vondrak for the single one-dimensional stochastic knapsack problem, and we provide new results for the multiple multidimensional stochastic knapsack problem.

■ SC38

C - Room 9A, Level 3

Global Optimization & MINLP with Applications

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Neng Fan, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, 32611, United States of America, andynfan@ufl.edu

1 - Robust Optimization Models for Support Vector Machine with Input Uncertainty

Hongsheng Xu, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, xuhongsh@ufl.edu, Neng Fan

We consider support vector machines (SVMs) with uncertainties of the training data sets. The types of uncertainties include interval, ellipsoidal and ball uncertainty for points. These problems are considered with linear and nonlinear SVMs. We proposed robust optimization models for these SVMs with uncertainties. The Lagrange multipliers are used to solve nonlinear models and integer program approaches with decomposition methods are used for robust models of transductive SVMs.

2 - Using Conditional Value-at-risk in the Shortest Path Problem to Find Robust Paths Under Arc Failures

Juliana Bright, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, juliana.bright@okstate.edu, Baski Balasundaram

Finding a shortest path in a network is a classical problem. In practice, arcs may fail — for instance, during natural disasters. We use Conditional Value-at-Risk (CVaR) to find a path that is robust under probabilistic arc failures. CVaR, a quantitative risk measure, is roughly the mean excess loss associated with a decision. This talk discusses ways to model losses and presents a MILP model to find a shortest path below a CVaR threshold. Preliminary computational results are also presented.

3 - Multi-way Clustering and Biclustering by the Ratio Cut and Normalized Cut in Graphs

Neng Fan, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, 32611, United States of America, andynfan@ufl.edu, Panos Pardalos

We consider the multi-way clustering problem based on graph partitioning models by the Ratio cut and Normalized cut. We formulate the problem using new quadratic and quadratically constrained models. Spectral relaxations, new semidefinite programming relaxations and linearization techniques are used to solve these problems. It has been shown that our proposed methods can obtain improved solutions.

4 - Network Analysis and Optimization in Epileptic Brain State Transition Study and Seizure Prediction

Jicong Zhang, PhD Candidate, University of Florida, 303 Weil Hall, ISE Department, Gainesville, FL, 32611, United States of America, jicong@ufl.edu, Panos Pardalos

Epilepsy is a chronic neurological disorder affecting 50 millions. An epileptic seizure can be predicted if there exists a preictal state which is a transitional state between interictal and ictal states. Studies show that consistent patterns are observable before seizure onsets in EEG. Based on constructed brain networks using nonlinear dynamics and dependency functions, network analysis and optimization can be applied to brain state transition study and seizure prediction with good effect.

■ SC39

C - Room 9B, Level 3

Optimization Society Prizes

Cluster: Optimization/Prizes
Sponsored Session

Chair: Nick Sahinidis, John E. Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sahinidis@cmu.edu

1 - Hooked on Integer Programming
George L. Nemhauser, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, United States of America, george.nemhauser@isye.gatech.edu

Integer programming is addictive. I got hooked more than forty years ago and I'm still an addict. There are many fun challenges and no indication that the rate of progress has diminished. In this talk I'll tell a little of my story and conclude with what I think are current opportunities.

2 - Analysis of First Order Methods for Large Scale Optimization
Zhi-Quan Luo, Professor, University of Minnesota, Dept Electrical and Computer Engineering, 200 Union Street SE, Minneapolis, MN, 55455, United States of America, luozq@ece.umn.edu

In this talk, we review the joint work with Paul Tseng on the first order methods for large scale smooth/nonsmooth optimization, and their impact to contemporary applications such as compressed sensing and image processing.

3 - Probability Inequalities for Sums of Random Matrices and Chance Constrained Optimization
Anthony Man-Cho So, Assistant Professor, The Chinese University of Hong Kong, Dept of Sys Engr & Engr Mgmt, Shatin, NT, Hong Kong - PRC, manchoso@se.cuhk.edu.hk

Chance constrained optimization has found applications in many areas—such as finance, control and signal processing—and is the subject of much research recently. In this talk, we will first discuss some recent advances in the study of probability inequalities for sums of random matrices. Then, we will demonstrate how these results can be used to construct safe tractable approximations of a variety of chance constrained optimization problems.

4 - Fast Multiple Splitting Algorithms for Convex Optimization
Shiqian Ma, Columbia University, 500 W. 120th Street, Mudd Blvd, Room 313, New York, NY, 10027, United States of America, sm2756@columbia.edu, Donald Goldfarb

We present two different classes of general K-splitting algorithms for solving convex optimization problems. We prove that the number of iterations needed by the first class of algorithms to obtain an $epsilon$-optimal solution is $O(1/epsilon)$. The algorithms in the second class are accelerated versions of those in the first class, where the complexity result is improved to $O(1/sqrt{epsilon})$ while the computational effort required at each iteration is almost unchanged.

■ SC40

C - Room 9C, Level 3

CEIR and Beyond

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: John Tomlin, Principal Research Scientist, Yahoo! Research, 4301 Great America Parkway, Santa Clara, CA, 95054, United States of America, tomlin@yahoo-inc.com

1 - One LP Code a Minute
John Forrest, IBM Research (Retd.), john.forrest@fastercoin.com

A short, content free, look back at LP codes which I have used, abused and written. Some attempt may be made to put the more successful codes in the context of the available computer architectures, but more emphasis will be on the codes which nobody else has heard of and which I have tried to forget. For example, hands up all those who have heard of Alligator?

2 - From LP/90/94 to UMPIRE
John Tomlin, Principal Research Scientist, Yahoo! Research, 4301 Great America Parkway, Santa Clara, CA, 95054, United States of America, tomlin@yahoo-inc.com

This talk outlines the features of CEIR LP/90/94 that survived into the UMPIRE Mathematical Programming System, describes some that did not, and summarizes the new features that were introduced in this code.

3 - IBM's Optimization Subroutine Library - History and Innovations
David Jensen, IBM Research, 1101 Kitchawan Road, Yorktown Heights, NY, United States of America, davjen@us.ibm.com

John Forrest was the principle author of IBM's Optimization Subroutine Library. It represented a significant departure from previous offerings for mathematical optimization. In this talk we will discuss the some of the innovations that made the product successful, focusing on the many contributions that John made to its design and implementation.

4 - Some OSL History
J.P. Fasano, IBM Research Watson, 1101 Kitchawan Road, Yorktown Heights, United States of America, jpfasano@us.ibm.com

This talk will provide some anecdotal stories and history on the early days of OSL development.

■ SC41

C - Room 10A, Level 3

Computational Economics for Integrated Assessment

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Todd Munson, Argonne National Laboratory, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, tmunson@mcs.anl.gov

1 - Sensitivity of Global Carbon Emissions to Uncertain Trade Elasticities
Todd Munson, Argonne National Laboratory, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, tmunson@mcs.anl.gov, Joshua Elliott, Sam Kortum, Fernando Perez Cervantes, David Wiesbach

In this talk we study a global computable general equilibrium model with carbon taxes and border tax adjustments for Annex B regions to understand the mitigation effects of such policies. Carbon contents for the border tax adjustments are computed endogenous to the model by applying a carbon conservation principle. Analysis of the results from these sensitivity studies are presented using matrices representing bilateral carbon emission flows.

2 - Distributional Impacts of Greenhouse Gas Mitigation Policies
Joshua Elliott, University of Chicago, Chicago, IL, United States of America, jelliott@ci.uchicago.edu, Don Fullerton, Todd Munson

We study the distributional impacts of greenhouse gas mitigation policies using the CIM-EARTH economic model. We develop general purpose tools that use survey consumption and panel income data to construct household consumers along demographic dimensions including lifetime wealth and region. We report on early results for the US and comment on efforts to expand models to other countries.

3 - The Role Agriculture and Forestry in Greenhouse Gas Mitigation Policy
Alla Golub, Purdue University, 403 West State Street, West Lafayette, IN, 47906, United States of America, golub@purdue.edu, Thomas Hertel, Steven Rose, Brent Sohngen, Benjamin Henderson

While agriculture and forestry, including associated land use change, account for about 30% of current global GHG emissions, they have the potential to play a much larger role in mitigation in the next few decades. This paper integrates the analysis of land use related non-CO2 emissions and carbon forest sequestration with more conventional analyses of CO2 emissions from fossil fuel combustion to provide a comprehensive assessment of the role of land in global GHG emissions and mitigation.

4 - Dynamic Stochastic General Equilibrium Analysis of Climate Change Policies and Discounting
Kenneth Judd, Hoover Institution, Hoover Institution, Stanford, CA, 94305, United States of America, kennethjudd@mac.com, Thomas Lontzek

We formulate dynamic stochastic general equilibrium extensions of Nordhaus' models of climate change and economic performance. We use multidimensional dynamic programming methods to study dynamically optimal policy responses. We use conventional risk analysis from finance to highlight the importance of the covariance and persistence of damages to economic output and find that these considerations substantially lower the hurdle required to justify significant mitigation policies.

■ SC42

C - Room 10B, Level 3

Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Shabbir Ahmed, Associate Professor, Georgia Institute of Tech, 765 Ferst Drive NW, Atlanta, GA, United States of America, sahmed@isye.gatech.edu

1 - A Decomposition Algorithm for General Stochastic Mixed-integer Programs
Suvrajeet Sen, Professor, Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, sen.22@osu.edu, Yunwei Qi

We present a new decomposition algorithm for stochastic mixed-integer programs with general integers, as well as continuous variables. The method draws upon the new cutting plane tree algorithm, which also ensures finite convergence of the decomposition method.

2 - Ellipsoid Method for Sample Average Approximation
Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr, Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu

We propose an approach to obtain a profoundly reduced sample for sample average approximation method. For each scenario, there is a polyhedron of the second stage problem and the very polyhedron can be characterized by its maximum volume inscribe ellipsoid. We use the numerical parameter of ellipsoid to differentiate the sampled scenarios in order to reduce the variance of recourse function. We present a two phrase method for large scale stochastic programming with numerical results.

3 - Chance-constrained Models and Benders-based Cutting Plane Algorithms for Insuring Critical Paths
Siqian Shen, PhD Candidate, Department of ISE, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, siqian.shen@gmail.com, Shabbir Ahmed, J. Cole Smith

We study a chance-constrained model arising in the protection of vital arcs in a critical path network, in which the probability of on-time completion is sufficiently large. We approximate the problem by using a two-stage mixed-integer program via SAA, and employ RLT to make it amenable to solution via Benders decomposition. We demonstrate the computational efficacy by testing a set of instances, and illustrate some management insights.

■ SC43

C - Room 1, Level 2- Mezzanine

Optimization in Radiotherapy

Sponsor: Health Applications
Sponsored Session

Chair: Dionne Aleman, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, aleman@mie.utoronto.ca

1 - Motion Management with Phase-Adapted 4D-Optimization
Omid Nohadani, Assistant Professor, Purdue University, 315 N. Grant Street, Bldg. E40-149, West Lafayette, IN, 47906, United States of America, nohadani@purdue.edu, Joao Seco, Thomas Bortfeld

Cancer treatment with ionizing radiation is often compromised by organ motion, particularly in lung cases. We present a spatiotemporal optimization method, which takes into account all phases of breathing. Monte Carlo dose calculations are employed to warrant for highest accuracy. We compare the performance of the proposed 4D-method with gating techniques on clinical lung cases and report significant improvements. These phase-adapted 4D-plans are intrinsically robust against irregular breathing.

2 - Efficiently Optimizing CVaR for IMRT with Sequential Sampling
Benjamin Armbruster, Northwestern University, 2145 Sheridan Road (Tech Bldg), Evanston, IL, 60208-3119, United States of America, armbruster@northwestern.edu, James Luedtke

We provide an overview of CVaR in radiation treatment planning and examine the unique challenges of the large QP that results. We combine a cutting-plane approach and a sequential sampling scheme, and we analyze its convergence by drawing an analogy to nonlinear stochastic programs.

3 - Semi-infinite Linear Programming for Sector Duration Optimization in Gamma Knife Perfexion
Hamid Ghaffari, PhD Candidate, University of Toronto, 5 King's Collage Road, Toronto, ON, M5S 3G8, Canada, ghaffari@mie.utoronto.ca, Dionne Aleman, Mark Ruschin, David Jaffray

We introduce a new approach to sector duration optimization (SDO) to find the optimal shot shapes in a Gamma Knife Perfexion treatment. The goal is to minimize overdosing of healthy tissue while delivering a high radiation dose to the target. A semi-infinite linear programming (SILP) approach is used to significantly reduce the size, and therefore the computational time, of SDO. We present the numerical results of clinical experiments using SILP for both radiotherapy and radiosurgery treatments.

■ SC44

C - Room 2, Level 2- Mezzanine

Healthcare Applications of Optimization Techniques

Sponsor: Health Applications
Sponsored Session

Chair: Lisa Maillart, University of Pittsburgh, 1048 Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15261, United States of America, maillart@pitt.edu

1 - Should We Screen if Breast Cancer Can Regress?
Shengfan Zhang, North Carolina State University, 3008 Kings Ct Apt H, Raleigh, NC, 27606, United States of America, szhang5@ncsu.edu, Julie Ivy

In decision modeling, breast cancer is often assumed to be a progressive disease. However some studies suggest that breast cancer may regress without treatment. In such cases, screening diagnosis may not be advantageous. We build a partially observable Markov model to explore the impact of the transition from In Situ cancer to cancer-free on breast cancer mortality and treatment. Our objective is to quantify how large the regression rate has to be in order to impact screening policy.

2 - A Stochastic Control Framework for Spatiotemporal Optimization in Radiotherapy
Archis Ghate, Professor, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195, United States of America, archis@u.washington.edu, Minsun Kim, Mark Phillips

Progress in functional imaging is enabling radiotherapy planners to monitor a patient's biological response over weeks of treatment. We propose a stochastic control-based treatment-planning framework where states represent biological conditions, and beam intensities are the controls. Approximate control schemes are compared for efficiency. Numerical simulations on head and neck test cases show a 64-98% improvement in treatment efficacy compared to conventional static-deterministic methods.

3 - Multi-range Robust Optimization with Application to R&D Project Selection
Ruken Duzgun, PhD Student, Lehigh University, 200 W. Packer Ave., Bethlehem, PA, 18015, United States of America, rud207@lehigh.edu, Aurelie Thiele

We consider a robust optimization approach to R&D project selection when investments are done in stages and cash flows are uncertain. To model the outcome of each phase, such as a drug trial, we introduce multiple ranges for the cash flows (e.g., high and low) at each time period and a parameter limiting the number of times the cash flows fall in the low range. We develop a tractable robust counterpart and present theoretical insights as well as numerical results.

4 - A Large Scale Dynamic Programming Approach to Placing Expedited Livers
Zeynep Erkin, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, zee2@pitt.edu, Lisa Maillart, Mark S. Roberts

When the standard match process does not result in timely allocation, livers are offered to a transplant center instead of a specific patient(s). The center then decides which, if any, of its patients should receive the organ. We model and analyze this sensitive resource allocation problem as a large-scale, average reward MDP. We estimate the MDP parameters using clinical data and implement ADP techniques to solve for the optimal policy that we compare with heuristic policies via simulation.

■ SC45

C - Room 6, Level 2- Mezzanine

Applications of Operations Research Models and Methods in Health Care

Sponsor: Health Applications
Sponsored Session

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

Co-Chair: Edward Wasil, American University, Kogod School of Business, Washington, DC, United States of America, ewasil@american.edu

1 - Threshold-based Heuristics for the Single-day Surgery Scheduling Problem

William Herring, Doctoral Candidate, University of Maryland, Mathematics Building, College Park, MD, 20742, United States of America, wherring@math.umd.edu, Jeffrey Herrmann

Scheduling elective surgeries is a dynamic, sequential decision-making process that must balance the costs of deferring waiting cases and blocking higher-priority cases. The single-day scheduling problem combines surgical block schedules, block release policies, and waiting lists. This talk presents a stochastic dynamic programming approach, an optimal algorithm for a special case, heuristics for the general case, and computational results that demonstrate the heuristics' effectiveness.

2 - A Data Driven Approach for Optimizing Kidney Allocation

Inbal Yahav, University of Maryland, Robert H. Smith School of Business, College Park, MD, United States of America, iyahav@rhsmith.umd.edu

In America, over 90,000 candidates currently wait for kidney transplantation, which increases annually by about 20,000. Current policy poorly matches donors with recipients. We present a policy combining an IP-based learning phase with a data mining phase, which outperforms current policy with respect to better matches and fewer organ rejections.

3 - The Effects of the Residency Teaching Model on the Efficiency of the Emergency Department

David Anderson, University of Maryland, Robert H. Smith School of Business, College Park, MD, United States of America, danderson@rhsmith.umd.edu, Bruce Golden, Katie Johnson, Joseph Lim, Jay Kellegrew, John Silberholz, Emily Sze, Ekta Taneja, Edward Tao

The effects of the residency teaching model on emergency room efficiency have been debated in the literature. We built a simulation model based on collected and historical database data from the University of Maryland Medical Center Emergency Department. We found that increased resident presence in the Emergency Department increased throughput for both critical and non critical patients.

4 - Factorial Design Quantifies Effects of Hand Hygiene and Nurse-to-Patient Ratio on MRSA Acquisition

Sean Barnes, University of Maryland, College Park, MD, United States of America, seanlbarnes@gmail.com, Bruce Golden, Edward Wasil, Anthony Harris, Jon Furuno

Optimal methods to control MRSA patient-to-patient transmission in the ICU setting are still unknown. We applied a 2k factorial design on the output of a stochastic, agent-based model to compare the effects of hand hygiene compliance and nurse-to-patient ratio on the transmission of MRSA in a 20-bed ICU. The results suggest that increasing the nurse-to-patient ratio is more effective at levels below ~60% compliance; however, improving compliance becomes the better strategy at higher levels.

■ SC46

C - Room 7, Level 2- Mezzanine

Panel Discussion: OR in Engineering Schools

Cluster: Invited Panels on Professional Issues
Invited Session

Moderator: Mark Daskin, Professor, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, msdaskin@umich.edu

1 - Panel Discussion: OR in Engineering Schools

Panelists: Mark Daskin, Professor, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, msdaskin@umich.edu, David Morton, Engineering Foundation Professor, The University of Texas at Austin, 1 University Station, C2200, Austin TX 78712-0292, United States of America, morton@mail.utexas.edu, Patrick Jaillet, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge MA, United States of America, jaillet@mit.edu, Lawrence V. Snyder, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem PA 18015, United States of America, larry.snyder@lehigh.edu, Margaret Brandeau, Professor, Management Science and Engineering, Stanford University, 380 Panama Way, Mail Code: 4026, Stanford CA 94305, United States of America, brandeau@stanford.edu

Panelists will present their perspectives on the state and health of operations research in engineering schools. Key issues include: where OR is taught in the curriculum, whether OR courses are required, enrollment trends, and how to increase the visibility of OR within engineering.

■ SC47

C - Room 8, Level 2- Mezzanine

Analysis of Next-Generation Sequencing Data

Cluster: Computational Biology and Bioinformatics
Invited Session

Chair: Alex Zelikovsky, Professor, Georgia State University, 34 Peachtree Street, Suite 1450, Atlanta, GA, 30303, United States of America, alexz@cs.gsu.edu

1 - Error Correction of Next-generation Sequencing Data

Dumitru Brinza, Staff Scientist, Bioinformatics, Life Technologies, 850 Lincoln Center Dr. M/S 408-2, Foster City, CA, 94404, United States of America, Dumitru.Brinza@lifetech.com

Ultra-high throughput next-generation sequencing technologies generate data with ~1-3% error rate, that makes usage of the data challenging. We present a spectral alignment error correction method implemented in SOLiD(TM) Accuracy Enhancement Tool (SAET). The method takes advantage of high coverage (>20x) provided by next-gen data and corrects miss-calls based on evidence from multiple reads of the same DNA region. On average SAET reduces the error rate by 5-10 times.

2 - Estimation of Alternative Splicing Isoform Frequencies From RNA-Seq Data

Ion Mandoiu, Associate Professor, University of Connecticut, CSE Department, 371 Fairfield Way, Unit 2155, Storrs, CT, 06269-2155, United States of America, ion@engr.uconn.edu, Serghei Mangul, Alex Zelikovsky, Marius Nicolae

We present a novel expectation-maximization algorithm for inferring alternative splicing isoform frequencies from high-throughput transcriptome sequencing (RNA-Seq) data. Our algorithm exploits largely ignored disambiguation information provided by the distribution of insert sizes generated during library preparation, and takes advantage of base quality scores, strand and read pairing information if available. Empirical experiments show significant accuracy improvements over existing methods.

3 - Bioinformatics Pipeline for Fosmid Based Molecular Haplotype Sequencing

Jorge Duitama, University of Connecticut, 371 Fairfield Way, Unit 2155, Storrs, CT, 06269, United States of America, jduitama@engr.uconn.edu, Gayle McEwen, Margret Hoehe, Thomas Huebsch, Eun-Kyung Suk, Sabrina Schulz

The process of grouping alleles of heterozygous variants coming from the same chromosome copy of an individual is called haplotyping. We developed a new bioinformatics pipeline for next generation sequencing (NGS) of fosmid pools to assemble separately the two chromosome copies in particular regions. The pipeline includes an algorithm for fosmids detection from coverage patterns in mapped reads, a fosmid specific alleles calling module and an algorithm for single individual haplotyping.

4 - HCV Quasispecies Reconstruction From 454 Reads

Alex Zelikovsky, Professor, Georgia State University, 34 Peachtree Street, Suite 1450, Atlanta, GA, 30303, United States of America, alexz@cs.gsu.edu, Irina Astrovskaya, Serghei Mangul

When reconstructing viral quasispecies, the main obstacle is that only a reference RNA is known and the challenge is to find "real" quasispecies sequences which are usually very close to each other. Even the number of quasispecies is not yet known and there is no any established model of clustering them. We report our analysis of 454 Lifescience reads using maximum likelihood model resolved with expectation maximization and several novel optimization models.

■ SC48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - JMP Division, SAS - Dynamic Visualization with JMP
Mia Stephens, JMP Division - SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, mia.stephens@jmp.com

JMP is data analysis and visualization software from the SAS Institute. Intuitive, interactive and graphical, JMP lets you focus on the insight your data can provide. JMP provides a complete array of statistical procedures, from basic to advanced, and produces integrated and dynamic visual output. We will demonstrate popular JMP tools for data visualization, including Tabulate, Graph BuilderÆ, Bubble Plots, the data filter, and new mapping tools.

2 - Innovative Scheduling - Practical Solutions to Real-World Logistics Problems
Ravindra K. Ahuja, Innovative Scheduling Inc., 2153 SE Hawthorne Rd., Suite 206, Gainesville, FL, 32641, United States of America, ravi@innovativescheduling.com

In this tutorial, we will share with the audience our experiences of building successful solutions to complex real-world operations research problems. We will describe several business problems, their modeling, algorithmic development, and packaging into decision support systems. We will explain the difficulties encountered, how we addressed them, and the lessons we learnt. We will also describe our approach for building optimization-based decision support systems in the rapid development mode.

■ SC49

C -Room 10, Level 2- Mezzanine

Global Sourcing and Boundaries of the Firm

Sponsor: Information Systems
Sponsored Session

Chair: Anjana Susarla, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, anjanas@andrew.cmu.edu

1 - How Organizational Practices Influence Service Performance
Jiban Khuntia, University of Maryland, College Park, MD, United States of America, jiban@umd.edu, Sunil Mithas, Anjali Kaushik, Jonathan Whitaker

This research focuses on the organizational practices of BPO service provider firms, and develops a conceptual model to link organizational practices with service performance outcomes. The model identifies three organizational practices that influence service performance: quality practice, customer relationship practice, and compensation practice. The results provide evidence that the three organizational practices lead to higher service performance outcomes.

2 - The Impact of Quality on Service Satisfaction in Outsourcing Relationships
Deepa Mani, Indian School of Business, ISB, Gachibowli, Hyderabad, India, deepa_mani@isb.edu, Nishta Langer

The reach and impact of outsourcing has expanded in the modern organization to include a variety of strategic business objectives. Yet, evidence suggests that many firms remain unprepared for the transformation that strategic outsourcing brings, resulting in significant dissatisfaction with their outsourcing engagements. In this study, we use data on 200 strategic outsourcing relationships to examine the drivers of service satisfaction. In particular, we focus on the dimensions of service quality in explaining variance in service satisfaction. Our results have important implications for theory and the management of outsourcing relationships.

3 - Knowledge Intensive IT Services: An Empirical Examination
Ramanath Subramanyam, Asst. Professor, University of Illinois, 1206 S. 6th St., 350 Wohlers Hall, Champaign, IL, 61822, United States of America, rsubrama@illinois.edu, Anjana Susarla

Increasingly, firms rely on external firms for access to critical knowledge. This paper focuses on the key challenge in designing contractual agreements that can protect competitive knowledge, whilst simultaneously providing incentives for inter-organizational learning and frictionless knowledge exchange. We integrate explanations from theories of incomplete contracts and knowledge-based research to investigate contract design characteristics.

■ SC50

C -Room 11, Level 2- Mezzanine

Internet-Based Information Intermediaries

Sponsor: Information Systems
Sponsored Session

Chair: Jason Kuruzovich, Assistant Professor of Management Information Systems, Rensselaer Polytechnic Institute, 137 Nelson Ave, Saratoga Springs, NY, 12866, United States of America, kuruzj@rpi.edu

Co-Chair: Animesh Animesh, Assistant Professor, McGill University, 1001 Sherbrooke West, Montreal, Canada, animesh.animesh@mcgill.ca

1 - Investigating the Accuracy of On-line Reputation Systems
Sarah Rice, University of Connecticut, 2100 Hillside Road, Storrs, United States of America, Sarah.Rice@business.uconn.edu

We address the accuracy of on-line reputation systems by specifically asking what influences an individual's choice to leave honest feedback, and how might the decision to leave no feedback be interpreted. We conduct an exploratory survey specifically designed to gain insights as to why on-line market participants may or may not contribute their private information to an on-line reputation system.

2 - A Disaggregate Level Analysis of User Contribution in an Online Community
Jui Ramaprasad, Assistant Professor, McGill University, 1001 Sherbrooke West #589, Montreal, QC, H3A1G5, Canada, jui.ramaprasad@mcgill.ca, Rishika Ramkumar

Consumers are increasingly receiving information from and contributing to online communities. In this study, we conduct a systematic empirical examination of the factors that drive online contribution. We find that opinions of a user's local network influence contribution more than those of the overall network. Also, active users and users with a longer relationship with the online community are more likely to contribute. We discuss the implications of the results for both theory and practice.

3 - An Empirical Analysis of the Adoption of Facebook on Campus
Oliver Yao, Associate Professor, Lehigh University, 621 Taylor St., Bethlehem, PA, 18015, United States of America, yuy3@lehigh.edu, Xue Bai

Using campus and Facebook data for 94 universities in the U.S., we examine the effect of offline environmental factors on the adoption of online social networks. We find that Facebook are used in a greater extent when the campus has a greater number of offline social communities, such as student clubs and organizations, and fraternities and sonorities; when the campus size is larger; and when the campus is located in a region with lower average temperatures and greater levels of precipitation.

4 - Online Pricing and Distribution Strategies: A Case Study of Air Travel
Nelson Granados, Assistant Professor of Information Systems, Pepperdine University, 18111 Von Karman Ave., Irvine, CA, 92612, United States of America, Nelson.Granados@pepperdine.edu, John Mooney

We discuss contemporary practices in the design of Internet-based marketing and sales in the air travel industry, with particular focus on merchandising, ala carte pricing, and ancillary fees. We examine the demand-side impacts of these practices. Based on these impacts, we offer some prescriptive guidelines for online air travel distribution strategies, including the Internet-based technological innovations that will enable them.

■ SC51

C -Room 12, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Microsoft - Presenting Microsoft Solver Foundation 3.0
Nathan Brixius, Microsoft Corporation, One Microsoft Way, Redmond, WA, 98052, United States of America, Senior Engineering Lead

Microsoft Technical Computing's Solver Foundation is a .Net runtime for mathematical programming, modeling, and optimization. The latest release broadens the range of models that can be created, solved, and analyzed using Solver Foundation Services (SFS) and OML to include linear and mixed-integer nonlinear problems. A demo and technology roadmap will be presented.

2 - AnyLogic - AnyLogic in Brief
Andrei Borshchev, General Director, AnyLogic NA-XJ Technologies, 9 Ramsey Road, Lebanon, NJ, 08833, United States of America, andrei@xjtek.com

AnyLogic is the one tool that recognizes the value of different approaches. With AnyLogic you can build models in multiple techniques or even combine them to create hybrid models that are truer to your system than those created with single-purpose tools. This workshop provides background, demos, and an overview of the tool, as well as an insight into future features.

■ SC52

C -Room 13, Level 2- Mezzanine

Container Security and Detection Systems

Sponsor: Military Applications
Sponsored Session

Chair: Ana Lisbeth Concho, Research Assistant, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, aconcho@stevens.edu

1 - Container Inspection Strategies Optimization via Heuristics Considering Budget and Space Constraints
Ana Lisbeth Concho, Research Assistant, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, aconcho@stevens.edu, Jose Ramirez-Marquez

A new approach for developing optimal shipping container inspection strategies at Port-of-Entry is proposed to maximize the detection-rate of suspicious containers and minimize the average inspection time while considering budget and space constraints. An evolutionary algorithm is used for simulating multiple inspection strategies and obtaining the corresponding Pareto set.

2 - Nuclear Shielding in Port of Entry Inspection
Tsvetan Asamov, Rutgers Center for Operations Research, 640 Bartholomew Road, Piscataway, NJ, 08854-8003, United States of America, asamov@rci.rutgers.edu, Jolie Cizewski, Elsayed Elsayed, Curtis McGinity

We present a physically consistent model for the detection of shielded nuclear materials in the Port-of-Entry inspection problem. We assume a Beta distribution for the probability density of both the nuclear source mass and shielding thickness. Our numerical results suggest that the radiation sensor readings for containers with nuclear materials may violate the widely held normality assumption. Additionally, we illustrate the necessity for real-time threshold optimization of radiation detectors.

3 - Maritime Simulation Model of Mobile Detection Systems
Daniel Faissol, Postdoctoral Researcher, Lawrence Livermore National Laboratory, 7000 East Ave., Livermore, CA, 94511, United States of America, faissol1@llnl.gov, Thomas Edmunds, Richard Wheeler

We have developed the Maritime Simulation Model (MSM) to evaluate the efficacy of a given detection architecture aimed at detecting a radioactive material being transported on a small boat. The use of simulation allows us to capture the interdependencies between the radiation detection model and the patrol operations model, as well as the complex geometry of the patrolled region. In this talk, we demonstrate MSM and present results and analysis.

■ SC53

C -Room 14, Level 2- Mezzanine

Networks and Inference

Cluster: New Trends in Wireless Networks: A Large-scale Systems Perspective
Invited Session

Chair: Sujay Sanghavi, Assistant Professor, ECE, UT Austin, 1 University Station, ENS 425, Austin, TX, 78712, United States of America, sanghavi@mail.utexas.edu

1 - Manipulation Robustness of Collaborative Filtering
Benjamin Van Roy, Associate Professor, Stanford University, Terman 315, Stanford University, Stanford, CA, 94305, United States of America, bvr@stanford.edu, Xiang Yan

A collaborative filtering system recommends to users products that similar users like. Collaborative filtering systems influence purchase decisions, and hence have become targets of manipulation by unscrupulous vendors. We demonstrate that while nearest neighbor algorithms, which are widely used in commercial systems, are highly susceptible to manipulation, a new class of algorithms we propose are robust in the sense that, on average, frequent users experience vanishing distortion.

2 - A Token-based Approach for Distributed Computation
Venkatesh Saligrama, Professor, Boston University, Boston, MA, United States of America, srv@bu.edu, Murat Alanyali

We consider distributed algorithms for data aggregation based on neighboring pairwise computations on a graph. We endow each node with a state that can either be active(transmit) or inactive. The idea is to control the message transmission by modulating the states. This framework admits different schemes such as Gossip and Coalescing random walks (CRW). We study per-node message and time complexities of different algorithms as a function of the network size.

3 - Network Codes for Distributed Storage and Interference Alignment
Alex Dimakis, Assistant Professor, University of Southern California, 532 EEB, 3740 McClintock Ave., Los Angeles, CA, 90089-2560, United States of America, dimakis@usc.edu

Distributed storage schemes for data centers and peer-to-peer networks often use traditional erasure codes to introduce redundancy for robustness. Following recent developments, we will show that interference alignment is fundamental for distributed storage repair problems and demonstrate equivalence of interference alignment to a rank minimization problem subject to full-rank constraints.

4 - Dirty Statistical Models
Sujay Sanghavi, Assistant Professor, ECE, UT Austin, 1 University Station, ENS 425, Austin, TX, 78712, United States of America, sanghavi@mail.utexas.edu

Several techniques in high-dimensional statistics decompose the data into a "truth" from a clean structural model, and noise; e.g. Compressed Sensing (sparsity), PCA (low-rank) etc. Real data, however, may not fit into any one such clean model. We introduce dirty models: instead of decomposing the data, we decompose the model itself - jointly using several clean models. This results in much more flexible and robust algorithms; we show this for multi-task learning, PCA and graphical models.

■ SC54

C -Room 15, Level 2- Mezzanine

Technology Choice in Semiconductor Manufacturing

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Richard Roth, Director of MIT Materials Systems Laboratory, Massachusetts Institute of Technology, 292 Main Street, Cambridge, United States of America, rroth@MIT.EDU

1 - Supply Chain and Timing Issues in the Transition to a 450mm Wafer Standard
Charles Fine, Professor, Massachusetts Institute of Technology, Cambridge, MA, United States of America, charley@mit.edu, Richard Roth

The transition to a 450mm wafer standard for the semiconductor industry offers an opportunity for long term improvements in throughput and costs. However, there are strategic questions about both the timing of the transition and the roles of various players within the supply chain. This work addresses the impact of timing decisions including introduction rate and rate of technology on the chipmakers, equipment suppliers and raw wafer producers.

2 - Economics of the Transition to 450mm Wafers in the Semiconductor Industry
Richard Roth, Director of MIT Materials Systems Laboratory, Massachusetts Institute of Technology, 292 Main Street, Cambridge, United States of America, rroth@MIT.EDU, Charles Fine

The semiconductor industry is considering using 450mm wafers to improve area throughput and reduce processing costs. However, several drawbacks exist including the large upfront investments and long learning horizon which may mean that it will take several years before the wafer size transition can pay for itself. This work explores the conditions under which there are sufficient long term cost savings to offset the early investments and cost penalties.

3 - Learning as a Driver Technology Choice Decisions in Semiconductor Manufacturing
Thomas Rand-Nash, Doctoral Candidate, Massachusetts Institute of Technology Materials Systems Laboratory, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, trand@mit.edu

This work explores process technology decision making in the presence of learning effects in semiconductor manufacturing, and hopes to characterize the conditions under which learning-related production cost effects impact technology choice decision making. Relevant factors considered include learning rates, production volume as a function of demand, market structure, and budget constraints.

4 - The Impact of Offshoring on the Innovation Trajectories of Firms versus Individuals

Erica Fuchs, PhD, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 129, Pittsburgh, PA, 15217, United States of America, erhf@andrew.cmu.edu, Chia-Hsuan Yang

After the burst of the telecom bubble in March 2000, the majority of U.S. optoelectronic component firms moved manufacturing offshore. This research explores (1) whether due to the different offshore production economics, the firms who move manufacturing offshore stop or slow U.S.-based R&D activities in particular technologies and (2) whether inventors originally within these offshoring firms, leave, and continue to innovate in the pre-offshoring technologies at different institutions.

■ SC55

C -Room 16, Level 2- Mezzanine

Innovation Processes

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Laura Kornish, Associate Professor, Leeds School of Business, University of Colorado, UCB 419, Boulder, CO, 80309, United States of America, kornish@colorado.edu

1 - The Impact of Device Choice on Outcomes in Hip Replacement Surgery

Kamalini Ramdas, London Business School, Regent's Park, London, NW14SA, United Kingdom, kramdas@london.edu, Khaled Saleh, Steven Stern, Haiyan Liu

It is well known in healthcare that a surgeon's experience in terms of number of surgeries performed is an important predictor of surgical outcomes. Unlike previous research in this area, we examine how experience with specific devices used in surgery affects surgical outcomes, using a data set consisting of all hip replacement surgeries conducted at the University of Virginia hospital in 2006-2008.

2 - Empirical Evidence for the Role of the Domain Name Itself in Website Performance

Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu, Karl Ulrich

This paper provides the first large-scale empirical evidence linking specific properties of internet domain names to the realized demand for their associated websites. We find that the websites with the highest demand have names that are short, include dictionary words, avoid punctuation symbols, and use numerals. The use of phonemes associated with disgust is negatively associated with performance for most websites, but positively associated with performance for adult sites.

3 - Idea Generation and Concept Selection

Svenja Sommer, Assistant Professor, HEC Paris, 1 Rue de la Liberation, Jouy-en-Josas, France, sommers@hec.fr, Stylianos Kavadias

Idea or concept generation and selection is an essential, but relatively poorly understood part of the new product design process. In this work, we consider how group interactions affect the information dissemination during the idea generation process, and how the idea generation process and organizational choices affect the concepts ultimately selected for further development.

4 - Opportunity Spaces in Innovation: Empirical Analysis of Large Samples of Ideas

Laura Kornish, Associate Professor, Leeds School of Business, University of Colorado, UCB 419, Boulder, CO, 80309, United States of America, kornish@colorado.edu, Karl Ulrich

Identifying a large number of ideas with parallel search is a common approach to innovation. One potential weakness of parallel search is repetition. We analyze repetition in five data sets comprising 1,368 opportunities and address three questions: (1) When a large number of efforts to generate ideas are conducted in parallel, how likely are the resulting ideas to be redundant? (2) How large are the opportunity spaces? (3) Are unique ideas more valuable than those that are similar to others?

■ SC56

C - Room 1, Level 1

Advances in Ranking and Selection

Sponsor: Simulation Society
Sponsored Session

Chair: Douglas Morrice, Professor, The University of Texas at Austin, Red McCombs School of Business, 1 University Station, B6500, Austin, TX, 78712-0212, United States of America, Douglas.Morrice@mccombs.utexas.edu

1 - Selection of a Good Enough Subset with Descriptive Complexity Preference

Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Bldg., 104 S. Mathews, Urbana, IL, United States of America, enluzhou@illinois.edu, Shen Yan, Chun-Hung Chen

Simple designs are usually more preferable than complex designs in the real world if their performances are within a good enough range. In this paper, we propose a simulation-based approach to identify m simplest good enough designs among K (K>m) total designs using an optimal simulation budget allocation scheme. The numerical results show that our approach finds the simplest good enough designs efficiently, and outperforms some other approaches on all the test problems.

2 - Decision Analytic Ranking and Selection Algorithms

Jason Merrick, Associate Professor, Virginia Commonwealth University, 1015 Floyd Avenue, Richmond, VA, 23284, United States of America, jrmerric@vcu.edu, Toni Sorrell

Ranking and selection problems can be cast as simple influence diagrams and solved with sampling-based algorithms designed for them. Alternatively, methods such as OCBA, 0-1, LL, and the knowledge gradient can be used. We perform an empirical comparison of these methods to investigate whether influence diagram algorithms are competitive for ranking and selection problems or ranking and selection methods should be adapted to solve influence diagrams.

3 - An Empirical Analysis of Transient Mean Ranking and Selection

Douglas Morrice, Professor, The University of Texas at Austin, Red McCombs School of Business, 1 University Station, B6500, Austin, TX, 78712-0212, United States of America, Douglas.Morrice@mccombs.utexas.edu, Chun-Hung Chen

In this presentation, we empirically analyze the performance of the transient mean Ranking and Selection algorithm. Based on this analysis, we consider ways in which to improve performance of the algorithm.

■ SC57

C - Room 2, Level 1

Operations-Finance Interface

Cluster: Risk Management
Invited Session

Chair: Fehmi Tanrisever, Assistant Professor, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612AZ, Netherlands, f.tanrisever@tue.nl

1 - An Integrated Approach to Commodity Risk Management

Fehmi Tanrisever, Assistant Professor, Eindhoven University of Technology, Den Dolech 2, Eindhoven, 5612AZ, Netherlands, f.tanrisever@tue.nl

We examine the operating and financial hedging decisions of a value maximizing firm, under imperfect capital markets. Motivated by the flour milling industry, we consider a firm who buys a certain commodity and converts it into a final product. We show that, the cost of financial distress may lead the firms to choose more conservative strategies via under-producing. We discuss how commodity markets can be used to mitigate this problem to generate more wealth for the shareholders.

2 - Operational Hedging Strategies to Overcome Financial Constraints for Clean Technology Startups

Sinan Erzurumlu, Assistant Professor, Babson College, Tomasso 123, Babson Park, MA, 02457, United States of America, serzurumlu@babson.edu, Fehmi Tanrisever, Nitin Joglekar

The clean technology sector has been hit by the recent credit squeeze because many clean technology startups rely on project financing from limited financial resources to fund their capital outlays. Startups can overcome the financing problem by reducing the potential risks of their technologies. Our goal is to develop a framework that conceptualizes the associated risks and biases associated with clean technology industry and discuss the role of operational hedging to manage any shortcomings.

3 - An Analysis of Joint Manufacturer-Bank Loans to Finance the Supply Chain

Jianer Zhou, Assistant Professor, Boston College, 140 Commonwealth Ave., Fulton 454C, Chestnut Hill, MA, 02467, United States of America, jianer.zhou@bc.edu, Harry Groenevelt

We consider a supply chain involving 3 parties: retailer, manufacturer and bank. To sell her products through a retailer whose ability to finance inventory is limited, the manufacturer partners with a bank to offer a loan program to the retailer. We formulate the interaction between the manufacturer and the retailer as a Stackelberg game. Our paper provides insights into the motivation of the manufacturer to offer a collaborative loan program if the financial market is incomplete.

4 - Risk Propagation in a Supply Chain
Alejandro Serrano, Zaragoza Logistics Center, Edificio Nayade 5, Bari 55 - PLAZA, Zaragoza, 50197, Spain, aserrano@zlc.edu.es, Santiago Kraiselburd, Rogelio Oliva

We study how risk, measured by the variability of payments from customers, propagates upstream in a supply chain, when firms have limited access to external funds, and unilaterally exceed trade credit agreements. We model a chain with three players, where the downstream player faces random demand. Using numerical Markov chains, we study the impact of firms' target leverage, demand variability, and agency costs on risk propagation.

■ SC58

C - Room 3, Level 1

Quantitative Methods for Credit Risk

Cluster: Quantitative Finance
Invited Session

Chair: Rafael Mendoza-Arriaga, Assistant Professor, McCombs School of Business, University of Texas at Austin, IROM, Austin, TX, 78712, United States of America, rafael.mendoza-arriaga@mccombs.utexas.edu

1 - Default Clustering and Valuation of Collateralized Debt Obligations
Xianhua Peng, Assistant Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, China, xp2102@caa.columbia.edu, Steven Kou

The recent financial crisis has witnessed the powerful impact of default clustering (i.e., one default event tends to trigger more default events in the future and cross-sectionally), especially on the market of collateralized debt obligations (CDOs). We propose a model for CDO pricing based on cumulative default intensities that can incorporate default clustering. The result of calibration to the market data when default correlation was substantially high shows that the model is promising.

2 - First Passage Time(s) of Two-dimensional Brownian Motion
Haowen Zhong, Columbia University, 500 West 120th Street, New York, NY, 10027, United States of America, hz2193@columbia.edu, Steven Kou

We deal with the first passage time problem of 2-dim drifted Brownian Motion. Via a PDE approach we solve for the Laplace transform of the first passage time(s) of an 2-dim drifted BM. We then perform a numerical inversion for the required pdf. Our approach not only is computational and practical convenient, but also provides useful insights leading to n-dim case.

3 - Optimal Importance Sampling for Dynamic Portfolio Credit Risk
Kay Giesecke, Stanford University, 414 Terman Center, Stanford, CA, United States of America, giesecke@stanford.edu, Alex Shkolnik

Dynamic intensity-based point process models, in which a firm default is governed by a stochastic intensity process, are widely used to model portfolio credit risk. In the context of these models, this paper develops, analyzes and evaluates an importance sampling scheme for estimating the probability of large portfolio losses. The scheme is widely applicable, and is shown to be asymptotically optimal. Numerical experiments illustrate the performance of the algorithm.

4 - A Class of Multivariate Lifetime Distributions Associated with Multi-dimensional Subordinators
Yunpeng Sun, Northwestern University, 2145 Sheridan Rd. C210, Evanston, IL, United States of America, ypengsun@iems.northwestern.edu, Rafael Mendoza-Arriaga, Vadim Linetsky

We construct a class of multivariate lifetime distributions associated with multi-dimensional Levy subordinators. The distributions in this class are parameterized by an n-dimensional Levy measure, a non-negative drift vector, and a set of univariate marginals. This class of lifetime distributions can be simulated with the computational effort linear in the number of lifetimes. Applications to multi-name credit risk modeling will be presented.

■ SC59

H - Salon A, 4th Floor

Doing Good with Good OR Student Competition

Cluster: Doing Good with Good OR Student Competition
Invited Session

Chair: James Cochran, Louisiana Tech University, Department of Marketing & Analysis, P.O. Box 10318, Ruston, LA, 71272, United States of America, jcochran@cab.latech.edu

Co-Chair: John Fowler, Arizona State University, School of Computing, Informatics, and Decision Systems Engineering, Tempe, AZ, United States of America, john.fowler@asu.edu

1 - Strategic Planning of Radiation Therapists: An IP Approach with Duration and Experience Constraints
Greg Werker, University of British Columbia, 3869 W 18th Avenue, Vancouver, Canada, gwerker@gmail.com, Martin Puterman, Mike Darud

Radiation therapists work in many tasks to provide treatment at the British Columbia Cancer Agency. Experience and duration constraints are important considerations when creating a two year staff plan. We developed a multi-period assignment model with side constraints and goal programming that balances conflicting objectives. The application is used to enable better use of this limited cancer care resource.

2 - Decision Model for Sustainable Water, Sanitation, & Household Energy in Developing Communities
Justin Henriques, PhD Candidate, University of Virginia, 151 Engineers Way, P.O. Box 400747, Charlottesville, VA, 22904, United States of America, jjh9a@virginia.edu, Garrick Louis

The lack of access to basic needs in developing countries leads to death, disease, and environmental degradation. This research creates decision support models for the systematic selection and implementation design of sustainable technologies for distributed water, sanitation, and household energy systems. The author applies these models in countries including Haiti, Indonesia, and Kenya. He also operates a non-profit organization that implements the research as community development projects.

3 - Improving the Educational Outcomes of Future Surgeons
Jonathan Turner, PhD Candidate, Northwestern University, Evanston, IL, United States of America, JonathanTurner@u.northwestern.edu, Heron Rodriguez, Mark Daskin, Debra DaRosa

Our analytical models and simulation have influenced Northwestern Memorial Hospital to increase the length of surgical resident rotations from one to two months. The software we designed will also evenly distribute operating room experiences across residents. These changes will increase resident-patient continuity of care, the educational experience of future physicians, patient satisfaction and patient safety.

■ SC60

H - Salon B, 4th Floor

Benefit-Risk Assessment and Communication in Pharmaceuticals

Sponsor: Decision Analysis
Sponsored Session

Chair: Jim Felli, Research Fellow, Eli Lilly & Company, Lilly Corporate Center, Indianapolis, IN, 46285, United States of America, jcfelli@lilly.com

1 - Benefit-Risk: A Story in Pictures
Jim Felli, Research Fellow, Eli Lilly & Company, Lilly Corporate Center, Indianapolis, IN, 46285, United States of America, jcfelli@lilly.com

Stories constitute the single most powerful weapon in a leader's arsenal. — Howard Gardner, Harvard University.

2 - Approaching Benefit/ Risk Analysis From a Decision Analytic Perspective
Marilyn Metcalf, Director, Quant & Dec Sciences, GSK, PO Box 13398, Five Moore Drive, Research Triangle Park, NC, 27709-3398, United States of America, marilyn.a.metcalf@gsk.com

Benefit/risk analyses have many features of decision analyses. We will review framing and tools familiar to decision analytic practitioners that can be helpful in many benefit/risk trade-offs. In addition, we will discuss communications approaches in collecting information, building models, and articulating results that are helpful in both arenas.

3 - Decision Analytic Models to Aid Informed Regulatory Decisions About Medicinal Products
Lawrence Phillips, London School of Economics & Political Science, Department of Management, Houghton Street, London, WC2A 2AE, United Kingdom, larry_phillips@msn.com, Barbara Fasolo

All drug regulators convert 10 gigabytes of data about a new medicinal product into a 'yes-no' approval decision through a process of discussion and debate that does not use quantitative models. Research at the European Medicines Agency shows how modelling improves the transparency and quality of the regulatory decision-making process, and facilitates communication about the balance of benefits and risks.

4 - Progress Toward More Systematic Benefit-Risk Assessment in Pharmaceuticals
Rebecca Noel, Research Scientist, Eli Lilly & Co., Lilly Corporate Center, Indianapolis, IN, United States of America, noel_rebecca_a@lilly.com

Assessing the benefit-risk (B-R) balance of medicines is a prominent challenge facing pharmaceutical manufacturers and regulators. While B-R assessments are the core of decision-making, the current process relies primarily on expert judgment. This session highlights efforts and approaches to develop and apply a more structured and systematic approach to B-R assessment for pharmaceutical regulatory decision-making.

■ SC63

H - Room 404, 4th Floor

Value of Information (VoI): From Theory to Applications

Sponsor: Decision Analysis
Sponsored Session

Chair: Laure Canis, US Army Corps of Engineers, 70 Pacific Street, Cambridge, MA, United States of America, laure.canis@polytechnique.org

1 - Value of Information and the Accuracy of Discrete Approximations
Arjun Ramakrishnan, Student, University of Texas at Austin, 1100 E32nd st Apt 106, Austin, TX, 78722, United States of America, arjunr@mail.utexas.edu, Eric Bickel

Value of information is one of the key features of decision analysis. My work deals with providing a consistent and functional methodology to determine VOI on proposed well tests in the presence of uncertainties. This method shows that VOI analysis by discretizing continuous probability distributions and using conventional decision trees can be accurate if the correct discretization is chosen. We also compare different discrete approximations.

2 - General Bounds on Value of Information in Two-act Linear Loss Decisions
Jeff Keisler, University of Massachusetts, Boston, MA, United States of America, Jeff.Keisler@umb.edu, Laure Canis

We consider the two act linear loss problem (TALL) when action alternative's payoff has known mean and standard deviation. We derive an analytic upper bound for the Expected Value of Perfect Information on this payoff, as the product of standard deviation and a function of the absolute ratio of the mean to the standard deviation, and extend the result to the case where the distribution is known to be symmetric. We also derive lower bounds. We compare with results for the normal distribution.

3 - Value for Information for Prioritizing Nano-related Research
Igor Linkov, US Army Corps of Engineers, Cambridge, MA, United States of America, igor.linkov@usace.army.mil, Laure Canis

We first present a decision model for selecting the optimal manufacturing process for Single Wall Carbon Nanotubes (SWCNT) from the point of view of different stakeholders. We then perform a Value of Information Analysis on health related and manufacturing criteria to establish when performing further research is worth the costs.

4 - The Value of Information for Some Stopping Problems
Debarun Bhattacharjya, Research Staff Member, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States of America, debarunb@us.ibm.com, Lea Deleris

In stopping problems such as the search for an apartment or employee, the decision maker receives a sequence of candidates and decides whether to choose the current candidate, thereby stopping the search, or whether to continue the search. We investigate properties of the value of information in several variations of the stopping problem, and discuss how a model that ignores sequential decisions can potentially severely under-estimate the value of information.

■ SC68

H - Room 415, 4th Floor

Managing Distribution Channels Under Competition

Sponsor: eBusiness
Sponsored Session

Chair: Yunzeng Wang, Professor of Finance and Management Science, University of California, Riverside, 900 University Avenue, Riverside, CA, 92521, United States of America, yunzeng.wang@ucr.edu

1 - Site-to-store or Store-to-site? Application of One-way Transshipment in Dual-channel Retailing
Chao Liang, PhD Candidate, The Unversity of Texas at Dallas, 800 W. Campbell Rd., Richardson, TX, 75080, United States of America, cxl071000@utdallas.edu, Suresh Sethi, Jun Hang

Although more than 80% of retailers now sell products through multiple channels, it is not clear how a retailer should integrate effectively a physical channel with an online channel. We compare two standard integration strategies site-to-store and store-to-site. We first consider the case in which the physical channel consists of one retail store, and then the multiple-retail-store case. Finally, we develop a simple heuristic to identify an effective strategy for the multiple-retail-store case.

2 - Private Labels vs. National Brands: Information Asymmetry and New Product Introduction
Arcan Nalca, Assistant Professor, Queen's University, 143 Union Street, Goodes Hall 226, Kingston, Ontario, K7L 3N6, Canada, arcan.nalca@business.queensu.ca, Tamer Boyaci, Saibal Ray

Retailers introduce private labels (PL) to gain profits directly from the PL and also use it as a strategic weapon against national brand (NB) manufacturers. Today, retailers also focus on design and innovation of PLs by improving the existing products through their ability to learn from customers. In this paper, we investigate the PL introduction and positioning decisions of a retailer and its effects on the NB manufacturer in an asymmetric information environment.

3 - The Effect of List Price on Channel Performance in a Revenue-sharing Contract
Jun Ru, University at Buffalo, The State University of New York, School of Management, Buffalo, NY, 14260, United States of America, jun.ru@utdallas.edu, Yunzeng Wang, Xiangpei Hu

Credited for creating innovative contracts for managing business with suppliers, Amazon.com offers a contract called Advantage Program. A key parameter is the product list price that Amazon.com allows a supplier to choose. It then sets the retail price at or below supplier's list price for selling the product to the market. We show that supplier's list price acting as a constraint on retailer's retail price plays a major role in determining firms' decision and performance in equilibrium.

■ SC69

H - Salon F, 6th Floor

Roundtable Session I - Upcoming Topics in Railroad Operations Research

Sponsor: Railrway Applications
Sponsored Session

Chair: Carl VanDyke, Oliver Wyman, 212 Carnegie Center, Princeton, NJ, United States of America, Carl.VanDyke@oliverwyman.com

Co-Chair: David Hunt, Oliver Wyman, 212 Carnegie Center, Princeton, NJ, 08540, United States of America, David.Hunt@oliverwyman.com

1 - Current Trends and Future Topics Rail Research: A Survey and Forecast
Michael Gorman, Associate Professor and J. Berry Endowed Fellow, University of Dayton, School of Business - MIS, OM DSC Dpt., 300 College Park, Dayton, OH, 45419-2130, United States of America, Michael.Gorman@notes.udayton.edu

In this presentation, I will survey the intensity of recent rail research in various areas. I will present indicators of trends for rail research, and prognosticate on hot research topics for the upcoming decade.

2 - Use Operations Research Models to Improve Railroad Operations
Clark Cheng, Director Operations Research, Norfolk Southern Corp, 1200 Peachtree St NE, Box 117, Atlanta, GA, 30309, United States of America, clark.cheng@nscorp.com

As an OR practitioner in the rail industry, I have witnessed the industry has embraced OR models in tactical and strategic decision making although there is still a long way to go. In this presentation, I will review what and how OR models have been used in a wide range of applications, e.g., car scheduling, fleet sizing, crew planning, vehicle routing, capacity planning, maintenance scheduling, service design, demand forecasting, etc. Also, I will discuss some upcoming topics in railroad.

3 - The Impacts of Positive Train Control (PTC) and Implications for Further Research

Carl VanDyke, Oliver Wyman, 212 Carnegie Center, Princeton, NJ, United States of America, Carl.VanDyke@oliverwyman.com, David Lehlbach, Rod Case, David Hunt

The Federal Railroad Administration has mandated that railroads implement PTC systems by 2015. The railways are implementing PTC as "overlay" systems, which are used in conjunction with existing control systems. This talk will examine various open questions related to PTC, and where further research is required on the design and performance of PTC. Topics such as braking algorithms, line capacity impact assessment, and the role of precision dispatching will be explored.

■ SC70

H - Salon G, 6th Floor

Joint Session AAS/ TSL: Irregular Operations in Aviation

Sponsor: Aviation Applications/ Transportation Science and Logistics Society
Sponsored Session

Chair: Jon Petersen, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30309, United States of America, Petersen@gatech.edu

1 - Airline Recovery via Benders and Lagrangian

Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road Room M239, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu, Seokcheol Chang, Milind Sohoni

Airline recovery is to find a modified schedule of flights, passenger itineraries, and aircraft in anticipation of a disruption (crew recovery is usually a follow-up process). We use an integer programming model, which is solved by a combination of Benders and Lagrangian. Instead of traditional dual prices, Lagrangian multipliers are used to form Benders cuts.

2 - A Solution Procedure for Airline Integrated Recovery

Jon Petersen, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30309, United States of America, Petersen@gatech.edu, Gustaf Solveling, Sergey Shebalov, Ellis Johnson, John-Paul Clarke

While the airline industry has benefited from advancements made in analytical OR methods, most applications stem from the frictionless environment of the planning stage. However the operational stage may be rife with schedule perturbations. The recovery process seeks to repair the flight schedule, aircraft rotations, crew schedules, and passenger itineraries in a tractable manner. Using math programming we solve the integrated problem and present promising computational results.

3 - Improving Passenger Service by Extending Disruption Management with Flight Planning

Bo Vaaben, Senior Consultant, Jeppesen, Koebmagergade 53 - 3th, Copenhagen, 1150, Denmark, Bo.Vaaben@jeppesen.com, Lavanya Marla, Cynthia Barnhart

When managing disruptions most airlines recover their operation by applying a combination of delays, swaps and cancellations. This paper presents how these traditional recovery techniques can be extended with altering flight plans. This is based on a network model and solved as a multi-commodity flow problem. The model allows an airline to find the right trade-off between fuel-burn and passenger service. Real life results from a medium sized carrier are presented.

4 - Restructuring of Terminal Areas During Thusingstorms using Convective Weather Forecasts

Diana Michalek, Massachusetts Institute of Technology, Operations Research Center, 77 Mass Ave, Bldg E40-130, Cambridge, MA, 02139-4307, United States of America, dianam@mit.edu, Hamsa Balakrishnan

The relaxation of the current rigid airspace structure, especially during stormy weather and in bottlenecked airport terminal areas, has the potential to increase airspace capacity and thereby decrease aircraft delay. We propose integer programming models for dynamic airspace configuration in the terminal area, taking into account both scheduled airspace demand and convective weather forecasts. We evaluate and discuss model results for realistic weather and demand scenarios.

■ SC71

H - Salon H, 6th Floor

Panel Discussion: Genesis of Data Envelopment Analysis

Cluster: In Honor of Bill Cooper
Invited Session

Moderator: Lawrance Seiford, Professor, University of Michigan, Ann Arbor, MI, United States of America, seiford@umich.edu

1 - Genesis of Data Envelopment Analysis

Panelists: Rajiv Banker, Temple University, Philadelphia, PA, United States of America, banker@TEMPLE.EDU, Arie Y. Lewin, Duke University, The Fuqua School of Business, Durham NC, United States of America, ayl3@duke.edu, William Cooper, University of Texas, Austin TX, United States of America, cooperw@mail.utexas.edu, Eduardo Rhodes

This session focuses on the objectives that led to the development of the DEA method for efficiency evaluation. Panelists will assess success in achieving those objectives over the past 30 years and challenges that lie ahead.

■ SC72

H - Salon J, 6th Floor

Transportation Pricing and Financing

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Stephen Boyles, University of Wyoming, Laramie, WY, United States of America, sboyles@uwyo.edu

1 - Roadway Pricing Strategies for Rural Freeways

Stephen Boyles, University of Wyoming, Laramie, WY, United States of America, sboyles@uwyo.edu, Promothes Saha, Ruoyu Liu

The primary goal of roadway tolling in rural areas is revenue generation rather than elimination of congestion externalities, and thus urban pricing models are not directly applicable. We present a model for finding socially-optimal prices accounting for the benefits obtained from toll revenue and the effects of diversion (including pavement deterioration and local economic activity.

2 - Private Involvement in Financing Public Projects

Zitao Zhang, Northwestern University, 2145 Sheridan Rd. Rm A316, Evanston, IL, 60201, United States of America, zitao-zhang@northwestern.edu, Pablo Durango-Cohen

This paper has taken the initial effort to understand potential complexities that could rise in the public-private collaboration of transportation investment. By adopting concepts from macroeconomic theory and public finance, we provide a prescriptive framework to illustrate tax variations under different circumstances and emphasize the importance of cost structure, timing of decision-making, and funding adequacy.

3 - Optimal Regulation on Private-sector Transportation Investment

Lei Zhang, Assistant Professor, Department of Civil and Environmental Engineering University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu, Jasmy Methipara, Yijing Lu, Andrea Robitallie

This paper develops a methodology for analyzing optimal regulatory policies on private-sector transportation investment. Our method combines the strengths of mathematical programming models in representing optimizing behavior and the advantages of agent-based techniques in simulating dynamic interactions on dissimilar time scales in large complex systems. Among all regulatory strategies examined for the test scenarios, profit/revenue sharing is shown to be the most effective policy in terms of welfare-maximization and equitable benefit distribution.

■ SC73

H - Salon K, 6th Floor

Vehicle Routing II: Stochastic and Dynamic Logistics Applications

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Alan Erera, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, alan.erera@isye.gatech.edu

1 - A Stochastic Programming Formulation for the Consistent Vehicle Routing Problem with Stochastic Customers: Some New Results

Michel Gendreau, CIRRELT, C.P. 6128, Succursale Centre-ville, Montreal, QC, Canada, Michel.Gendreau@cirrelt.ca, Ola Jabali, Walter Rei, Tom Van Woensel, Ton de Kok

The Consistent Vehicle Routing Problem corresponds to a situation encountered by express mail delivery companies who wish to provide their regular commercial customers with consistent service, in the sense that they would like to visit them every day around the same time, if they need service. We have proposed to model this problem as variant of the Vehicle Routing Problem with Stochastic Customers. We report and analyze recent computational results on a set of small to medium-size instances.

2 - Dynamic Stochastic Traveling Salesman Problem: Value of Real-time Traffic Information

Tae Su Cheong, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, taesu.qlink@gmail.com, Chelsea White III

After each stop, we assume that the vehicle chooses the next stop that has not yet been visited, based on current traffic conditions. Travel time along each arc in the network is modeled as a random variable, and the congestion status of the network evolves as a Markov chain. We present an efficient algorithm for dynamicaly determining a tour that minimizes the expected total travel time and give examples that indicate the value of traffic congestion information.

3 - SimuRial: A Reliability-based Algorithm to Solve the VRP with Stochastic Demands

Javier Faulin Fajardo, Professor, Public University of Navarre, Campus Arrosadia, Pamplona, 31006, Spain, javier.faulin@unavarra.es, Scott Grasman, Angel Juan, Alejandro Garcia del Valle

The VRP with Stochastic Demand (VRPSD) is a NP-hard problem in which demand is not revealed until the distribution vehicle visit the customer. That situation can cause infeasibilities which should be avoided. Our approach SimuRial is focused on reducing the probability of occurrence of such undesirable situations called route failures using Reliability concepts and Monte Carlo simulation. Some new generic instances are generated and some promising results are obtained.

4 - Robust Empty Repositioning in Large Scale Freight Consolidation Networks

Antonio Carbajal, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States of America, acarbajal@gatech.edu, Alan Erera, Martin Savelsbergh

Large scale consolidation networks require cost effective repositioning plans to correct empty-container imbalances among terminals. We present techniques to develop robust repositioning plans to hedge against uncertainty in the supply and demand of containers. We address modeling issues and solution techniques and present computational results on test instances.

■ SC74

H - Room 602, 6th Floor

Online Adaptive Routing

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Song Gao, University of Massachusetts-Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, United States of America, songgao@ecs.umass.edu

1 - Hierarchical Time-dependent Shortest Path Algorithm for Dynamic Traffic Assignment Models

Yang Gao, University of Arizona, Tucson, Tucson, AZ, United States of America, gabegao@email.arizona.edu, Yi-Chang Chiu

To improve the efficiency and accuracy of time-dependent shortest path algorithms, when applied to fine-grained, large-scale dynamic traffic network modeling, we propose an algorithm that utilizes network structure and dynamic traffic information, and combines both heuristic and exact optimization approaches. Numerical results demonstrate the improved computational efficiency and high solution quality of the proposed algorithm.

2 - Optimal Paths in Dynamic Networks with Dependent Random Link Travel Times

He Huang, University of Massachusetts-Amherst, Amherst, MA, United States of America, he@engin.umass.edu, Song Gao

We find paths with minimum expected disutility in a stochastic time-dependent network where all link travel times at all times are jointly distributed random variables. A comparison is made with similar problems that do not consider the stochastic dependencies, through theoretical results in small networks and computational results in large networks. The impact of stochastic dependencies on optimal path generation is shown to be related to the level of correlation and risk attitudes.

3 - A Prospect Theory Model for Strategic Route Choice with Stated Preference Data

Song Gao, University of Massachusetts-Amherst, 214C Marston Hall, 130 Natural Resources Rd, Amherst, MA, United States of America, songgao@ecs.umass.edu, Mike Razo

Most route choice studies with real-time information account for detours a traveler takes in response to received information, but not strategic choice behavior, where a traveler plans ahead for information to be received later. We develop a strategic route choice model that incorporates Cumulative Prospect Theory to account for risk. The model is estimated on stated preference data from interactive maps, and offers insights into risk-taking and strategic choice behavior in a simple network.

Sunday, 4:30pm - 6:00pm

■ SD01

C - Ballroom D1, Level 4

Optimization and Equilibrium Modeling for Energy Markets - I

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Steve Gabriel, Associate Professor, University of Maryland, 1143 Martin Hall, Department of Civil & Env. Engineering, College Park, MD, 20742, United States of America, sgabriel@umd.edu

1 - An Optimization Model for Biogas Production From Wastewater

Chalida u-Tapao, PhD Student, University of Maryland, College Park, MD, United States of America, cutapao@umd.edu, Steve Gabriel, Mark Ramirez, Christopher Peot

We present a new optimization model that considers both operational and investement decisions for an advanced wastewater treatment plant. These decisions involve converting wastewater into biosolids (fertilizer), methane gas, and electricity for internal or external purposes. We consider objective function to minimize carbon emissions, energy usage as well as maximize net profit.

2 - Options to Hedge Against Producer Risks in Electricity Markets

Salvador Pineda, PhD Student, University Castilla - La Mancha, Campus Universitario s/n, Ciudad Real, 13071, Spain, Salvador.Pineda@uclm.es, Antonio J. Conejo

In electricity markets power producers face both price risk and production availability risk. Forward contracts are well-known financial instruments to hedge the risk related to price volatility, but not the risk pertaining to unexpected unit failures. Using a multi-stage stochastic programming model, this presentation analyzes the advantages of hedging with options, compared to forward contracts, for a risk-averse producer if pool prices and unit availability are uncertain.

3 - Unit Commitment Benefits of LMP-based Market Coupling: A Stylized Model for Insight

Benjamin Hobbs, Professor/Sr. Research Associate, The Johns Hopkins University DoGEE/University of Cambridge EPRG, 313 Ames Hall, 3400 No. Charles St., Baltimore, MD, United States of America, bhobbs@jhu.edu, Harry van der Weijde

Stochastic unit commitment models are used to estimate the benefits of locational marginal pricing that arise from better coordination of day-ahead commitment decisions and real-time balancing markets in adjacent power markets subject to wind volatility. This model is applied to a stylised system. We conclude that both types of benefits are highly sensitive to load and generator characteristics, and that the benefits of coordinated balancing are larger than those of coordinated unit commitment.

4 - An Approach to Solve Discretely-constrained Linear MCPs
Steve Gabriel, Associate Professor, University of Maryland, 1143 Martin Hall, Department of Civil & Env. Engineering, College Park, MD, 20742, United States of America, sgabriel@umd.edu, Antonio J. Conejo, Sauleh Siddiqui, Carlos Ruiz Mora

In this presentation we provide a new method to solve discretely-constrained linear MCPs. We provide both theoretical as well as numerical results with applications in energy markets.

■ SD02

C - Ballroom D2, Level 4

Dynamic Optimization in Energy

Cluster: Energy: Modeling the Interface Between Markets and Operations
Invited Session

Chair: Canan Uckun, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, cuckun@chicagobooth.edu

1 - Managing Supply Surplus in an Electricity System
Owen Wu, Assistant Professor, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, MI, United States of America, owenwu@umich.edu

Contingency planning is crucial for electricity systems with high penetration of wind power. Under excessive energy supply surplus situations, jointly optimizing the operations of energy storages, conventional power plants, and wind power generators is paramount to the reliability and efficiency of the system. For a basic system, we characterize the strategies that minimize the expected system cost under supply surplus situations.

2 - Dynamic Scheduling of Demand Response Events for the Smart Grid
Jason Black, Researcher, GE Global Research, 1 Research Circle, K14A64, Niskayuna, NY, 12309, United States of America, blackj@ge.com, Rajesh Tyagi

Electric Utilities currently utilize simple approaches for dispatching demand response. These approaches do not optimize either the number of participating customers or the duration of their responses according to the physical or economic conditions on the power system. We present a methodology to optimally schedule customers for DR events. Our approach determines the best number of participants, as well as the timing for their participation in the event based on prevailing conditions.

3 - Dynamic Electricity Pricing for Smart Homes
Canan Uckun, 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 model the retailers' real-time pricing problem and consumers' responses as dynamic programs. Since the retailers have millions of consumers, the problem gets very large in size. We solve it by using an ADP approach.

■ SD03

C - Ballroom D3, Level 4

Joint Session ENRE/ Optimization: Optimization and Risk Management in Oil and Gas Exploration and Production

Sponsor: Energy, Natural Resources and the Environment/ Optimization
Sponsored Session

Chair: Leon Lasdon, Professor, IROM Department, McCombs Business School, University of Texas, Austin, TX, 78712, United States of America, leon.lasdon@mccombs.utexas.edu

1 - CR Models for Optimal Waterflooding of Oil Fields
Leon Lasdon, Professor, IROM Department, McCombs Business School, University of Texas, Austin, TX, 78712, United States of America, lasdon@mail.utexas.edu, Anh Nguyen, Larry Lake

We describe multiperiod "capacitance-resistance" models which identify the strength and dynamics of interconnections between water injection wells and oil production wells. A GAMS implementation is used to solve parameter identification and optimal injection problems as large NLP's. Examples are presented using real data from several oil fields.

2 - Using Optimization to Evaluate Major Subsurface Risks in Natural Gas Development Projects
Amin Ettehad, PhD Student, University of Texas, Austin, TX, 78712, United States of America, amin_ettehad@mail.utexas.edu, Larry Lake, Christopher Jablonowski

Optimization of oil and gas fields requires integrated quantitative models to systematically and simultaneously account for the technical and economic aspects of hydrocarbon recovery. In this paper, the authors extend their previous work on an integrated gas storage model to the case of gas production. The focus is on screening economics, scenario analysis, and uncertainty analysis.

3 - Portfolio Approach to Competitive Bidding for Offshore Petroleum Leases
W. Brian Lambert, PhD Student, Colorado School of Mines, Golden, CO, 80401, United States of America, wlambert@mymail.mines.edu, Michael Walls

During a competitive bidding process, exploration and development firms must decide how much to bid for blocks of uncertain petroleum reserves offshore. We compare a portfolio approach to selecting bids that minimize portfolio variance, subject to a minimum expected return, with that of a block-by-block approach to selecting bids that maximizes the expected return of each block. We find alternative bidding strategies with lower risk-return profiles than achieved by the single-block approach.

■ SD04

C - Ballroom D4, Level 4

Energy Infrastructure Planning Models

Cluster: Clean Energy
Invited Session

Chair: Thomas Edmunds, Lawrence Livermore National Laboratory, 7000 East Ave., Livermore, CA, United States of America, Edmunds2@llnl.gov

1 - Transmission Network Expansion Planning with Simulation Optimization
Russell Bent, Los Alamos National Laboratory, Los Alamos National Laboratory, Los Alamos, NM, 87545, United States of America, rbent@lanl.gov, Alan Berscheid, G. Loren Toole

The transmission expansion problem considers how to upgrade electric power. The problem is complex, non-linear, and non-convex. The power grid is evolving (e.g. adding renewable generation) and the adaptation of traditional approximations to the real, complex is no longer easy. This necessitates new optimization techniques. We describe a local search variation of Limited Discrepancy Search that encapsulates the complexity of power flows in a black box to address the complexity directly.

2 - Comparing the p-Median and Flow-refueling Models for Locating Alternative-fuel Stations
Michael Kuby, Professor, Arizona State University, School of Geographical Sciences, and Urban Planning, Tempe, AZ, 85287-5302, United States of America, mikekuby@asu.edu, Christopher Upchurch

Two popular models for optimizing station infrastructure are the node-based p-median model and the path-based flow-refueling model. We analyze how well stations located by each model perform on the other's objective. Stations located for flow-refueling do better at minimizing distance to demand nodes than stations located by the p-median model do at maximizing flows refueled, especially for long-distance trips. Locations for the flow-refueling model also tend to be more stable as p increases.

3 - Approximate Dynamic Programming for a Stochastic Multiscale Energy Policy Model
Warren Powell, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, powell@princeton.edu

We are interested in optimizing energy investments over a multidecade horizon under uncertainty, without the errors introduced by averaging energy from wind and solar over time. Using approximate dynamic programming, we model intermittent energy in hourly increments in the presence of hydroelectric storage, while making yearly investment decisions over 20 years. We show that the results are near-optimal on a deterministic dataset, and produce robust solutions under uncertainty.

■ SD05

C - Ballroom D5, Level 4

Sports and Entertainment

Contributed Session

Chair: Bumsoo Kim, Doctoral Student, George Washington University, 2201 G Street NW, Fungar Hall 415, Washington, DC, 20052, United States of America, bk4498@gwu.edu

1 - Expect Return on Bets for Parlay versus Multiple Spread and Moneyline Bets

Henry Amato, Professor of Managerial Sciences, University of Nevada Reno, 1664 N. Virginia St, Mail Stop 028, Reno, NV, 89557, United States of America, hna@unr.edu, Sheri Faircloth

This paper considers the rationality of betting parlays as oppose to wagering on multiple single games against the spread or moneyline. In general, we find that a bettor who can pick with at least a break-even probability on several games has a higher expected return on investment by placing parlay wagers than multiple single game wagers. This paper shows how to determine the number of teams to play in a parlay based on win probabilities which will give the highest return on investment.

2 - Fantasy Football: An Integer Optimization Model and Forecasting Technique

Andy Sun, Massachusetts Instititute of Technology, Operations Research Center, 50 Memorial Drive, Cambridge, MA, United States of America, sunx@mit.edu, Dimitris Bertsimas, Adrian Becker

Fantasy Football is a weekly online game in which participants earn fantasy points based on the real life performance of NFL players. Despite its vast popularity and intensive analysis by experts, no known method provides a comprehensive strategy for the entire season. With this motivation, we develop a prediction model for player fantasy performance, and mixed IP formulations for drafting and weekly lineup management. We present simulation results comparing our methods to expert ranking.

3 - Optimization for an Effective Team Formation in Professional Sports

Emrah Zarifoglu, Operations Research Scientist, Gravitant, Inc., 3491 Lake Austin Blvd. Apt C, Austin, TX, 78703, United States of America, zarifemrah@gmail.com, Ilyas Iyoob

College and professional sports leagues are increasingly using Operations Research for improvement on the field as well as off the field. Optimizing player selection is a good example of off the field optimization. Each franchise would like to maximize their team's success by selecting the right players while satisfying budget constraints and rules of the league. We propose rules of thumb for a franchise to achieve its goal optimally by effective player selection.

4 - Optimal Relegation in Sports

Martin Puterman, Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Martin.Puterman@sauder.ubc.ca, Qingchen Wang

Many sports including soccer,golf and international hockey use relegation rules to allocate teams or players to different divisions, tours or leagues based on relative abilities or accomplishments. We use simulation to compare the efficacy of different relegation rules with respect to a range of objectives. Our approach includes a latent model for ability or skill and a random mechanism based on skill to determine performance.

5 - Effectiveness of Product Placement in POP Contents: Analysis of Korean Commercial Programming

Bumsoo Kim, Doctoral Student, George Washington University, 2201 G Street NW, Fungar Hall 415, Washington, DC, 20052, United States of America, bk4498@gwu.edu, Joohwan Seo

This study investigates the 'Korean Pop Wave' phenomenon in recent years and study the effectivenss of product placement in Pop contents. We look at the abnormal increase in inbound tourists from East Asian countries to Korea and propose a Regime Switching State-Space model to analyze the intangible Pop Wave effects. Study shows that product placement is a powerful marketing strategy and highlights the importance of understanding the economic drivers and consequences of product placement.

■ SD06

C - Ballroom E, Level 4

Tutorial: Optimal Control of Queueing Networks

Cluster: Tutorials

Invited Session

Chair: Michael Veatch, Gordon College, Department of Mathematics, 255 Grapevine Road, Wenham, MA, 01923, United States of America, Mike.Veatch@gordon.edu

1 - Optimal Control of Queueing Networks

Michael Veatch, Gordon College, Department of Mathematics, 255 Grapevine Road, Wenham, MA, 01923, United States of America, Mike.Veatch@gordon.edu

This talk addresses Markov decision process formulations of queueing network control problems. Manufacturing and service system models are used to illustrate some formulation approaches that facilitate computation. Software developed by the author to solve small examples is described. The structure of optimal policies is addressed through connections with fluid models and by reviewing some monotone control results.

■ SD07

C - Ballroom F & G, Level 4

Joint Session JFIG/ WORMS: Panel Discussion: Balancing Work and Life

Sponsor: Junior Faculty Interest Group/ Women in OR/MS

Sponsored Session

Moderator: Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa, AL, United States of America, bkeskin@cba.ua.edu

Moderator: Sadan Kulturel-Konak, Associate Professor of Management Information Systems, Penn State Berks, Tulpehocken Rd. P.O. Box 7009, Reading, PA, 19610, United States of America, sadan@psu.edu

1 - Panel Discussion: Balancing Work and Life

Panelists: Sadan Kulturel-Konak, Associate Professor of Management Information Systems, Penn State Berks, Tulpehocken Rd. P.O. Box 7009, Reading, PA, 19610, United States of America, sadan@psu.edu, Ariela Sofer, George Mason University, Fairfax VA, United States of America, asofer@gmu.edu, Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts Amherst, Isenberg School of Management, Amherst MA 01003, United States of America, nagurney@gbfin.umass.edu, Martin Wortman, Professor, Texas A&M University, College Station TX, United States of America, wortman@tamu.edu, Lawrance Seiford, Professor, University of Michigan, Ann Arbor MI, United States of America, seiford@umich.edu, Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa AL, United States of America, bkeskin@cba.ua.edu, Cynthia Barnhart, Associate Dean for Academic Affairs, School of Engineering, Massachusetts Institute of Technology, Room 1-206, 77 Massachusetts Avenue, Cambridge MA 02139, United States of America, cbarnhar@mit.edu

All of us must allocate 24 hours a day to the activities of life. How well we balance work responsibilities with personal activities we truly enjoy directly affects our quality of life. It also helps manage stress. Are you satisfied with your balance of time between work and life? If you answered "no," you are not alone. Achieving balance with work and life is an ongoing process of juggling responsibilities at work and the personal needs. In this interactive panel discussion, the successful panelists will share their experiences and secrets in managing this balance. After the panel discussion, the floor will be open to questions.

■ SD08

C - Room 11A, Level 4

Facility Network Design Models

Sponsor: Location Analysis
Sponsored Session

Chair: Robert Aboolian, California State University San Marcos, 333 S. Twin Oaks Valley Road, San Marcos, CA, United States of America, raboolia@csusm.edu

1 - Hydrogen Production Facility Network Design From Stochastic Green Energy Supply Source

Jorge E. 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

We analyze the profit maximization problem for an integrated firm generating electricity from wind and producing hydrogen through electrolysis, operating on a single node of a transmission network under nodal pricing. We present the firm's optimal actions for any given market scenario, and formulate the firm's capacity optimization problem. We then address the hydrogen production location/capacity problem.

2 - The Gravity Multiple Server Location Problem

Zvi Drezner, Professor, California State University - Fullerton, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu, Tammy Drezner

We propose models for locating facilities serve a set of demand points. The number of facilities is unknown. There is a given number of servers to be distributed among the facilities. Each facility acts as an M/M/k queuing system. In one model we assume that customers do not consider the waiting time at the facility in their facility selection. In a second model we assume that customers know the expected waiting time at the facility and consider it in their facility selection.

3 - Efficient Algorithms for Reliable Supply Network Design

Tingting Cui, University of California-Berkeley, Berkeley, CA, United States of America, tingting@ieor.berkeley.edu, Z. Max Shen, Robert Aboolian

Under the risk of random facility failure, the reliable supply network design problems study proactive strategies for the system structure, as well as the consequent customer assignment/reassignment issues. We present efficient algorithms that are based on linear reformulation of the original nonlinear MIP for lower bounds, neighborhood search procedures to improve the upper bounds, and cutting plane processes to confine the search space.

4 - A Multi-stage Stochastic Supply Chain Network Design Problem with Financial Decisions and Risk

Stefan Nickel, Karlsruhe Institute of Technology (KIT), Institute for Operations Research, Karlsruhe, Germany, stefan.nickel@kit.edu, Francisco Saldanha-da-Gama, Hans-Peter Ziegler

We consider a multi-period supply network design problem. The decisions to be made involve the location of facilities, the flow of commodities and the amount of money spent in alternative investments. Costumer demands and interest rates are assumed to be uncertain and are described by discrete scenarios. The problem is formulated as a multi-stage stochastic mixed-integer linear-programming problem. All variables in all periods interact because of the considered service level and downside risk.

5 - Preventive Healthcare Facility Network Design with Congestion

Robert Aboolian, California State University San Marcos, 333 S. Twin Oaks Valley Road, San Marcos, CA, United States of America, raboolia@csusm.edu, Vedat Verter, Oded Berman

The efficiency of a preventive care program depends on participation of its clients. We address the design of a network of preventive care facilities facing uncertain participation. The problem is to find the number, locations and capacities of the facilities to maximize the overall participation. Accessibility, a main factor in client participation, is measured by the sum of travel time to facility and the waiting and service time at that facility. We present an exact approach for this problem.

■ SD09

C - Room 11B, Level 4

Healthcare Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Mor Armony, Stern School of Business, New York University, New York, NY, United States of America, marmony@stern.nyu.edu

1 - The Impact of Cross-border Patient Movement on the Delivery of Healthcare Services

Dimitrios Andritsos, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, dandrits@anderson.ucla.edu, Christopher Tang

Motivated from recent legislative discussions in the European Union, which are intended to provide European patients with "free choice" to decide on the country they receive treatment, we analyze a Stackelberg game that captures the interactions among patients, providers, and healthcare funders. We examine the impact of such "free choice" on the performance of healthcare systems of different countries in equilibrium and use publicly available data to compare with the findings of our model.

2 - Burn Unit Triage in a Catastrophic Scenario

Carri Chan, Columbia University, 3022 Broadway, Uris Hall, Room 410, New York, NY, 10027, United States of America, cwchan@columbia.edu, Linda Green

The U.S. has mandated that regions develop plans for burn victims of mass casualty events. Hospitals without specialized burn units will initially care for patients until they can be transferred to available burn beds. We describe a series of transfer policies developed for NYC using varying assumptions about availability of patients' medical histories. We show how knowledge of co-morbidities impacts optimal triage decisions and the expected number of survivors.

3 - Improving Access to Diagnosis in Developing Countries: Access vs. Accuracy and Network Externality

Sarang Deo, Assistant Professor, Northwestern University - Kellogg School of Management, Evanston, IL, United States of America, s-deo@kellogg.northwestern.edu, Milind Sohoni

Several novel, point-of-care diagnostic devices are being rolled out in developing countries that can eliminate long diagnostic delays. Allocation of limited supply of these devices is based on thumb rules such as clinic size and disease burden. We develop an optimization model to study the impact of network externality on the allocation decision - allocation to one clinic changes the delays at clinics that don't receive the allocation - and apply it to infant HIV diagnosis network in Uganda.

4 - "Nursevendor Problem": Personnel Staffing in the Presence of Endogenous Absenteeism

Sergei Savin, The Wharton School, University of Pennsylvania, Philadelphia, PA, United States of America, savin@wharton.upenn.edu, Linda Green, Nicos Savva

The problem of determining nurse staffing levels in a hospital environment is a complex task due to variable patient census levels and service capacity caused by nurse absenteeism. In this paper, we combine an empirical investigation of the factors affecting nurse absenteeism rates with an analytical treatment of nurse staffing decisions using a novel variant of the newsvendor model.

■ SD10

C - Room 12A, Level 4

Large-scale Queueing Systems with Applications to Call Centers

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Itai Gurvich, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu

1 - Wait-time Predictors for Service Systems with Time-varying Demand and Capacity

Rouba Ibrahim, University of Montreal, Montreal, Canada, rei2101@columbia.edu, Ward Whitt

We develop new improved real-time delay predictors for many-server service systems with a time-varying arrival rate, a time-varying number of servers and customer abandonment. These delay predictors may be used to make delay announcements. We use computer simulation to show that the proposed predictors outperform previous predictors.

2 - Hazard Rate Scaling of the Abandonment Distribution for the GI/M/n + GI Queue in Heavy Traffic
Tolga Tezcan, Assistant Professor, University of Rochester, 305 Schlegel Hall, Rochester, NY, 14627, United States of America, Tolga.Tezcan@simon.rochester.edu, Josh Reed

We obtain a heavy traffic limit for the GI/M/n+GI queue which includes the entire patience time distribution. Our main approach is to scale the hazard rate function of the patience time distribution in such a way such that our resulting diffusion approximation contains the entire hazard rate function. We then show through numerical studies that for various key performance measures, our approximations outperform those commonly used in practice.

3 - An Overflow System with Many Servers: Approximations and Implications to Call Center Outsourcing
Ohad Perry, CWI, Science Park 123, Amsterdam, 1098 XG, Netherlands, ohad.perry@cwi.nl, 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, in turn, simplified expressions for the customer waiting-time distribution. The asymptotic independence is shown to be useful in solving some call-center optimization problems.

4 - On the Accuracy of Fluid Models for Capacity Sizing in Queueing Systems with Impatient Customers
Achal Bassamboo, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, a-bassamboo@kellogg.northwestern.edu, Ramandeep Randhawa

We study the optimal capacity sizing problem for M/M/N+G systems. 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.

■ SD11

C - Room 12B, Level 4

Managing Supply Chain Disruption Risk

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Gregory DeCroix, Associate Professor, University of Wisconsin-Madison, 975 University Avenue, Madison, WI, 53706, United States of America, gdecroix@bus.wisc.edu

1 - Sourcing for Supplier Effort and Competition
Cuihong Li, University of Connecticut, School of Business, Storrs, CT, United States of America, cuihong.li@business.uconn.edu

We study a buyer's sourcing strategy in terms of the supply base design and contracting mechanism, considering suppliers' cost-reduction effort and supplier competition. In the supply base design, the buyer determines the number of suppliers (one or two) in the supply base, and the capacity to be invested in each supplier. In the contracting mechanism design, the buyer chooses the time of price and capacity decisions, either before or after suppliers' effort investment.

2 - Production Planning Under Power Uncertainty
Cagri Latifoglu, Doctoral Candidate, Lehigh University, ISE Department, 200 West Packer Ave., Mohler Lab, Bethlehem, PA, 18015, United States of America, cal206@lehigh.edu, Lawrence V. Snyder, Pietro Belotti

We consider production planning under electricity supply uncertainty where the uncertainty is caused by participation in an Interruptible Load Contract (ILC) offered by the electricity retailer. An ILC is a mechanism that allows the electricity retailer to mitigate some of the risk that arises from fluctuations in the demand and supply of electricity. We have developed a robust optimization model for production planning that renders the industrial company less vulnerable to power interruptions.

3 - Using a Dual-sourcing Option in the Presence of Asymmetric Information About Supplier Reliability
Zhibin Yang, University of Oregon, zyang@lcbmail.uoregon.edu, Goker Aydin, Volodymyr Babich, Damian Beil

We study a manufacturer's use of dual-sourcing option to manage supply disruption risk under asymmetric information about supplier reliability. The manufacturer faces a tradeoff between benefit of supplier competition and benefit of diversification. Asymmetric information pushes the manufacturer away from diversification, because it increases the benefit of supplier competition. However, the dual-sourcing option may be more valuable for the manufacturer under asymmetric information.

4 - Managing Supply Disruptions in Assemble-to-order Systems
Gregory DeCroix, Associate Professor, University of Wisconsin-Madison, 975 University Avenue, Madison, WI, 53706, United States of America, gdecroix@bus.wisc.edu, Zigeng Liu

We study the management of inventories in an ATO system with multiple components and finished products. Since the optimal policy for ATO systems (even without disruptions) is unknown, we explore several alternate policies of varying complexity. We develop methods for computing or approximating key performance metrics, and compare performance across policies. We also explore the implications of supply disruptions on decisions such as supplier selection and the use of component commonality.

■ SD12

C - Room 13A, Level 4

Network Design Applications in Supply Chains

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Halit Uster, Associate Professor, Industrial and Systems Eng, Texas A&M University, College Station, TX, 77843, United States of America, uster@tamu.edu

1 - Green Supply Chains for Remote Locations
Yue Geng, Northwestern University, 2145 Sheridan Road, Room C223, Evanston, IL, United States of America, yue-geng@northwestern.edu, Diego Klabjan

Logistics to remote locations post challenges including highly seasonal variability, limited options resulting in high transportation costs, and low carbon footprint requirements. Using optimization and analytics, we show how to design a cost and environmentally effective logistics network and estimate future feasibility.

2 - Strategic Design of a Hydrogen Supply Chain
Rosemary Berger, Research Affiliate, Massachusetts Institute of Technology Center for Transportation and Logistics, 77 Massachusetts Avenue, E40-276, Cambridge, MA, 02139, United States of America, rosemary.berger@verizon.net, Jarrod Goentzel, Mozart Menezes

Realizing the vision of the hydrogen economy requires the capability to produce large quantities of hydrogen at competitive cost with minimal carbon emissions. This work describes a decision support model that optimizes a hydrogen supply chain, determining where to produce and how to distribute, with a focus on renewable energy sources and multiple distribution options. Insights into centralized versus decentralized production strategies are discussed, and a case study of Spain is presented.

3 - Integrated Multi-product Network Design Models with Lead Time and Safety Stock Considerations
Reha Uzsoy, Clifton A. Anderson Distinguished Professor, North Carolina State University, 400 Daniels Hall College of Engineering, North Carolina State University, Raleigh, NC, 27695, United States of America, ruzsoy@ncsu.edu, Karthik Sourirajan, Leyla Ozsen

We wish to locate distribution centers to support a number of retailers. The replenishment lead time at a distribution center (DC), serving a set of demand points, is a function of the total flow of all products through the DC. The safety stock levels at each DC are determined for individual products and consider risk pooling across the demand points served by that DC. We propose heuristics to obtain approximate solutions and evaluate their performance.

4 - Design and Analysis of Relay Networks in TL and LTL Transportation
Halit Uster, Associate Professor, Industrial and Systems Eng, Texas A&M University, College Station, TX, 77843, United States of America, uster@tamu.edu, Panitan Kewcharoenwong

We consider the optimum design of a relay network with applications in Less-than-Truckload (LTL) and and Truckload (TL) transportation. The locations of relays and routing of commodities are determined in such a way that driver tour length, circuity, and load imbalance are controlled while the total design cost is minimized. We present an accelerated Bender decomposition approach for model solution and extensive numerical results on the impact of using relay networks.

■ SD13

C - Room 13B, Level 4

Market Influence on Supply Chain Performance

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Annabelle Feng, Assistant Professor, The University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, Annabelle.Feng@mccombs.utexas.edu

1 - Optimal Pricing and Bundling of Vertically Differentiated Information Goods

Xiajun Pan, Assistant Professor, University of Missouri at Kansas City, 5110 Cherry St., Kansas City, MO, 64110, United States of America, panxia@umkc.edu, Dorothee Honhon

We study how to choose the optimal bundling strategy for a retailer offering vertically differentiated information goods. We characterize 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 containing all the components and how to price the offered individual components and the bundle in order to maximize the retailer's profit.

2 - Using Free Gift Cards to Avoid Salvaging in the Newsvendor Problem

Jing Zhou, Assistant Professor, University of North Carolina Charlotte, 9201 University City Blvd., Charlotte, NC, 28223, United States of America, jzhou7@uncc.edu, SungJune Park, Moutaz Khouja

Cachon and Swinney (2009) study the effect of strategic consumers on retailers' inventory and pricing policy and on their profits in a newsvendor setting. We extend their model by allowing the retailers to salvage leftover products by giving free gift cards to consumers who purchase the product at the regular price. We derive the optimal ordering and gift card policy and the conditions under which offering gift cards is more beneficial than not offering gift cards for the retailers.

3 - Innovation and Complementarity: Economic Incentives and Market Outcomes

Zhixi Wan, HEC Paris, 1, rue de la Liberation, Jouy en Josas, 78351, France, WAN@hec.fr, Daniel Levinthal, Brian Wu

We develop a model to explain the failure of incumbent firms faced radical technical change. We focus on the effect of the incumbent's complementary asset (e.g., good production management) on its choice between an old technology trajectory that can better leverage the complementary asset and a new trajectory that more likely fits market taste. We find that in equilibrium the incumbent may forego the new technology and invest more than the entrant but win competition less likely.

4 - Contracting and Coordination Under Asymmetric Production Cost Information

Annabelle Feng, Assistant Professor, The University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712, United States of America, Annabelle.Feng@mccombs.utexas.edu, Xianghua Gan, Metin Cakanyildirim, Suresh Sethi

We analyze a supply chain consisting of a supplier and a retailer. The supplier's unit production cost, which characterizes his type, is only privately known to him. The retailer offers a menu of contracts, each of which consists of two parameters: the ordering quantity and the supplier's share of the channel profit. We show that the optimal contract depends critically on a surrogate measure — the size of the outside market that the supplier may serve if not trading with the retailer.

■ SD14

C - Room 14, Level 4

Supply Chain Management I

Contributed Session

Chair: Zhenying Zhao, Supply Chain Architect, Intel, 2126 E. Aloe Pl, Chandler, AZ, United States of America, zhenying.zhao@intel.com

1 - Design of Traceability Systems for Product Recall

Hongyan Dai, Hong Kong University of Science and Technology, IELM Department, Hong Kong, Hong Kong - PRC, daihy@ust.hk, Mitchell M. Tseng, Paul Zipkin

A product recall is enormously expensive, both financially and reputationally. Inability to trace back defect sources results in excessive recalls and unclear liabilities. We propose a rigorous model to link design parameters of traceability systems to supply chain performance and investigate the impacts of pricing strategies on liability allocation and incentives to improve traceability. Our larger goal is to provide a systematic method to better manage product recalls with new technologies.

2 - Should Design Action be Outsourced with Production Action? The Effect of Commitment

Pei-Cheng Liao, Associate Professor, National Taiwan University, Department of Accounting, No. 1, Sec. 4, Roosevelt Rd., Taipei, 10617, Taiwan - ROC, pcliao@ntu.edu.tw, Suresh Radhakrishnan

We examine outsourcing decision and show that the client's inability to pre-commit 'not to intervene and help the vendor out,' could result in more tasks being outsourced. We provide a rationale for the puzzle that even though the vendor's responsibilities increase, the client's unit price for the vendor does not increase correspondingly. We highlight the importance of taking the agency problem arising from such commitment problems into account to provide the 'right' incentives to the vendors.

3 - Global Sourching with Foreign Tax Credit Planning

Joice Hu, Purdue University, 403. State Street, W. Lafayette, IN, United States of America, hu23@purdue.edu, Vernon Hsu

Most countries employ he worldwide tax system in which a multinational firm's global incomes are subject to its home country's tax. Under this system, foreign tax credits generated from a subsidiary located in a high-tax regime can be use to offset the tax liability generated from another subsidiary located in a low-tax regime. Our paper characterizes the interdependence between the global firm's two subsidiaries at both international tax and supply chain operations level.

4 - Achieving Low Cost Supply Chain (LCSC) with Optimization-based Planning

Zhenying Zhao, Supply Chain Architect, Intel, 2126 E. Aloe Pl, Chandler, AZ, United States of America, zhenying.zhao@intel.com, Shamin Shirodkar

In this paper, we introduce an integrated optimization-based solver for Intel supply chain planning. We discuss the solver architecture including a unique Production Planning Model (PPM), data-driven constraint generation, Object Relational Mapping (ORM), and pattern-based design, as well as various performance enhancement techniques to handle large-scale MIP modelThe solver has reduced the planning cycle time from weeks to one day and brings down inventory dramatically.

■ SD15

C - Room 15, Level 4

Behavioral OM and Neighboring Fields: Decision Theory, Leadership and Economics

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Christoph Loch, INSEAD, Constance de Blvd, Fontainebleau, France, Christoph.LOCH@insead.edu

1 - Economic and Environmental Assessment of Remanufacturing Strategies for Cell Phone Service Providers

Anton Ovchinnikov, University of Virginia, Darden School of Business, 100 Darden Blvd., Charlottesville, 22903, United States of America, Ovchinnikova@darden.virginia.edu, Vered Doctori-Blass, Gal Raz

We look at remanufacturing from the perspective of a wireless service provider and through a combination of an analytical model and a behavioral study, analyze the economic and environmental impacts of introducing a remanufactured version of a high-end product into a product line that otherwise consists of new high- and low-end products. We find that although remanufacturing is in most cases profitable, it is not necessarily environmentally beneficial.

2 - Demand Censoring and Newsvendor Decisions: Research Results and Pedagogical Case

David Drake, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, david.drake@insead.edu, Nils Rudi

In an experimental newsvendor setting, we manipulate demand feedback (i.e., censored and uncensored demand feedback conditions) to study three phenomena: level and adjustment behavior - average quantity and the variability of order quantities; and observation bias - the impact of the degree of demand feedback on order quantities. We summarize results, and report on a case developed from this work that has been used to teach 3,000 MBAs and executives the newsvendor model and related challenges.

3 - Mental Balancing of Tradeoffs

Sanjiv Erat, University of California San Diego, San Diego, CA, United States of America, serat@ucsd.edu

The current article proposes that people, when faced with a tradeoff, employ mental balancing heuristic wherein they attempt to equate and thus minimize the "imbalance" between tradeoff costs/benefits. Four experiments offer evidence consistent with the proposed heuristic. The implications of the heuristic to operational decision-making is discussed.

4 - The Core Functions of Leadership
Christoph Loch, INSEAD, Constance de Blvd, Fontainebleau, France, Christoph.LOCH@insead.edu, G. Mohammad Ahmad

The core functions of leadership are to help the group coordinate actions and resolve conflicts. In experiments we examine followers' demand for leadership and their benefits from it. Demand for leadership as well as the group's benefit increase the more difficult the coordination and conflict resolution problems become.

■ SD16

C - Room 16A, Level 4

Capital Projects Supply Chain Research

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Scott J. Mason, Fluor Endowed Chair and Professor, Clemson University, 124 Freeman Hall, Clemson, SC, 29634, United States of America, mason@clemson.edu

1 - Capital Projects Supply Chain: An Introduction
Scott J. Mason, Fluor Endowed Chair and Professor, Clemson University, 124 Freeman Hall, Clemson, SC, 29634, United States of America, mason@clemson.edu, Bill Ferrell

Capital projects are large construction endeavors involving the design, engineering, procurement, and construction of entities like power plants, refineries, and semiconductor wafer fabs. These projects have unique features that make efficient execution very difficult. We provide an overview of research in IE/OR/supply chain that we believe can produce value add in this domain by reducing costs associated with inventory levels, damage, and waste as well as shortening overall project duration.

2 - Capital Project Supply Chains: Execution and Innovation
Daryl Johnson, Marketing Director, Fluor Supply Chain Solutions, Fluor Corporation, 1 Fluor Daniel Drive, Sugar Land, TX, 77478, United States of America, daryl.johnson@fluor.com, Jim Scotti, Larry Jackson

Fluor Corporation is a Fortune 500 company providing comprehensive capabilities and world-class expertise in engineering, procurement, construction, commissioning, operations, maintenance and project management for many of the world's most challenging, complex projects. The presentation will include unique elements, success stories, and lessons learned related to global execution of capital projects.

3 - Improving Capital Project Values using Risk Mitigating Lead Time Options
Erik Hertzler, Intel, Chandler, AZ, 85226, United States of America, Erik.F.Hertzler@Intel.com, Felix Cheng, Karl Kempf, John Fowler

Confronted with uncertainty in demand, long durations in supply and large costs, it is crucial to mitigate financial risk. Decreasing lead times enables use of forecasts that are inherently more accurate. Lead Time Option contracts are useful when mutually agreeable option costs are negotiated. We are solving this problem using historical demand forecast error and servicing costs based upon lead time to create an efficient frontier for option cost vs. lead time reduction.

4 - Equipment Procurement Strategy with Reservation and Forecast Revision: A Heuristic Approach
Chen Peng, Stanford University, 14 Comstock Circle, Apt 106, Stanford, CA, 94305, United States of America, chenpeng@stanford.edu, Feryal Erhun, Karl Kempf, Erik Hertzler

In a business environment with volatile market demand, high penalties for unmet demand, long capacity delivery leadtimes, and rigid capital procurement contracts, firms in capital-intensive semiconductor industry often over-purchase capital equipment; an inefficiency that amounts to losses of hundreds of millions of dollars per annum. We propose a dual-mode equipment procurement model to reduce this inefficiency.

■ SD17

C - Room 16B, Level 4

Non-financial Applications of Options: The Business of Making Risky Decisions

Cluster: Practice of OR/MS
Invited Session

Chair: Scott Mathews, Technical Fellow, The Boeing Company, P.O. Box 3707 MC 42-54, Seattle, WA, 98124-2207, United States of America, Scott.H.Mathews@boeing.com

1 - Performance Options: Risk-averse and -Seeking Decision-making Capability for Strategic Performance
Scott Mathews, Technical Fellow, The Boeing Company, P.O. Box 3707 MC 42-54, Seattle, WA, 98124-2207, United States of America, Scott.H.Mathews@boeing.com

The Performance Option Algorithm provides risk-averse and risk-seeking decision-making capability for strategic, non-financial options dealing with performance. Performance is a measure of capability, such as speed, range and time. An option is an opportunity to make an initial resource commitment that may or may not have a long-term beneficial payoff, such as an investment in new technology to improve the performance, or capability, characteristics of a new product or service.

2 - Performance Options: An Options-based Decision Framework for Valuing Non-financial Returns
Jacomo Corbo, University of Pennsylvania-The Wharton School, 3730 Walnut Street, 555 Jon M. Huntsman, Philadelphia, PA, 19104, United States of America, jacomo@wharton.upenn.edu, Scott Mathews

The application of real options is typically restricted to strategic management problems about investment and investment modes—in short, to financial domains. Here, we present results on a real options calculation in a non-financial setting, namely Formula One (F1) pit stop strategy. We show how to calibrate the calculation against empirical data, discuss fidelity, and compare results against machine learning approaches.

3 - Equivalence of the Utility Indifference Price and Linear Price of an Option in an Incomplete Market
Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61801, United States of America, aliabbas@uiuc.edu

In an incomplete market, the market maker may value an investment project, as well as an option on this investment, by the utility indifference price. Under what conditions does the indifference price of the option in this case equal the linear price? We derive the utility functions, and lattice structures of the investment, that enable this result. The new lattice generalizes the traditional uS/dS upward and downward movements and allows for negative asset values.

■ SD18

C - Room 17A, Level 4

Optimization in Health Care

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Robert R. Meyer, Professor Emeritus, University of Wisconsin, Madison, WI, 53706, United States of America, rrm@cs.wisc.edu

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Radiation Treatment Planning: Beam Angle Selection
Robert R. Meyer, Professor Emeritus, University of Wisconsin, Madison, WI, 53706, United States of America, rrm@cs.wisc.edu, Leyuan Shi, Hao Howard Zhang, Weiwei Chen, Warren D'Souza

An important element of radiation treatment planning (RTP) for cancer therapy is the selection of 5-9 angles (out of 360 possible angles in relation to the patient) for the radiation beam. Using single-beam data extracted from plans employing equally-spaced beams, we have developed a Nested Partitions approach for this combinatorial optimization problem.

2 - Cluster-based Linear Program for Solving Large-scale Radiation Treatment Planning Problem

Hao Howard Zhang, University of Maryland, 6812 Mapleleaf Ct, Apt 101, Baltimore, MD, 21209, United States of America, hzhan001@umaryland.edu, Warren D'Souza, Leyuan Shi, Robert R. Meyer

We present a computer-cluster-based linear programming (LP) method for intensity-modulated radiation therapy (IMRT) dose optimization. High-resolution data obtained from accurate Monte-Carlo dose calculation can be utilized as input. Large LPs, which have to be decomposed to be solvable on a single PC, can be solved efficiently via our approach. Results are presented for challenging clinical test cases and contrasted with conventional IMRT and intensity-modulated arc therapy (IMAT) plans.

3 - Time-varying Intensity Modulated Radiation Therapy Optimization with Changing Tumor Geometry

Behlul Saka, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, bsaka@uark.edu, Ronald Rardin, Mark Langer

Although radiation therapy is typically planned as a single overall treatment, it is delivered over several weeks in 30-40 sessions or "fractions," and both cumulative and per-fraction dose constraints apply. The extended time also invites improvement by periodic re-optimization using updated imaging of tumor geometry. We present an efficient rolling-horizon approach to computing plans meeting all these requirements,and demonstrate its effectiveness on realistic cases simulating practice.

■ SD19

C - Room 17B, Level 4

Topics in Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Sunil Kumar, Stanford University, Graduate School of Business, Stanford, CA, 94305-5015, United States of America, skumar@stanford.edu

1 - Markdown Management: Pricing as a Signaling Device

Ramandeep Randhawa, University of Southern California, 3670 Trousdale Pkwy, Los Angeles, CA, United States of America, ramandeep.randhawa@marshall.usc.edu, Gad Allon, 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 - A Simple New Scheme for High-dimensional Dynamic Allocation

Vivek Farias, Massachusetts Institute of Technology, Sloan School, 50 Memorial Drive, Cambridge, MA, United States of America, vivekf@mit.edu, Florin Ciocan, Yiwei Chen

We present 'hedged re-optimization' — a simple generic approach to a swathe of high dimensional dynamic allocation problems. We demonstrate it's practiality and establish surprising uniform performance guarantees.

3 - Reoptimization Heuristics with Bounded Revenue Loss

Stefanus Jasin, Stanford University, 1030 El Monte Ave #215, Mountain View, CA, 94040, United States of America, stf48198@stanford.edu, Sunil Kumar

Many heuristics in Revenue Management involves repeated resolves of a deterministic Linear Program. We study the effectiveness of reoptimization approaches in a model where demand arrives according to Poisson processes. We provide a class of heuristics whose expected loss does not scale with the size of the problem, validating its use in networks with moderate capacities and demands. We also discuss extension incorporating customer choice and unknown parameters.

4 - Revenue Management for a Web Publisher using Advertising Networks

Sami Najafi-Asadolahi, London Business School, London, United Kingdom, snajafi.PhD2005@london.edu, Kristin Fridgeirsdottir

We consider a web publisher facing uncertain demand from advertisers requesting space through an ad network, and an uncertain supply of impressions from viewers. Formulating the problem as a novel queuing system, we show that the optimal CPM price can increase in the number of ads rotated in a slot. We also show that in a competitive setting, more web traffic may not mean more revenue.

■ SD20

C - Room 18A, Level 4

Applications of Pricing Optimization

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Robert Phillips, Professor, Columbia University, Uris 408, 3022 Broadway, New York, NY, 10027, United States of America, rp2051@columbia.edu

1 - Optimal Pricing with Adverse Selection

Robert Phillips, Professor, Columbia University, Uris 408, 3022 Broadway, New York, NY, 10027, United States of America, rp2051@columbia.edu, Robin Raffard

We model adverse selection in consumer lending as differential price sensitivity between "goods" and "bads" in a population. We characterize optimal pricing policies with adverse selection, compare the results to commonly used "risk-based pricing" approaches, and estimate the magnitude of the effects on both risk and profitability using real world data.

2 - An Efficient Formulation for the Choice Based Linear Program

Guillermo Gallego, Columbia University, New York, NY, United States of America, gmg2@columbia.edu

We present a formulation of the deterministic choice based linear program that reduces the number of variables from an exponential number to just one per origin-destination fare. The formulation works for general attraction models where the attractiveness of the no-purchase alternative depends on the products in the consideration set that are not offered. The model allows for multiple market segments and encompasses both the independent and the multinomial demand models.

3 - Self Storage Revenue Management

Garrett Van Ryzin, Columbia University, New York, NY, United States of America, gjv1@columbia.edu

We provide an overview of an industry project applying pricing optimization to a self storage business. We discuss the unique challenges in demand estimation and optimization encountered in the industry and provide an overview of the system that was developed.

4 - Revenue Management of Consumer Options for Sporting Events

Fikret Gocmen, PhD Candidate, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, fcg2110@columbia.edu, Robert Phillips, Guillermo Gallego, Santiago Balseiro

In elimination tournaments there is uncertainty about which teams will advance to the final game. Thus, we consider consumer options that are contingent on a team reaching the event, i.e. the bearer is guaranteed a ticket in the final game only if her team advances to that stage. We formulate the problem of pricing such options using a discrete choice revenue management model, and show that options increase both the organizer's profit and the total consumers' surplus.

■ SD21

C - Room 18B, Level 4

Modeling Healthcare Systems

Sponsor: Service Science
Sponsored Session

Chair: Greg Werker, University of British Columbia, 3869 W 18th Avenue, Vancouver, Canada, gwerker@gmail.com

1 - System of Systems and Service Systems as Complimentary Approaches for Healthcare Problems

Po-Ching DeLaurentis, Regenstrief Institute, Inc., 410 W. 10th St., Indianapolis, IN, 46202, United States of America, pcdelaur@iupui.edu, Dan DeLaurentis, Matt Burton, Brad Doebbeling

This talk considers key features of a system of systems and service systems in the context of healthcare service. We propose an integration of system of systems and service systems approaches yielding benefits in terms of both correct and complete representation of healthcare services and applicability of associated modeling tools for solving problems. We will show an initial mapping and an example of this integration in the context of an information intensive healthcare delivery system.

2 - A Multi-agent Supply and Demand Model of Health Providers and Patients

Greg Werker, University of British Columbia, 3869 W 18th Avenue, Vancouver, Canada, gwerker@gmail.com

Motivated by Vancouver's Downtown Eastside - a small geographic area with many health agencies providing mental health and addictions services - we propose a multi-agent model containing both competitive and cooperative elements. We use the model to find mechanisms that encourage system optimality and policies that enhance cooperative action.

■ SD22

C - Room 18C, Level 4

Organizing Service Development & Service Curriculum

Sponsor: Service Science
Sponsored Session

Chair: William Millhiser, Assistant Professor, Zicklin School of Business, Baruch College, The City University of New York, 55 Lexington Ave, Box B9-240, New York, NY, 10010, United States of America, william.millhiser@baruch.cuny.edu

1 - An Interactive Game to Learn Sustainability Engineering

Rodolfo Fernandez, The University of Texas at El Paso, 500 W. University Av., El Paso, TX, United States of America, refernandez@miners.utep.edu, Ricardo Meraz, Olivia Moreno, Heidi Taboada

In the present talk, a novel sustainability engineering game will be presented. The game was developed by undergraduate students as part of their final project in a newly developed Sustainability Engineering course. The main objective of the game is to provide an interactive way of teaching different sustainability concepts such as life cycle analysis, ethical consumerism and design for the environment.

2 - Implementing Sustainability Engineering Principles Into the Undergraduate Engineering Curricula

Abril Vazquez, Research Assistant, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, apvasquez@miners.utep.edu, Jose Espiritu

In the present talk, an overview of the curricula developed to teach a new Sustainability Engineering class will be presented. The course was team-taught by faculty from the Industrial, Manufacturing and Systems Engineering Department and the Mechanical Engineering Department. It was offered during the Spring 2010 semester as a technical elective course open to undergraduate students enrolled in the College of Engineering at The University of Texas at El Paso.

3 - Curriculum Development: Switching From Production to Service Operations Management

William Millhiser, Assistant Professor, Zicklin School of Business, Baruch College, The City University of New York, 55 Lexington Ave, Box B9-240, New York, NY, 10010, United States of America, william.millhiser@baruch.cuny.edu

We recently converted a core class from "Production & Operations Management" to "Service Operations Management." Why is this important at the largest AACSB-accredited business school? What aspects of services were included in the new syllabus? What was the outcome of the textbook selection process? How did we find consensus among instructors who deliver 28 sections to 2000 BBA students annually? In answering these questions, this will be an interactive session drawing upon audience experiences.

4 - How to Organize New Service Development?

Thomas Meiren, Head of New Service Development, Fraunhofer IAO, Nobelstr. 12, Stuttgart, 70569, Germany, Thomas.Meiren@iao.fraunhofer.de, Adrienne Schäfer, Lars Witel, Bo Edvardsson

New services are playing an increasingly important role in companies and often they are crucial for their future survival. In parallel, this raises the question about appropriate structures and processes for the successful development of new services. The presentation discusses current strategies and different organizational options for New Service Development and includes selected case studies as well as the results of an empirical study among 791 European companies.

■ SD23

C - Room 18D, Level 4

Panel Discussion: Introduction to Service Science Research Institutes

Sponsor: Service Science
Sponsored Session

Moderator: Grace Lin, WRO & Columbia University, 9 Garey Drive, Chappaqua, NY, 10514, United States of America, gracelin.ny@gmail.com

1 - Panel Discussion: Introduction to Service Science Research Institutes

Panelists: Christoph Heitz, Professor, Zurich University of Applied Sciences, Rosenstrasse 3, Winterhur, 8401, Switzerland, heit@zhaw.ch, Roland T. Rust, Distinguished University Professor and David Bruce Smith Chair in Marketing, Robert H. Smith School of Business, 3451 Van Munching Hall, University of Maryland, College Park MD 20742-1815, United States of America, rrust@rhsmith.umd.edu, Krishna Singh, SRII President & IBM Service Science Research Programs, IBM ALmaden Research Center, San Jose CA 95120, United States of America, KrisSingh@us.ibm.com

Representatives from selected Service Science related Institutes will discuss their visions, missions, and their views (or definitions) of Service Science. They will discuss their R & D activities, projects, and success stories.

■ SD24

C - Room 19A, Level 4

Joint Session SPPSN/ MIF: Statistical Issues in Public Policy

Sponsor: Public Programs, Service and Needs/ Minority Issues
Sponsored Session

Chair: Kobi Abayomi, Assistant Professor, Georgia Institute of Technology, 765 Ferst Dr., 444 Groseclose, Atlanta, GA, 30332, United States of America, kabayomi3@isye.gatech.edu

1 - Statistical Evaluation of Land Use Change via Ethanol

Dexin Luo, Geogia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, dexin.luo@gatech.edu, Kobi Abayomi

Dependence in compositional data - sum constrained or 'simplexed' data models - cannot be asserted via linear correlation. We introduce methodology for distance from independence in compositional data using replicates and the empirical copula. We illustrate competition among the constituents of US corn yield vis a vis Ethanol production.

2 - Statistical Evaluation of Wealth Inequality

Kobi Abayomi, Assistant Professor, Georgia Institute of Technology, 765 Ferst Dr., 444 Groseclose, Atlanta, GA, 30332, United States of America, kabayomi3@isye.gatech.edu

We amend Theil's Index - a popular measure for distributional apportioning - to correct the mis-specification of between and across group inequality. We introduce tests of equi-inequality, under the correction. We illustrate the methodology on Health and Retirement Survey (HRS) data.

3 - Statistical Methodology for the Millennium Development Goals Index

Gonzalo Pizarro, United Nations Development Programme, Manhattan, NY, United States of America, gonzalo.pizarro@undp.org, Kobi Abayomi

The Millennium Development Goals (MDG) Index is a linear combination of disparate multivariate data designed to measure nation-wide progress toward the United Nations' 2015 development targets. We illustrate a Bayesian methodology for creating the index.

■ SD25

C - Room 19B, Level 4

Strategic Interactions in Disaster Relief Operations

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Justin Yates, Assistant Professor, Texas A&M University, 237D Zachry Engineering Center, 3131 TAMU, College Station, TX, 77843-3131, United States of America, jtyates@tamu.edu

Co-Chair: Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu

1 - Structuring Public Private Partnerships in Transportation Infrastructure
Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr, Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu, Qingbin Cui

The public private partnership for transportation infrastructure is established through contractual agreements, long term maintenance contracts, and long term leases to essentially outsource some traditional government functions to private partners in order to finance the transportation infrastructure, downsize government, and control spending. We propose a convex optimization method by affine controllers to mathematically solve the multi-stage model.

2 - Key Dynamics for Sustainable Partnerships in Haitian Disaster Recovery
John Coles, johnbcoles@gmail.com, Jun Zhuang, Justin Yates

On January 12th 2010, a 7.0 magnitude earthquake struck close to Port-au-Prince, Haiti. A flexible cost-benefit ratio was implemented to assist agencies' in assessing partnership efficacy using the costs and benefits discussed in interviews with agency representatives working in Haiti. Guidelines for partnership selection were developed using the first-hand information to assist responding agencies in identification of the key factors that can make partnerships more effective.

3 - Structuring Dynamic Public Response to Multiple Biological Terrorist Attacks
Richard John, Associate Professor, University of Southern California, Department of Psychology & CREATE, SGM 621, MC-1061, Los Angeles, CA, 90089-1061, United States of America, richardj@usc.edu, Heather Rosoff

We utilize an immersive video scenario simulation methodology to explore reactions of various stakeholder groups to multiple terrorist attacks using weaponized anthrax in the Seattle, Washington area. As the attack unfolds respondents are faced with various decision dilemmas over time; their responses reveal viable options, uncertainties, information needs, risk attitude, and value trade-offs. We structure stake-holder specific decision models to predict public response to biological disasters.

4 - Network Infrastructure Vulnerability Mitigation
Alan Murray, Professor, Arizona State University, Geographical Sciences and Urban Planning, Tempe, AZ, 85287, United States of America, atmurray@asu.edu

Critical network infrastructure management is an important and challenging task as system components may fail or be damaged due to natural disasters, human error or sabotage. Because continued, uninterrupted performance of network infrastructure is essential, this paper develops an optimization model for selecting network components to protect/harden in order to maximize system performance if one or more other (unprotected) components are damaged or destroyed.

5 - Behavioral Rates of Return Following Terrorist Attacks
Fynnwin Prager, USC CREATE, 3710 McClintock Avenue, RTH 314, Los Angeles, United States of America, fprager@usc.edu, William J Burns, Colin MacKenzie

We look at the rate of return in public behavior following the shocks of hazardous events such as terrorist attacks. We observe behavioral change following various incident types and through various data sets. We find that the rate of return to previous behavior in these cases follows similar paths as those derived from mathematical and focus group based studies. Our results have important implications for modeling the behavioral and economic impacts of catastrophic events.

■ SD26

C - Room 4A, Level 3

Data Mining for Business Intelligence

Sponsor: Data Mining
Sponsored Session

Chair: Hyunjung Helen Shin, Professor, Ajou University, San 5 Wonchun-dong Yeoungtong-gu, Suwon, 443-749, Korea, Republic of, shin@ajou.ac.kr

1 - A Hybrid Customer Score for Response Modeling using Support Vector Regression with Pattern Selection
Dongil Kim, PhD Student, Seoul National University, 599 Gwanakno, Seoul, Korea, Republic of, dikim01@snu.ac.kr, Sungzoon Cho

Response models identifying respondents for upcoming marketing promotions usually employ classification models to predict the response probability of each customer. However, the purchase amount of each customer is also crucial. In this paper, we propose a hybrid customer score employing both the response probability and the purchase amount. Support vector regression was used to predict the purchase amount. In addition, a pattern selection method was used to reduce the training time complexity.

2 - Exceptional Utility Detection in Managed Print Services
John Handley, Xerox Corporation, John.Handley@xerox.com

We present a data mining application for a managed print service to determine whether customers are receiving value. The system reads monthly black/white and color print counts and prices from thousands of printers in many accounts, fits a Cobb-Douglas utility model to ratios of BW to color print volumes and prices per print using robust statistical procedures, and uses estimated parameters of the model to detect cases of exceptional economic utility, an imbalance in price and printing behavior.

3 - Stock Price Prediction using Hierarchical Network Structure
Kanghee Park, PhD Student, Ajou University, San 5, Woncheon-dong Yeongtong-gu, Paldal 822, Suwon, Korea, Republic of, can17@ajou.ac.kr, Hyoung Ro Lee, Hyunjung Helen Shin

Stock price prediction using the conventional time series techniques often falls, sensitively reacting to irregular and external interventions propagated from global economical issues. To cope with this, we propose to employ a network structure for time series prediction. The network can include many time series indices within a unified framework and represent the relationship between two indices with various forms of connections such as simple, causal, and hierarchical links.

4 - The Impact of the Frequency and Sentiment of News on Stock Price
Sunghoon Park, PhD Student, Seoul National University, Seoul, Korea, Republic of, shpark82@snu.ac.kr, Jeong Geun Yeom, Sungzoon Cho

Mass media delivers tons of information to the public, which have critical influences on the decisions of investors. We analyze the influence of the frequency and sentiment of news articles on stock prices. Most of time, frequent exposure in the media leads to an upward trend of stock price. However, it was found that the stock prices highly fluctuates or decreases when there's an increase of negative news articles on certain issue.

■ SD27

C - Room 4B, Level 3

Nicholson Student Paper Prize Competition, II

Cluster: Nicholson Student Paper Prize
Invited Session

Chair: Sigrun Andradottir, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, sa@gatech.edu

1 - On the Rate of Convergence to Stationarity of the M/M/N Queue in the Halfin-Whitt Regime
David Goldberg, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, dag3141@mit.edu, David Gamarnik

We study the rate of convergence to stationarity of the M/M/n queue in the Halfin-Whitt regime. We prove that a phase transition occurs when the excess parameter B reaches 1.86. For B less than 1.86, the rate of convergence is quadratic in B; above 1.86 it is the solution to an explicit equation. We also bound the prefactor governing the rate of convergence uniformly over n, and derive a rule-of-thumb for the time it takes an overloaded (underloaded) queueing system to return to steady-state.

2 - Rare-event Simulation for Many-server Queues
Henry Lam, PhD Candidate, Harvard University, Department of Statistics, Cambridge, MA, United States of America, khhlam@gmail.com, Jose Blanchet

We develop rare-event simulation methodology for the analysis of loss events in a many-server loss system, focusing on the steady-state loss probability (i.e. fraction of lost customers over arrivals) and the behavior of the whole system leading to loss events. The algorithm, which can be shown to be asymptotically optimal, requires working with a full measure-valued process descriptor, the first of such kind in the rare-event simulation context under the setting of many-server queues.

3 - A Strongly Polynomial Algorithm for Controlled Queues
Alexander Zadorojniy, PhD Student, School of Electrical Engineering, Tel-Aviv University, Tel-Aviv 69978, Israel, Tel-Aviv, Israel, alexander.zadorojniy@gmail.com, Adam Shwartz, Guy Even

We consider the problem of computing optimal policies of finite-state finite-action Markov decision processes (MDPs). A reduction to a continuum of constrained MDPs (CMDPs) is presented such that the optimal policies for these CMDPs constitute a path in a graph defined over the deterministic policies. We present an algorithm based on this new approach that finds this path, and thus an optimal policy. We prove that the length of this path is polynomial if the MDP satisfies a coupling property.

4 - Refined Square-root Staffing for Call Centers with Impatient Customers
Bo Zhang, Georgia Institute of Technology, Atlanta, GA, United States of America, Johan van Leeuwaarden, Bert Zwart

We consider a useful model of call centers, i.e. the Erlang A model. To minimize the staffing level subject to different service-level constraints, we propose refined square-root staffing (SRS) rules, which preserve the insightfulness and computational scalability of the celebrated SRS principle and yet achieve a stronger form of optimality. The refinements are derived by developing corrected diffusion approximations and then using them to explicitly characterize the error of conventional SRS.

■ SD28

C - Room 4C, Level 3

Nanomanufacturing & Nanoinformatics II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

Co-Chair: Tirthankar Dasgupta, Assistant Professor, Harvard University, Science Center, 1 Oxford Street, Cambridge, MA, United States of America, dasgupta@stat.harvard.edu

1 - A Statistical Approach to Modeling the Potential Data in Nanoquantification
Xinwei Deng, Visiting Assistant Professor, University of Wisconsin-Madison, Department of Statistics, 1300 University Ave., Madison, WI, 53706, United States of America, xdeng@cs.wisc.edu, Peter Qian, Xudong Wang

Quantifying the potential from nanomaterials under AFM scanning is challenged by its small scale and complicated surface topography. A physical model is difficult to fully capture the complicated relations between potential and topography. In this work, we propose a statistical approach to modeling such relations. It provides the flexibility to explore the significant factors and identify a parsimonious model, which gives a better prediction performance and meaningful physical interpretation.

2 - Hierarchical Modeling of Weight Kinetics of Silica Nanowire Growth Under Different Temperatures
Li Wang, University of Southern California, 3715 McClintock Avenue, GER 236, Los Angeles, CA, 90089, United States of America, wang40@usc.edu, Qiang Huang, Li Zhu, Tirthankar Dasgupta

To understand the weight kinetics of silica nanowire growth under different temperatures, we postulate a physics-driven bayesian hierarchical model. The model is able to utilize growth temperature information to improve characterization of the weight kinetics. Model parameters are obtained by Monte Carlo Markov Chain(MCMC) simulation, using experimental observations as input. The modeling of observed initial weight loss is also discussed.

3 - The Constrained Random Effect Models for Nanoparticle Synthesis
Jye Chyi Lu, Georgia Institute of Technology, Atlanta, GA, jclu@isye.gatech.edu, Andres Hernandez, Martha Grover, Hin Kyeol Woo

This research formulates the likelihood for mean nanoparticle sizes, where some of them are not available due to engineering constraints. Since the data are collected from computer experiments, random effects are included in the logistics and normal regressions for modeling spatial dependence of data.

4 - Nonparametric Bayesian Modeling of Hazard Rate with Change-point for Nanoelectronic Devices
Tao Yuan, Assistant Professor, Ohio University, Stocker Center 279, Athens, OH, 45701, United States of America, yuan@ohio.edu, Chia-han Yang, Way Kuo, Yue Kuo

This study proposes a model for hazard rate with a change-point using nonparametric Bayesian method. The decreasing hazard rate in the infant mortality period is modeled by a stochastic jump process. Simulation algorithm based on Gibbs sampling is developed for posterior inference. The proposed approach is applied to analyze the experimental failure times of two nanoelectronic devices and compared with other parametric and nonparametric methods.

■ SD29

C - Room 5A, Level 3

Technometrics Invited Papers

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: David Steinberg, Department of Statistics and Operations Research, School of Mathematical Sciences, Tel Aviv University, Tel Aviv 69978, dms@post.tau.ac.il

Co-Chair: Hugh Chipman, hugh.chipman@acadiau.ca

1 - Reliability Growth Management Metrics and Statistical Methods for Discrete-use Systems
J. Brian Hall, Division Chief, Aviation, Missiles, and C4ISR, U.S. Army Test and Evaluation Command, 4120 Susquehanna Avenue, TEAE-REA, Dr. J. Brian Hall, APG, MD, 21005, United States of America, jbrianhall@msn.com, Paul Ellner, Ali Mosleh

Reliability growth management metrics and statistical procedures are presented for discrete-use systems. These metrics serve as concomitant measures of programmatic risk and system maturity that may be utilized to assess the progress of ongoing reliability growth efforts, or lack thereof. A methodology overview is given, as well as an application to a ground-to-air missile program. Extensions to reliability growth planning for discrete-use systems is also covered.

2 - Discussion on Reliability Growth Management Metrics and Statistical Methods for Discrete-use Systems
Christine Anderson-Cook, Donald Gaver, Art Fries, Nozer Singpurwalla, Alyson Wilson

We will have a discussion on Brian Hall's presentation.

3 - Discussion of Paper by Hall, Ellner, and Mosleh
Donald Gaver, Distinguished Professor, Naval Postgraduate School, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, DGaver@nps.edu, Patricia Jacobs

This interesting paper provides an approach to reliability growth problems that has novel features, such as that of using a random parameter, or "mixture" model to describe the introduction of "failure modes" into a system, and the effects of removal efforts. It is provocative and and stimulating by suggesting, perhaps implicitly, that many further efforts in this important area are needed.

■ SD30

C - Room 5B, Level 3

Joint Session QSR/ Service Science: SPC Applied to Service Industry

Sponsor: Quality, Statistics and Reliability/ Service Science
Sponsored Session

Chair: Fugee Tsung, Professor and Head, Department of Industrial Engineering and Logistics Management, Hong Kong University of Science and Tech, Clear Water Bay, Kowloon, Hong Kong - PRC, season@ust.hk

1 - Service System Monitoring via Detection of Cycle Time Changes
Nan Chen, Research Assistant, University of Wisconsin Madison, 1513 University Ave, Madison, WI, 53705, United States of America, nchen3@wisc.edu, Shiyu Zhou

The cycle time in service systems usually refers to the time required for a customer to traverse through the system in a designed routine. It is well known as an important performance measure of service systems regarding their responsiveness and capacity. In this presentation, I will introduce a control chart designed for detecting cycle time changes with the ability to adjust according to arrival patterns. Successful applications can result in faster response and better resource allocations.

2 - Statistical Process Control for Multistage Processes with Binary Data
Yanfen Shang, HKUST, Clear Water Bay, Kowloon, Hong Kong, Hong Kong - PRC, shangyf@ust.hk, Changliang Zou, Fugee Tsung

This paper proposes a binary state space model (BSSM) for modeling multistage processes with binomial (binary) data and develops corresponding monitoring and diagnosis schemes by utilizing a hierarchical likelihood approach and directional information based on the BSSM. Our simulation results show that the proposed schemes consistently outperform the existing chi-square scheme in monitoring and diagnosing for binomial multistage processes.

3 - Multivariate Categorical Charting Techniques via Log-linear Models
Jian Li, Hong Kong University of Science and Technology, Rm 5551, Dept of IELM, Clear Water Bay, Kowloon, Hong Kong - PRC, jianli@ust.hk, Fugee Tsung, Changliang Zou

The statistical process control for multivariate categorical processes is addressed. We employ the log-linear model for sufficiently characterizing the relationship among the categorical variables and propose a novel Phase II control chart. This chart incorporates the monitoring of multivariate binomial or multivariate multinomial processes into a unified framework, and it is easy to implement and efficient to detect various shifts. Numerical simulations demonstrate its effectiveness.

4 - SPC Application in Web Traffic Stability Monitoring
Jing Zhong, Applied Researcher, Microsoft Corp., 555 110th Ave. NE, Bellevue, WA, 98004, United States of America, zhongjing81@gmail.com

The continuing growth of internet has brought extremely high volume web search data, as well as challenges to traffic stability monitoring. The early detection and diagnosis of out-of-control status is critical for online service quality assurance. However the high dimension and correlation among the metrics that commonly adopted in online practice has limited the efficiency of fast root cause diagnosis. This work will show a real life application of SPC in the web search industry.

■ SD31

C - Room 5C, Level 3

Detection and Characterization of Complex Patterns in Health Informatics

Sponsor: Data Mining
Sponsored Session

Chair: Artur Dubrawski, Carnegie Mellon University, 5000 Forbes Avenue, NSH 3121, Pittsburgh, PA, United States of America, awd@cs.cmu.edu

1 - Discovering Complex Anomalous Clusters using Disjunctive Anomaly Detection Algorithm
Maheshkumar Sabhnani, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sabhnani@cs.cmu.edu, Artur Dubrawski, Jeff Schneider

Disjunctive Anomaly Detection algorithm (DAD) is designed to identify complex anomalous clusters in multidimensional categorical data. It is unique in its ability to detect clusters which can be characterized using conjunctive-disjunctive statements. It can also discern separate overlapping effects caused by distinct processes that simultaneously affect the same subsets of data. DAD is shown to outperform alternative state-of-the art methods for microarray analysis and syndromic surveillance.

2 - Visualizing Complex Relationships to Support Transition of Disease Classification
Ryan McDermitt, Partner, Nyka Consulting, 4898 Tarry Glen Dr, Suwance, GA, 30024, United States of America, ryan.mcdermitt@nykaconsulting.com, Krista Yager

The US health care industry is under federal mandate to transition from ICD-9 to ICD-10 (International Classification of Disease for Medical Diagnosis and Procedures (ICD-9<20,000 codes: ICD-10>140,000 codes.) The logic to develop ICD-10 codes is independent with no foundational overlap shared with ICD-9 (ICD-10 codes have an intelligent alpha-numeric naming convention.) The relationships while difficult to map and understand has successfully been defined and visualized into clusters.

3 - Fast Generalized Subset Scan for Anomalous Pattern Detection
Edward McFowland III, Carnegie Mellon University, Pittsburgh, PA, United States of America, emcfowla@andrew.cmu.edu, Skyler Speakman, 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. Our empirical results show the utility of FGSS across multiple domains, including detection of patterns in Emergency Department visits, container shipments, and network intrusion data.

4 - Scalable Detection of Anomalous Patterns with Connectivity Constraints
Skyler Speakman, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, United States of America, sspeakma@andrew.cmu.edu, Daniel Neill

We present GraphScan, a method for detecting arbitrary-shaped connected clusters in graph or network data. For spatial event detection, graph nodes represent locations and edges represent adjacency between neighboring locations. GraphScan enables efficient, exact computation of the most anomalous subgraph for graphs of up to 100 nodes. We evaluate GraphScan using simulated disease outbreaks injected into real-world hospital data, and show substantial improvements in run time and detection power.

■ SD32

C - Room 6A, Level 3

Computing With GPUs

Sponsor: Computing Society
Sponsored Session

Chair: Nick Sahinidis, John E. Swearingen Professor, Carnegie Mellon University, Department of Chemical Engineering, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, sahinidis@cmu.edu

1 - Solving Large-scale Dense SOCP on Heterogeneous Computing Platform
Yuriy Zinchenko, University of Calgary, Calgary, Canada, yzinchen@ucalgary.ca

To minimize negative impact of uncertainties in optimal radiotherapy planning for cancer treatment, a convex robust counterpart of a conventional model has been proposed. The robust model is a large-scale dense SOCP. However, presently, such an approach is clinically infeasible due to excessive computational demands associated with solving the resulting problem. We investigate the use of heterogeneous platforms, namely GP-GPU, to speed up linear algebra operations required by IPM solver.

2 - Optimizing Codes for OpenCL and NVIDIA Fermi
Anne C. Elster, NTNU, 7517 Stoncliff CIR, (Address for sabbatic leave 2010/11), Norway, elster@idi.ntnu.no

Modern GPUs are now massive floating-point stream processors that offer energy efficient compute power. With the recent development of tools such as CUDA and OpenCL, it has become much easier to fully utilize the computational power these system offer. This presentation will highlight some of the experiences the author's research group has had with recent GPUs, including looking at using GPUs to compress data in order to lower latency between disk and memory and between CPU memory and GPUs.

3 - GPU Computing with Kaczmarz's and Other Iterative Algorithms for Linear Systems

Joseph Elble, University of Illinois at Urbana Champaign, 932 Waterview Way Apt D, Champaign, IL, 61822, United States of America, joseph.elble@gmail.com, Panagiotis Vouzis, Nick Sahinidis

The GPU is used to solve large linear systems derived from partial differential equations. The PDEs studied are common to many fields, e.g. fluid dynamics and structural mechanics. The paper presents comparisons between GPU and CPU implementations of several well-known iterative methods. The results demonstrate that our GPU implementation outperforms CPU implementations of these algorithms, as well as previously studied parallel implementations on Linux clusters and shared memory systems.

4 - A GPU Implementation of BLAST

Panagiotis Vouzis, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, United States of America, pvouzis@cmu.edu, Nick Sahinidis

We present results with a GPU implementation of the widely used bioinformatics software BLAST. The algorithm relies on the approximate solution of dynamic programs to identify similarities in protein sequence. We present an implementation using CUDA on an NVIDIA GPU.

■ SD33

C - Room 6B, Level 3

Computational and Systems Biology

Sponsor: Computing Society
Sponsored Session

Chair: Teresa Przytycka, NCBI / NLM / NIH, 8600 Rockville Pike, Bethesda, MD, 20894, United States of America, przytyck@ncbi.nlm.nih.gov

1 - A Tensor Higher-order GSVD for Comparison of Global DNA Expression From Multiple Organisms

Sri Priya Ponnapalli, University of Texas at Austin, Department Electrical and Computer Engr., Austin, TX, United States of America, sripriyaponnapalli@gmail.com, Michael A. Saunders, Orly Alter

The increase in high-dimensional datasets recording multiple aspects of a single phenomenon is accompanied by a need for mathematical frameworks that can compare multiple large-scale matrices of different numbers of rows. The only such framework to date, the GSVD, is limited to two matrices. We define a tensor GSVD that under certain conditions extends all the properties of the GSVD to more than two matrices, and illustrate it with a comparison of DNA microarray data from multiple organisms.

2 - Tuning and Controlling Gene Expression Noise in Synthetic Gene Networks

Rhys M Adams, Graduate Research Assistant, University of Texas, 1515 Holcombe Blvd, Houston, TX, 77030, United States of America, rhysm.adams@gmail.com, Gàbor Balàzsi, James Collins, Kevin Murphy

We have developed and studied a set of synthetic gene regulatory networks using members of the TetR family of transcription factors. With these gene regulatory networks we are able to control mean gene expression and noise (or variation) levels as well as their sensitivities to environmental perturbations. By controlling these "demographics" of gene expression, investigators will be able to study what aspects of gene expression affect cell population fitness in a precise manner.

3 - Informativity-guided Analysis of Genomic Data

Maga Rowicka, Assistant Professor, University of Texas Medical Branch, 301 University Blvd, Galveston, TX, 77554, United States of America, merowick@UTMB.EDU, Jang Yi

A bottleneck in systems biology today is data analysis, especially extracting biologically meaningful information (BMI). We present an approach for determining the amount of BMI contained in a set of genes arising from a genomic experiment. Quantifying BMI of such a set allows optimization of the data analysis toward obtaining most biologically meaningful results. We demonstrate how our approach can be used to improve analysis of various genomic datasets.

4 - Connecting Genotype to Phenotype

Teresa Przytycka, NCBI / NLM / NIH, 8600 Rockville Pike, Bethesda, MD, 20894, United States of America, przytyck@ncbi.nlm.nih.gov, Yoo-ah Kim, Stefan Wuchty

In complex diseases different genotypic perturbations lead to the same disease by dys-regulating same cellular pathways. I will discuss our computational method, that utilizes graph-theoretical apporaches and optimization techniques to identify such dys-regulated pathways.

■ SD34

C - Room 7, Level 3

ICS Leading Edge Tutorial

Sponsor: Computing Society
Sponsored Session

Chair: Robert Dell, Professor and Chairman, Naval Postgraduate School, Naval Postgraduate School, Monterey, CA, 93943, United States of America, Dell@nps.edu

1 - A Nested Benders Decomposition Algorithm for Protecting Critical Infrastructure

Matthew Carlyle, Associate Professor, Naval Postgraduate School, 1411 Cunningham Rd. Gl-211, Monterey, CA, 93943, United States of America, mcarlyle@nps.edu, Gerald Brown, David Alderson, Kevin Wood

We present three-stage optimization models for determining vulnerabilities in critical infrastructure systems and designing or redesigning such systems to reduce their susceptibility to deliberate, optimal attacks. We then present a nested Benders decomposition algorithm for solving these models, and show results for problem instances that represent real infrastructure systems at functionally and computationally reasonable levels of detail.

■ SD35

C - Room 8A, Level 3

Stochastic Models in Operations Research

Sponsor: Applied Probability
Sponsored Session

Chair: Jose Blanchet, Columbia University, 500 W 120th Suite 340, New York, NY, United States of America, jose.blanchet@columbia.edu

1 - Optimal Size-based Task Assignment for Multi-server Queues in the Quality-driven Regime

Bo Zhang, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States of America, bozhang@gatech.edu, Bert Zwart

We consider the M/G/N queue in a certain many-server asymptotic regime, namely the Quality-Driven regime. We propose a size-based task assignment policy, under which the steady-state probability that there are more jobs than servers in the system is shown to coincide with the corresponding probability in an infinite-server queue on a logarithmic scale. This suggests that in this regime separating large and small jobs properly can protect system performance against job size variability.

2 - Characterization of Stationary Distributions of Reflected Diffusions in Polyhedral Domains

Weining Kang, Assistant Professor, University of Maryland, Baltimore County, Department of Mathematics and Statistics, Baltimore, MD, United States of America, wkang@umbc.edu, Kavita Ramanan

In this talk we consider a class of reflected diffusions in polyhedral domains defined via an extended Skorokhod problem. Reflected diffusions in this class are shown to be solutions to a submartingale problem. Necessary and sufficient conditions for a probability measure to be the stationary distribution for the class of reflected diffusions are established. Illustrative examples of diffusion limits of stochastic networks are provided.

3 - Portfolio Rebalancing Error with Mean Reversion and Jumps

Xingbo Xu, Columbia University, S. W. Mudd Building, Rm 313A, 500 West 120th Street, New York, NY, 10027, United States of America, xx2126@columbia.edu, Paul Glasserman

We analyze the limiting distribution of the difference between discretely and continuously rebalanced portfolios as the rebalancing frequency increases when the underlying asset dynamics have mean reversion or jumps. In the first case, the asymptotic error is normal; mean reversion has no effect on the limiting variance but appears in the covariance between the error and the continuous portfolio. With jumps, the asymptotic error is never normal but the limiting variance has a simple form.

4 - Monte Carlo Techniques for Reflected Fluid Networks

Jose Blanchet, Columbia University, 500 W 120th Suite 340, New York, NY, United States of America, jose.blanchet@columbia.edu, Xinyun Chen

We will discuss some techniques that can be used to estimate, with a controlled error, expectations via simulation of reflected fluid networks in the positive quadrant. Our discussion also includes steady-state simulation.

■ SD36

C - Room 8B, Level 3

Case Competition II - INFORM-ED's Annual Case Competition is an Opportunity for INFORMS Members to Showcase Their Efforts in the Classroom

Sponsor: INFORM-ED
Sponsored Session

Chair: Mike Racer, University of Memphis, 334 Fogelman, Memphis, TN, United States of America, mracer@memphis.edu

1 - A Leader Home Improvement Retailer Commitment to Disaster Response
Monica Villarreal, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30318, United States of America, monica_cvg@yahoo.com, Paul Kerl, Matt Drake, Ozlem Ergun, Gonca Karakus, Pinar Keskinocak, Julie Swann

The Home Depot (THD) is motivated to be a strong first responder to both natural and man-made disasters. If THD is going to attain its highest priority of preparing customers for the event and providing adequate supply levels for the post-event cleanup and repair operations, the company must have a detailed operational plan for stocking the stores and bringing them back on-line as soon as possible after the disaster.

2 - KEY Electronics - Sourcing and Warehouse Analysis
Tim Kraft, Stanford University, 920 South California Avenue, Palo Alto, CA, 94306, United States of America, tkraft@stanford.edu, Yenho Thomas Chung, Feryal Erhun

Based in Oklahoma City, OK, KEY Electronics is a consumer electronics retailer with over 1,500 stores throughout the United States and Mexico. KEY has a limited retail presence in Mexico, which it would like to expand from 30 stores in 2009 to 70 by year-end 2012. As part of its Mexico growth strategy, KEY must 1) improve its current sourcing of products for Mexico and 2) determine how to revamp its existing warehouse operations.

■ SD37

C - Room 8C, Level 3

Stochastic Models for Market Microstructure

Sponsor: Applied Probability
Sponsored Session

Chair: Costis Maglaras, Professor, Columbia Business School, 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 - Information Aggregation in Smooth Markets
Krishnamurthy Iyer, Stanford University, 19A Comstock Circle Apt 101, Stanford, CA, United States of America, kriyer@stanford.edu, Ramesh Johari, Ciamac Moallemi

We consider a market model with finitely many informed rational risk-averse traders interacting with a market maker. We identify a basic asymptotic smoothness condition on the price in the market that ensures information aggregation under a portfolio convergence assumption. The condition requires that, eventually, per unit price of infinitesimal purchases or sales be the same. Notably, we show that, under mild conditions, market makers based on market scoring rules satisfy asymptotic smoothness.

2 - Price Volatility as a Limit of Queuing Systems
Sasha Stoikov, Cornell University, 55 Broad Street, New York, NY, United States of America, sfs33@cornell.edu, Josh Reed, Marco Avellaneda

We present a stochastic model for the bid and ask quotes of a traded asset. We describe methods for computing the probability p(x,y) that the next price move is up, conditional on the bid (x) and ask sizes (y). We then define the efficient price to be a weighted average of the bid and the ask prices, where p(x,y) is the weight applied on the ask price. The instantaneous volatility of this efficient price may be interpreted as as a microstructure-adjusted volatility.

3 - A Multiclass Queueing Model of Limit Order Book Dynamics
Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu, Costis Maglaras

We model the limit order book as system of two, coupled multiclass queues. Specifically, each side of the book is modeled as a single server, multiclass queue operating under a strict priority rule defined by the prices associated with each limit order. We describe the transient dynamics of this system, and formulate and solve the optimal execution problem for a block of shares over a short time horizon. We derive the market impact function associated with our microstructure model.

■ SD38

C - Room 9A, Level 3

Novel Global Optimization Methods

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Zelda Zabinsky, Professor, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195, United States of America, zelda@u.washington.edu

1 - Solving Nonlinear Integer Programs with Nonconvex Quadratic Constraints
Youdong Lin, Lindo Systems, Inc., 1415 N Dayton St, Chicago, IL, 60642, United States of America, ylin@lindo.com, Linus Schrage

We describe a software implementation for finding global optima to nonlinear programs that contain integer variables as well as one or more constraints that contain nonconvex quadratic terms. We discuss and analyze the effectiveness of various methods for constructing convex relaxations and for doing branching.

2 - Probabilistic Branch and Bound for Global Optimization of Noisy Functions
Wei Wang, PhD Candidate, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195, United States of America, wangwei@uw.edu, Zelda Zabinsky, Archis Ghate

We introduce a probabilistic branch-and-bound (PBnB) scheme for global optimization of noisy functions. We use statistical analysis to guide the branching and pruning scheme, which also prescribes the number of sample points and associated replications for estimating the true function values. The scheme terminates with a probability bound on the optimality gap. Numerical results are presented.

3 - Global Optimization of Truss Structure Design
John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu, Tallys Yunes, Tallys Yunes

We solve truss structure design problems with discrete bar sizes without introducing integer variables. We use a global optimization method that relies on constraint programming as well logic cuts and linear quasi-relaxations to accelerate the search. The solution is implemented in a general solver, SIMPL, that solves a wide range of global optimization problems by integrating techniques. It solves the truss problems 2 to 7 times faster than commercial MILP solvers.

4 - Interacting Multi-Criteria Annealing Algorithm
Onur Mete, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195, United States of America, mete@u.washington.edu, Zelda Zabinsky

We develop an Interacting Multi-Criteria Annealing (IMCA) algorithm that generates a population of candidate points according to Pattern Hit-and-Run Markov chain. The candidate points interact through selection rules representing multiple criteria. The IMCA algorithm converges to a subset of Pareto optimal solutions. We present analytical and numerical results of our algorithm for multi-criteria optimization.

■ SD39

C - Room 9B, Level 3

Advances in Combinatorial Optimization and Integer Programming II

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Andrea Lodi, DEIS, University of Bologna, Viale Risorgimento, 2, Bologna, 40136, Italy, andrea.lodi@unibo.it

Co-Chair: Andrea Tramontani, DEIS, University of Bologna, Viale Risorgimento 2, Bologna, 40136, Italy, andrea.tramontani@unibo.it

1 - Solving Optimization Problems at Google
Emilie Danna, Software Engineer, Google, 1600 Amphitheatre Pkwy, Mountain View, CA, 94043, United States of America, edanna@google.com, Mihai Amarandei-Stavila, Bruno De Backer, Vincent Furnon, Laurent Perron, Emmanuel Guéré

Google operations offer many opportunities to apply optimization. In this talk, we describe the optimization problem underlying several of Google's operations and we examine how it is solved with integer programming, constraint programming and local search.

2 - Integer-free Polytopes of Maximal Gomory-Chvatal Rank
Sebastian Pokutta, Technische Universität Darmstadt, Dolivo Str. 15, Darmstadt, Germany, pokutta@mathematik.tu-darmstadt.de, Andreas S. Schulz

It is an open problem to characterize polytopes of maximal Gomory-Chvatal rank, even if we restrict ourselves to polytopes in the 0/1-cube. In fact, tight bounds on the rank of a polytope contained in the 0/1-cube are unknown. We consider the important special case of polytopes contained in the 0/1-cube that contain no integer points. For this class, we provide a complete characterization of polytopes with maximal rank.

3 - Lifted Inequalities for 0-1 Mixed-integer Bilinear Covering Sets
Kwanghun Chung, PhD Student, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, khchung@ufl.edu, Jean-Philippe Richard, Mohit Tawarmalani

Lifting, a technique for generating strong valid inequalities in integer programming, has recently been extended to nonlinear programming. In this talk, we present large families of facet-defining inequalities for 0-1 mixed-integer bilinear covering sets via sequence-independent lifting techniques. We also relate the polyhedral structure of the bilinear set to that of the single-node flow set and show that our facets generalize lifted flow cover inequalities from the IP literature.

4 - Interdiction Branching
Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Andrea Lodi, Stefano Smriglio, Fabrizio Rossi

We introduce "interdiction branching," a branching method that exploits the bilevel nature of disjunction selection. The method is designed to overcome the difficulties in solving problems for which branching on variables is inherently weak by computing a set of variables of which at least one must be nonzero in any improving solution. We present computational results that show the effectiveness of this method on well-known combinatorial problems.

■ SD40

C - Room 9C, Level 3

Panel Discusssion: Forrest-fest | COIN-OR 10th Retrospective

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Moderator: Robin Lougee, Program Manager, COIN-OR, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, rlougee@us.ibm.com

1 - Panel Discussion: Self-documenting Code and Other 'Tricks' of the Trade
Panelists: Robin Lougee, Program Manager, COIN-OR, IBM TJ Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, rlougee@us.ibm.com, John Tomlin, Principal Research Scientist, Yahoo! Research, 4301 Great America Parkway, Santa Clara CA 95054, United States of America, tomlin@yahoo-inc.com, John Forrest, IBM Research (Retd.), john.forrest@fastercoin.com

COIN-OR's success in its first decade is due in large part to the software contributions of John Forrest, particularly CLP and CBC. In this panel, John and others will share their perspectives on optimization software development - what we've learned and where we need to go. (Submit questions at info@coin-or.org)

■ SD41

C - Room 10A, Level 3

Efficient Methods for Sparse or Low-rank Optimization

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Zhaosong Lu, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca

1 - Fast First-order Alternating Direction Multiplier Methods for Compressed Sensing and Related Problems
Donald Goldfarb, Professor, Columbia University, 500 W. 120th Street, Mudd Building, Room 313, New York, NY, 10027, United States of America, goldfarb@columbia.edu, Shiqian Ma

We present both Gauss-Seidel-like and Jacobi-like first-order alternating direction multiplier (augmented Lagrangian) methods for solving convex optimization problems that require O(1/sqrt(epsilon)) iterations to compute an epsilon-optimal solution. We apply these methods to various problems whose solutions are known to either be sparse or low rank or both.

2 - Existence of Sparse Solutions in Random Quadratic Optimization Problems
Jiming Peng, University of Illinois at Urbana-Champaign, 117 Transportation Building MC-238, Urbana-Champaign, United States of America, pengj@illinois.edu

In recent years, the sparse solutions for certain classes of optimization problems have attracted much attention in numerous disciplines. In this talk, we report some results on sparse solutions for nonconvex quadratic optimization problems with random data, these include the sparse solutions for the so-called standard quadrtaic optimization problem and sparse solutions for the well-known Markowitz's mean variance model.

3 - Penalty Decomposition (PD) Methods for Rank Minimization
Zhaosong Lu, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca

We first establish that a class of rank minimization problems have closed form solutions. We then propose PD methods for rank minimization problems in which each subproblem is solved by a BCD method. We show that any limit point of the sequence generated by our method when applied to the rank constrained minimization problem is a stationary point of a nonlinear reformulation of the problem. Finally, we apply the methods to matrix completion and nearest low-rank correlation matrix problems.

■ SD42

C - Room 10B, Level 3

Joint Session OPT/ MIF: Stochastic Programming - Applications

Sponsor: Optimization/Stochastic Programming/ Minority Issues
Sponsored Session

Chair: Lewis Ntaimo, Associate Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ntaimo@tamu.edu

1 - A Stochastic Programming Approach for Reducing Energy Consumption in Data Centers
Julian A. Gallego Arrubla, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, kamizama77@tamu.edu, Young Myoung Ko, Lewis Ntaimo, Natarajan Gautam, Ronny Polansky

Data centers consume a phenomenal amount of energy which can be significantly reduced by appropriately allocating resources using technologies such as virtualization, voltage scaling and powering off servers. For this we formulate and solve a large-scale stochastic integer program that incorporates inherent variability and uncertainty especially in terms of workload experienced by the system. Numerical results based on real traces indicate a significant energy saving.

2 - Efficient Nested Solutions of the Bipartite Stochastic Network Interdiction Problem
Mike Nehme, The University of Texas at Austin, 2412 W 12th Street, Austin, TX, 78703, United States of America, mikenehme@yahoo.com, David Morton

We describe a stochastic network interdiction model for deploying radiation detectors at border checkpoints to detect smugglers of nuclear material. The model is stochastic because the smuggler's origin-destination pair is known only through a probability distribution when the detectors are installed. While the problem is strongly NP-hard, we describe a family of instances which may be solved in polynomial time, and show that the solutions to this family are nested.

3 - Optimizing Natural Gas Supply and Energy Trading for an Electricity Generation Company
Jose Prina, Assistant Professor, Pontificia Universidad Catolica de Chile, Department of Industrial and Syst. Eng., Avda. Vicuna Mackenna 4860, Macul, Santiago, Chile, jprina@ing.puc.cl, Oran Kittithreerapronchai, Sujin Kim, Panida Jirutitijaroen

We consider an electric power company that owns thermal plants and participates in a deregulated market. Different types of contracts for natural gas procurement are available, including access to the spot market. The company also manages natural gas storage capacity. A stochastic programming model that allows to optimize fuel and electricity transactions is presented. This model considers electricity contracts, spot market trading, and natural gas storage management.

4 - Stochastic Online Scheduling of Multi-step Sequential Medical Procedures in Nuclear Medicine

Eduardo Perez, Postdoctoral Research Associate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, eduardopr@neo.tamu.edu, Lewis Ntaimo, Cesar Malave

Nuclear medicine (NM) procedures use radioisotopes for diagnosis and treatment of patients. These multi-step procedures have to be performed under strict time constraints. The need to provide high levels of patient service in NM lead to scheduling issues such as dealing with uncertainty in patient arrivals. We present a stochastic online framework that uses a stochastic integer programming model for patient scheduling in NM. A computational study based on an actual NM clinic will be presented.

■ SD43

C - Room 1, Level 2- Mezzanine

Scheduling Healthcare Workforce

Sponsor: Health Applications
Sponsored Session

Chair: Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu

1 - Midterm Scheduling of Physicians with Flexible Shifts using Branch-and-price

Jens Brunner, TUM School of Management, Arcisstr. 21, München, 80333, Germany, Jens.Brunner@wi.tum.de

We present a new methodology to solve the flexible shift scheduling problem of physicians when hospital administrators can exploit flexible shifts to cover demand. The objective is to minimize the total assignment cost subject to individual and general labor contracts. The resulting model constructs shifts implicitly. To find high quality rosters, we develop a branch-and-price algorithm. Computational results demonstrate the efficiency of the algorithm for several planning horizons.

2 - Nurse Scheduling in an Operating Suite

Gino Lim, Associate Professor PhD, University of Houston, E211, Engineering Building 2, Houston, TX, 77204, United States of America, ginolim@uh.edu, Arezou Mobasher

We introduce two IP models for assigning nurses to different surgery cases in an operating suite. A nurse assignment model was developed to allocate the required number of nurses with appropriate specialties to all surgery cases with different procedure complexities for a daily nurse schedule. In addition, a nurse lunch model was developed to establish lunch schedules for working nurses without interfering the on-going surgery cases. Numerical experiments show the effectiveness of these models.

3 - Removing Barriers to Resident-patient Continuity of Care

Jonathan Turner, PhD Candidate, Northwestern University, Evanston, IL, United States of America, JonathanTurner@u.northwestern.edu, Debra DaRosa, Mark Daskin, Sanjay Mehrotra, Heron Rodriguez, Paul Speicher

Our data show that continuity of care (CoC) between surgical residents and patients is very low. Our analytical model and our simulation show that keeping it low are 1) long time periods between diagnosis, surgery and follow-up 2) that residents don't attend clinic appointments often enough to see patients at these stages and 3) that the residents spending time operating are not the ones spending time seeing patients. The analysis and simulation also show how several strategies can improve CoC.

4 - Distributional Robust New Vendor Models for Nurse Demand Estimation

Ashley Davis, PhD Candidate, Northwestern University, IEMS, 2145 Sheridan Road, Room C210, Evanston, IL, 60208, United States of America, ashleydavis2012@u.northwestern.edu, Mark Daskin, Sanjay Mehrotra

Facing uncertain patient volumes, hospitals must maintain nurse-to-patient ratios to offer safe patient care. Using a distributional-robust newsvendor model we analyze data from the general surgery and intensive care units of hospitals in Chicago, IL and Augusta, GA. Benefits of using the model are discussed.

■ SD44

C - Room 2, Level 2- Mezzanine

Healthcare Operations

Sponsor: Health Applications
Sponsored Session

Chair: Hari Balasubramanian, Assistant Professor, University of Massachusetts, Amherst, 160 Governors Drive, Amherst, MA, 01003, United States of America, hbalasubraman@ecs.umass.edu

1 - Using Simulation to Improve the Educational Impact in a Surgical Suite

Todd R. Huschka, Mayo Clinic, 200 1st AVE SW, Rochester, MN, 55905, United States of America, Huschka.Todd@mayo.edu, Brian T. Denton, Erica Weikert, Jonathan Woodall, Celia Wang

Balancing the needs of the patient and the surgeon together with the desire to provide educational opportunities for in room providers is a high priority within an academic medical center. Using simulation modeling we explore how various changes to the instructor/student relationship may impact a surgical suite. We present results that provide insight into staffing decisions.

2 - Design and Optimization of a Hospital Inpatient Bed Management System

Jonathan Helm, University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave, Ann Arbor, MI, United States of America, jhelm@umich.edu, Mark Van Oyen

Although a hospital represents a complex network of subsystems that must all work together to serve dynamically changing patient needs, these subsystems are often managed independently, causing congestion and bottlenecks in patient flow that impact cost, quality and access. We present a framework for coordinating and optimizing hospital admissions based on the stochastic process that governs bed occupancy by unit and patient type to maximize throughput subject to quality and access constraints.

3 - Surgical Yield Management: Predictive Models for Case Screening

John Osborn, Operations Manager, Mayo Clinic, 200 1st Street SW, Mary Brigh 2-810, Rochester, MN, 55905, United States of America, Osborn.John@mayo.edu

Surgeon productivity is critical to a viable surgical practice. Elective case volume is driven by consultations in an outpatient setting, but not all patients are surgical candidates, thus careful planning is necessary to maximize the yield of a given consultative day. This paper presents screening models, based on yield management principles, to maximize elective case yield.

4 - Operations Research in Primary Care

Hari Balasubramanian, Assistant Professor, University of Massachusetts, Amherst, 160 Governors Drive, Amherst, MA, 01003, United States of America, hbalasubraman@ecs.umass.edu

We look at different operational aspects of managing a primary care practice, from panel management and case-mix considerations to capacity planning and the design of flexible teams. The presentation will also foreground the broader context of primary care in the United States.

■ SD45

C - Room 6, Level 2- Mezzanine

Optimization in Medicine

Sponsor: Health Applications
Sponsored Session

Chair: Brian T. Denton, North Carolina State University, Campus Box 7906, 111 Lampe Drive, Raleigh, NC, 27695-7906, United States of America, bdenton@ncsu.edu

1 - Alleviating the Impact of an Epidemic

Cecilia Zenteno, Columbia University, 500 W 120th St., New York, NY, United States of America, cecizl@gmail.com, Daniel Bienstock

Consider a finite resource (such as manpower) that can be used to alleviate the impact of an ongoing epidemic. Each day, one can decide how of the resource to allocate; however, there is uncertainty as to the future course of the epidemic. We consider robust versions of the classical SEIR model, and algorithms for intelligently rationing the resource. Joint work with Daniel Bienstock.

2 - Optimal Design of Multiple Medication Guidelines for Type 2 Diabetes Patients

Jennifer Mason, North Carolina State University, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, jemason2@ncsu.edu, Brian T. Denton, Steven Smith, Nilay Shah

Patients with type 2 diabetes are often prescribed many medications to manage their risk for cardiovascular events. We present an MDP model to determine the optimal sequence and timing of blood pressure and cholesterol medications with an objective of primary and secondary event prevention. We consider multiple criteria including expected quality-adjusted life years and expected discounted costs of care. We compare our results to outcomes for implementing current US and international guidelines.

3 - Multi-objective Recipient Prioritization Optimization in Liver Transplantation

Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, United States of America, nkong@purdue.edu, Wen-Hsin Feng, Dadi Xing

Since cadaveric liver is scarce and life-saving resource for end-stage liver disease patients, it is critical to design schemes to prioritize the patients for receiving liver transplants under the consideration of several conflicting system outcomes. Through a simulation model, we embed an extended ranking and selection procedure in a genetic algorithm for the resultant multi-objective stochastic optimization problem and we construct a Pareto front for optimal prioritization schemes.

4 - HIV Treatment in Resource-limited Environments: An Approximate Dynamic Programming Approach

Theologos Bountourelis, Post-Doctoral Associate, University Of Pittsburgh, 1048 Benedum Hall, 3700 O'Hara Street, Pittsburgh, PA, 15261, United States of America, bountourelis@gmail.com, Ronald Braithwaite, Andrew J. Schaefer, Mark S. Roberts, Rob Koppenhaver

In the past 20 years, HIV has globally claimed over 20 million lives with the sub-Saharan Africa area impacted the most. It is estimated that millions of patients are currently in need of treatment with fewer than 8% having access to it. Under such resource constraints, the question of efficient treatment allocation becomes relevant. We implement ideas drawn from the area of Approximate Dynamic Programming (ADP) to design treatment allocation policies that improve population survival rates.

■ SD46

C - Room 7, Level 2- Mezzanine

Undergraduate Research Showcase I

Cluster: Undergraduate Operations Research Prize
Invited Session

Chair: Joel Sokol, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, jsokol@isye.gatech.edu

1 - Global Humanitarian Supply Chain Improvements for the World Food Programme (WFP)

James Wade, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, j.wade@gatech.edu, Ozlem Ergun, Lawrence Li, Julie Swann, Santiago Aviles, Elhadj Bah, Manuel Jimenez, Alvaro Morales

Most of the current literature in humanitarian logistics focuses on disaster relief and emergency response in non-food supply chains. Humanitarian relief and logistics, however, may extend for years after the initial event and the literature is limited in this area. In this paper we attempt to provide a novel example in humanitarian logistics by describing a collaborative project between Georgia Tech and the World Food Programme (WFP) to improve WFP's sustained humanitarian supply chain operations. To make these improvements our team developed a mathematical model to evaluate the effects of strategic changes to the global supply chain, such as prepositioning, and an inventory management tool to standardize and facilitate inventory-ordering decisions.

2 - Lake to Puddle: A System Dynamics Approach to Social, Economic, and Environmental Consequences of Water Use in Udaipur, India

Ashka Dave, Washington University, St. Louis, MO, United States of America, ashkadave@gmail.com

In Udaipur water shortages are evident as lakes in the city dry to puddles every summer. The shortage results from the convergence of social, economic, and environmental factors and is detrimental due to the economic importance of lake tourism for residents. A system dynamics model was constructed in order to study: (1) interdependency of domestic, industrial, and tourist water use on the supply of water (2) areas for policy and interventions to alleviate water shortages, and (3) areas of future research. Collecting additional data will help test suggested interventions, which include reducing distribution losses, reducing demand, and treating polluted water.

3 - Robust Power Generation Planning Under Demand Uncertainty

Phoebe Zhimei Lai, University of California - Berkeley, Berkeley, CA, United States of America, phoebe.lai@berkeley.edu, Aurelie Thiele

We present a robust optimization approach to the power generation problem faced by an electric company in presence of demand uncertainty, where the random demand at each time period is modeled as an uncertain parameter belonging to a known range. We develop a novel modeling technique, based on demand aggregation, to successfully utilize the robust optimization methodology for this problem structure, i.e., right-hand-side uncertainty. Our computational study suggests that, in order to achieve the highest possible cost improvements, the width of the range forecast should be chosen to capture the shape of the demand distribution. Numerical experiments are very encouraging.

4 - Reasoning by Constraint Satisfaction

Rasit Cesur, Sakarya University, Turkey, rasitcesur@gmail.com

Human beings can be produced by a system that has a single function to work on different specialized data. How we find guilty in a crime case? We need evidences. Without evidences (information) there is no way to clarify the case. Constraints have to be satisfied to achieve goal in a CSP. The information has to be gained for finding guilty or solving any problem. Because of this similarity, our thinking mechanism can be handled as a CSP. In this study, spell checking problem is handled to understand our thinking modal regarding sensory motor stage described by Piaget.

■ SD47

C - Room 8, Level 2- Mezzanine

Joint Session Computational Biology/ HAS: Biological Applications

Cluster: Computational Biology and Bioinformatics/ Health Applications
Invited Session

Chair: Allen Holder, Rose-Hulman Institute of Technology, 5500 Wabash, Terre Haute, IN, United States of America, holder@rose-hulman.edu

1 - Accelerating ILP Solutions for Multi-state Phylogenetics Through Generalized Buneman Pruning

Russell Schwartz, Associate Professor, Carnegie Mellon University, 4400 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, russells@andrew.cmu.edu, Navodit Misra, R. Ravi, Guy Blelloch

Integer linear programming has proven a powerful tool for maximum parsimony phylogeny construction, but efficient solutions have depended on a solution-space pruning construct called the Buneman graph that is defined only for binary genetic data. Here we describe a generalization of Buneman theory to arbitrary numbers of states and present applications of the resulting ILP methods to various previously infeasible data types, such as amino acid sequences and copy number variations.

2 - Use of a New Dihedral Angle Measure in Modeling Protein Complexes

Jim Smith, Professor, University of Massachusetts, 160 Govenors Drive, Amherst, MA, 01003, United States of America, jmsmith@ecs.umass.edu, Corina Rusu

Our main objective in this research is to better understand the protein structure of a large protein complex of the Type III secretion system (T3SS). This Type III secretion is comprised of more than twenty unique proteins and is one of the most complex protein secretion apparatuses known. In particular, we will study the T3SS for {Yersina pestis} (plague).

3 - Contact Geometry of Protein Folds

Yosi Shibberu, Associate Professor Mathematics, Rose-Hulman Institute of Technolgy, 5500 Wabash Ave, Terre Haute, IN, 47803, United States of America, shibberu@rose-hulman.edu, Allen Holder

We review the problem of aligning the 3D structures of protein molecules and introduce a new geometric description of the problem using n-dimensional Euclidean geometry. The new geometric description has both geometric and graph theoretic elements which we describe.

4 - Ordering Genotypes to Decompose the Pure Parsimony Problem

Allen Holder, Rose-Hulman Institute of Technology, 5500 Wabash, Terre Haute, IN, United States of America, holder@rose-hulman.edu

We show that the problem of haplotyping by pure parsimony, which is known to be APX-hard, decomposes into smaller problems upon ordering the genotypes. The ordering induces a lattice like structure that allows a polynomial bound on the problem. The bound is sharp, and we identify a sub-class of problems that is solvable in polynomial time.

■ SD48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - AMPL Optimization LLC - New and Forthcoming Developments in the AMPL Modeling Language and System
Robert Fourer, AMPL Optimization, 900 Sierra Place SE, Albuquerque, NM, 87108, United States of America, 4er@ampl.com, David M. Gay

We describe recent and ongoing projects to extend and enhance AMPL to facilitate both formulation and implementation of optimization models. Extensions to AMPL's language will allow for more natural description of discrete models and stochastic data. New solver interfaces will make nontraditional solvers more accessible for practical modeling. A new callable interface to the AMPL system will facilitate business deployment.

2 - Ziena Optimization, Inc. - New Developments in the KNITRO 7.0 Optimization Solver
Richard Waltz, Ziena Optimization, Inc., 1801 Maple Avenue, Evanston, IL, 60201, United States of America, waltz@ziena.com

This software demonstration will highlight areas of improvement in the new version 7.0 release of the KNITRO optimization solver. Benchmark results will be presented showing significant performance gains for large-scale models. The demo will also provide an overview of how to effectively use KNITRO in a variety of environments and applications.

■ SD49

C -Room 10, Level 2- Mezzanine

Designing and Managing Systems Development Processes

Sponsor: Information Systems
Sponsored Session

Chair: Jungpil Hahn, Assistant Professor of Management, Purdue University, 100 S. Grant St., RAWL 4042, West Lafayette, IN, 47907, United States of America, jphahn@purdue.edu

1 - Coordination in Enterprise Architecting: Preliminary Findings
J. Alberto Espinosa, Associate Professor of Information Technology, American University, 4400 Massachusetts Ave., N.W., Washington, DC, 20016, United States of America, alberto@american.edu, Wai Fong Boh, Frank Armour

Enterprise architecture (EA) models the desired relationships between business processes and technology. Managing the EA can be daunting because of the complex interdependencies among business, technology and the people involved. This has received little attention and our study fills this gap. We provide preliminary evidence from a Grounded Theory study of 30 practitioner interviews.

2 - Fuzzy Methodologies: Recognizing Context in IS Project Management
Kelly Slaughter, Manager, Grant Thornton, 1717 Main, Dallas, TX, 75201, United States of America, kelly.slaughter@gt.com, Jennifer McClung, Nancy Murr, Blake Sellers

IS projects are frequently managed through invariant methodologies tailored to the project's idiosyncratic context though managerial improvisation. An interdisciplinary analysis of a two year IS implementation suggests introducing structured variations in these methodologies to accommodate knowledge related contingencies of organizational learning, spillover, IT worker experience, and user roles.

3 - Requirements Engineering and Logics of Innovation: Exploration and Exploitation in IS Development
Sean Hansen, Assistant Professor, Rochester Institute of Technology, Saunders College of Business, 105 Lomb Memorial Drive, Rochester, NY, 14623-5608, United States of America, swh4@case.edu, Michel Avital, Kalle Lyytinen

The exploration of new opportunities and the exploitation of existing competencies represent competing logics of innovation within organizations. Through its essential role in generating a design space between existing problems and design solutions, requirements engineering (RE) represents a domain where exploration and exploitation need to be integrated. Through a field study of IT professionals, we analyze the degree to which prevailing RE practice incorporates these logics of innovation.

4 - Knowledge Overlaps in Information System Development
Jungpil Hahn, Assistant Professor of Management, Purdue University, 100 S. Grant St., RAWL 4042, West Lafayette, IN, 47907, United States of America, jphahn@purdue.edu, Gwanhoo Lee

Information systems development (ISD) is a search process by which the ISD team seeks to find an optimal system configuration that produces the best results. Naturally, knowledge overlaps between business and IS play an important role in the ISD process. Using an NK fitness landscapes model, we investigate how knowledge overlaps influence ISD performance for varying levels of interdependencies among design choices, and for different distributions of within- and between-unit interdependencies.

■ SD50

C -Room 11, Level 2- Mezzanine

Trading Agents

Sponsor: Information Systems
Sponsored Session

Chair: Wolfgang Ketter, Assistant Professor, Erasmus University, Rotterdam School of Management, Department of Decision and Information Science, Rotterdam, Netherlands, wketter@rsm.nl

1 - Preference Modeling in a Competitive Agent-based Energy Market
Yixin Lu, PhD Candidate, Rotterdam School of Management, Erasmus University Rotterdam, Burgemeester Oudlaan 50, Rotterdam, 3062 PA, Netherlands, ylu@rsm.nl, Wolfgang Ketter, John Collins, Eric van Heck, Manuela Veloso, Prashant Reddy

TAC Energy is a competition that models future retail energy markets to facilitate research in economic decision-making in Smart Grids. It challenges research teams to design agents which would act as energy retail brokers, purchasing power from distributed sources and regional energy exchanges, and selling power to consumers and exchanges. To develop profitable portfolios, such broker agents must estimate and reason about different customers' preferences in an effective and efficient way.

2 - TacTex09: a Champion Bidding Agent for Ad Auctions
Peter Stone, Associate Professor, The University of Texas at Austin, 1 University Station C0500, Austin, TX, 78712, United States of America, pstone@cs.utexas.edu, Doran Chakraborty, David Pardoe

In the Trading Agent Competition Ad Auctions Game, agents compete to sell products by bidding to have their ads shown in a search engine's sponsored search results. We report on the winning agent from the first (2009) competition, TacTex. TacTex estimates the full game state from limited information, uses these estimates to make predictions, and then optimizes its actions (daily bids, ads, and spending limits) with respect to these predictions.

3 - Agent-based Test Bed Study of Participant Behavior in Integrated Financial and Real Energy Markets
Abhishek Somani, Economics PhD Candidate, Iowa State University, 260 Heady Hall, Iowa State University, Ames, IA, 50011, United States of America, somaniabhishek@yahoo.com, Leigh Tesfatsion

Financial and real markets are intricately connected in restructured electric power systems. Participant behaviors in these integrated markets are not well understood and, additionally, not easily studied using conventional analytical models. This talk will discuss the potential use of agent-based test beds for conducting such studies.

4 - Agent-based Simulation of Private Customer Reactions to Variable Electricity Pricing
Carsten Block, Karlsruhe Institute of Technology, Karlsruhe, Germany, carsten.block@kit.edu, John Collins, Sebastian Gottwalt, Wolfgang Ketter

Demand Side Management is important for future Smart Grids. We present a model that simulates energy consumption of households when customers face varying energy prices. Software agents simulate private customer electricity consumption in a smart home. Customer preferences and the price for electricity determine the use of appliances. The simulation shows results on the impact of time-based demand-response tariffs. Different pricing schemes for private electricity customers are tested.

■ SD51

C -Room 12, Level 2- Mezzanine

ICS Prize Winners

Sponsor: Computing Society
Sponsored Session

Chair: Samuel Burer, Associate Professor, University of Iowa, S346 Pappajohn Business Building, Iowa City, IA, 52242-1994, United States of America, samuel-burer@uiowa.edu

1 - ICS Prize Winners

The winners of the 2010 ICS Prize and the 2009 ICS Student Paper Award present their award-winning work.

2 - On the Nullstellensatz Method for Combinatorial Optimization

Susan Margulies, Pfeiffer-VIGRE Post-doctoral Instructor, Rice University, 6100 Main St. MS #134, Houston, TX, 77005, United States of America, susan.margulies@rice.edu, Shmuel Onn, Jon Lee, P.N. Malkin, Jesus A. De Loera

Unlike linear models, systems of multivariate polynomial equations over the complex numbers or finite fields can be compactly used to model combinatorial problems. In this way, a problem is feasible (e.g. a graph is 3-colorable, Hamiltonian, etc.) if and only if a given system of polynomial equations has a solution. In the work of M. Laurent, J. Lasserre and P. Parrilo, Y.Nesterov, and others, continuous optimization problems which are modeled by zero-dimensional radical ideals have been shown to have a finite sequence of semidefinite programs that converge to an optimal solution. For yes/no combinatorial decision problems (e.g., is a graph G 3-colorable?), we observed that Hilbert's Nullstellensatz gives a sequence of {\em linear algebra} problems that eventually determines feasibility. This has advantages as linear algebra is quite stable on computation and sparsity is well-understood. In this talk, we present theoretical and experimental results on these sequences of large-scale, sparse, linear algebra relaxations to the combinatorial optimization problem. We show that the size of the smallest Nullstellensatz linear algebra system certifying that there is no stable set of size larger than the stability number of the graph grows as the stability number of the graph. We additionally describe ideas for optimizing the method, such as utilizing alternative forms of the Nullstellensatz, adding carefully-constructed polynomials to the system, branching and exploiting symmetry. Finally, in the case of 3-colorability, we use this method to successfully solve graph problem instances having thousands of nodes and tens of thousands of edges.

3 - A New Stochastic Derivative Estimator for Discontinuous Payoff Functions with Application to Financial Derivatives

Yongqiang Wang, University of Maryland, College Park, 3182 AVW, College Park, MD, United States of America, yqwang@umd.edu, Michael Fu, Steven Marcus

The paper describes a new unbiased stochastic derivative estimator for a class of discontinuous payoff functions that arise in many options pricing settings from finance. The method generalizes two other well-known methods (infinitesimal perturbation analysis and the likelihood ratio method) and can be applied to functions of more general forms containing indicator functions. In addition, the new estimator can be computed from a single sample path or simulation, whereas existing estimators in the literature require additional simulations.

■ SD52

C -Room 13, Level 2- Mezzanine

Logistics Challenges and Supply Chain Innovation

Sponsor: Military Applications
Sponsored Session

Chair: Thomas Turner, Principal Operations Research Analyst, Concurrent Technologies Corporation, 747 River Road, Hollis, ME, 04042, United States of America, turnert@ctc.com

1 - Using Simulation to Support Maintenance and Rotation Planning for the Marine Corps Armor Fleet

Thomas Turner, Principal Operations Research Analyst, Concurrent Technologies Corporation, 747 River Road, Hollis, ME, 04042, United States of America, turnert@ctc.com, Alan Moses

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.

2 - Effect of Variable Improvement Factor on Optimal Preventive Maintenance and Replacement Schedules

Kamran Moghaddam, Post-Doctoral Research Associate, University of Louisville, Department of Industrial Engineering, Louisville, KY, 40292, United States of America, ksmogh01@louisville.edu, John Usher

We develop a new mathematical formulation to determine optimal preventive maintenance and replacement schedule of a system. We model the cases of minimizing total cost and maximizing the system reliability. We present a new mathematical function to model the improvement factor based on the ratio of maintenance and repair costs, and show how it outperforms fixed improvement factor models by analyzing the effectiveness of in terms of cost and reliability of the system.

3 - Flowcasting: A BreakThrough in Supply Chain Integration

Sylvain Landry, Professor, HEC Montréal, 3000 Cote-Sainte-Catherine, Montreal, Qc, H3T2A7, Canada, sylvain.landry@hec.ca, Jacques Roy, Martin Beaulieu

Since the bullwhip effect was demonstrated by Forrester, many attempts have been made to fight it. It occurs when each link in a supply chain acts independently and is unconnected to consumer demand at the point of sale. A revolutionary method called flowcasting uses a single forecast at the store level to replenish the entire supply chain through DRP/MRP planning to manage the flow instead of forecasting demand at each level. This presentation will describe this approach and its impact.

4 - A Center for Innovation in Logistics Systems

Greg Parlier, Institute for Defense Analyses, Madison, AL, United States of America, gparlier@ida.org

A comprehensive analytical architecture to enable US Army Logistics Transformation is presented, incorporating an "engine for innovation" to accelerate and sustain continual improvement. Strategic management challenges are addressed, including management information and decision support systems, human capital investment needs, organizational design and strategic alignment for a learning organization.

■ SD53

C -Room 14, Level 2- Mezzanine

Telecommunications

Contributed Session

Chair: Carlos Oliveira, Bloomberg LP, 731 Lexington Avenue, New York, NY, United States of America, coliveira@gmail.com

1 - From Herding Sheep to Herding Cats: Balancing Compliance and Innovation in the Internet Age

Chintan Vaishnav, Massachusetts Institute of Technology, 32 Vassar Street, Room 32-G806, Cambridge, MA, 02139, United States of America, chintanv@mit.edu

This research analyzes how a telecommunications regulator can balance compliance with innovation as the Internet disrupts traditional communications technologies. We have developed a system-level dynamic feedback model of regulation, competition, and innovation in telecommunications. We propose a combination of two policy levers-Limiting Significant Market Power (SMP) Accumulation and Building Broad-based Consensus around Regulatory Issues-that most effectively achieve the desired balance.

2 - The Impact of Vertical Market Entry of Network Operators in the Wireless Telecom Industry

Xiahua Wei, University of California, San Diego, Department of Economics, La Jolla, CA, 92092-0534, United States of America, xiwei@ucsd.edu

Mobile virtual network operators (MVNOs) purchase airtime from mobile network operators (MNOs) and resell the service, as they do not have spectrum license or necessary network infrastructure. This study seeks to understand the impact of this vertical relationship on incumbent MNOs' performance. I first construct a model to explain why MNOs sell to MVNOs rather than acquiring them in a vertical integration. I further investigate empirically whether MNOs benefit from such a strategic partnership.

3 - Forecasting New Technologies in Telecommunications: Past Experience and Future Directions

Lawrence Vanston, President, Technology Futures, Inc., 13740 Research Blvd, Bldg C-1, Austin, TX, 78750, United States of America, lvanston@tfi.com

Forecasting new technologies requires judgment, knowledge and modeling skills in a world where success is relative and delayed. For 25 years, telecom has provided a rich forecasting environment with seismic transitions in broadband, wireless, fiber optics, the Internet, etc. The future is as promising. In this presentation I draw lessons from past forecasts, provide ideas about the future and explain how modeling skills from operations research apply to the fuzzy world of forecasting the future.

4 - The Deterministic Wireless Local Area Design Problem
Jason Kratz, Graduate Student, Southern Methodist University, 6425 N. Ownby Drive, Dallas, TX, United States of America, jkratz@smu.edu

We have designed an algorithm that uses partitioning and global optimization techniques to place Access Points (APs) for a Wireless Local Area Network Design Problem with known locations of Mobile Devices (such as Desktop Computers). This algorithm does not require a set of fixed potential AP locations. We have also conducted an empirical analysis comparing our algorithms with other metaheuristic algorithms.

5 - Optimization Models for Center Based Multicasting Routing
Carlos Oliveira, Bloomberg LP, 731 Lexington Avenue, 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.

■ SD54

C -Room 15, Level 2- Mezzanine

Panel Discussion: Meet the Editors and Ask Them Questions

Sponsor: Technology Management/New Product Development
Sponsored Session

Moderator: Leonardo Santiago, Federal University of Minas Gerais, Department of Production Engineering, Av. Antonio Carlos, 6627 - Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br

1 - Panel Discussion: Meet the Editors and Ask Them Questions
Panelists:Leonardo Santiago, Federal University of Minas Gerais, Department of Production Engineering, Av. Antonio Carlos, 6627 - Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br, Cheryl Gaimon, Regents' Professor, Georgia Institute of Technology, College of Management, Atlanta 30308, United States of America, cheryl.gaimon@mgt.gatech.edu, Daniel Levinthal, Reginald H. Jones Professor of Corporate Management, Wharton School, University of Pennsylvania, Philadelphia PA, United States of America, dlev@wharton.upenn.edu, Rajiv Sabherwal, University of Missouri Curators Professor, University of Missouri at St. Louis, sabherwal@umsl.edu, Morgan Swink, Professor and Eli Broad Legacy Fellow, Michigan State University, swink@bus.msu.edu, Kamalini Ramdas,London Business School, Regent's Park, London NW14SA, United Kingdom, kramdas@london.edu, Stylianos Kavadias,Associate Professor, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, United States of America, Stylianos.Kavadias@mgt.gatech.edu

(i) Prof Kamalini Ramdas, Department of Entrepreneurship and Innovation of Management Science; (ii) Prof Cheryl Gaimon, Department of Management of Technology of Production and Operations Management; (iii) Prof. Dan Levinthal, Organizational Science; (iv) Prof Rajiv Sabherwal, IEEE Transactions of Engineering Management; (v) Prof Morgan Swink, Journal of Operations Management; (vi) Prof Stylianos Kavadias, Department of NPD, R&D, and Project Management of Production and Operations Management

■ SD55

C -Room 16, Level 2- Mezzanine

New Product Development

Contributed Session

Chair: Katrina Appell, PhD Candidate, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48103, United States of America, appell@umich.edu

1 - An Integrated Approach to Supply Chain Configuration by Matching with PD Decisions
Bimal Nepal, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, nepal@tamu.edu, Femi Famuyiwa, Leslie Monplaisir

Supply chain configuration decisions are directly influenced by the decisions made at early stages of the product development (PD) process. This paper presents an integrated approach to supply chain configuration at early stages of the product development by matching the SC design with product architecture type. A multi-objective optimization is presented by considering total supply chain costs and computability factors for supplier selection at each node of the SC.

2 - Global Procurement Decision-making Model for New Product Components
Masatake Saito, Boston University, 133 Park St. #805, Brookline, MA, 02446, United States of America, msaito@tamacc.chuo-u.ac.jp

Global procurement decision makers have to select the best component out of many possible alternatives. The selection of a supplier is based not only on quality, cost and delivery but also on suppliers' value, risk and logistics cost, etc. This decision type could be applied to new model which combined an improved AHP method and a multi-objective problem under some constraints. In this paper, we propose a decision-making model and a framework for a decision support system.

3 - Lean Product Development: An Analysis of Two Deployments
Katrina Appell, PhD Candidate, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48103, United States of America, appell@umich.edu

Lean product development has been well documented, although techniques for successful transformation from traditional environments to lean product development have not been. The research objective is to better understand the methodology by which lean product development is appropriately deployed in traditional product development environments. This will be explored with a comparative study of two deployments comparing an enterprise-wide approach with a project level focused approach.

■ SD56

C - Room 1, Level 1

Simulation Optimization Techniques

Sponsor: Simulation Society
Sponsored Session

Chair: JianQiang Hu, Professor, Fudan University, 670 GuoShun Road, Siyuan Building, Room 508, Shanghai, 200433, China, hujq@fudan.edu.cn

1 - Optimization Methods for VaR Constrained Portfolio Selection Problems
Xiaoling Sun, Professor, Fudan University, 670 Guoshun Road, Shanghai, China, xls@fudan.edu.cn, Xueting Cui, Xiaojin Zheng, Duan Li

In this talk, we discuss the sample model of VaR constrained mean-variance portfolio selection problem. We propose several convex relaxations based on semidefinite programming and second-order cone programming for the mixed-integer quadratic programming reformulation problem. Branch-and-bound method based on SDP and SOCP relaxations is discussed. Computational results with Monte-Carlo sampling and historic data are also presented.

2 - A Kriging Based Tradeoff Between Exploration and Exploitation
Jeff Hong, Hong Kong University of Science and Technology, Dept of Industrial Engineering and Logis, Hong Kong - PRC, hongl@ust.hk, Lihua Sun

Random search algorithms are often used to solve black box optimization problems. Sampling distributions used in these algorithms need to balance the efforts for exploration (global search) and exploitation (local search). In this paper, we propose a kriging based approach that uses a Gaussian process to construct a sampling distribution in each iteration of the optimization algorithm, and demonstrate the advantages of our approach.

3 - Model-based Evolutionary Optimization
Michael Fu, Professor, University of Maryland-College Park, 4305 Van Munching Hall, College Park, MD, 20742, United States of America, mfu@umd.edu, Steven Marcus, Yongqiang Wang

We propose a new framework for global optimization by building a connection between global optimization problems and evolutionary games, based on which we develop a Model-based Evolutionary Optimization (MEO) algorithm. MEO gives a new insight into the mechanism of model updating in model-based global optimization algorithms. Based on MEO, a novel Population Model-based Evolutionary Optimization algorithm is proposed, which better captures the multimodal property of global optimization problems.

4 - Contamination Control in Food Supply Chain
JianQiang Hu, Professor, Fudan University, 670 GuoShun Road, Siyuan Building, Room 508, Shanghai, 200433, China, hujq@fudan.edu.cn, Feng Chun Wang, Rong Zeng Cao, Yifan Xu, Yingjie Hu

In this paper, we study a contamination control problem in food supply chain. We formulate the problem as a dynamic programming problem and then study the structure of the optimal control which turns out to be very similar to the hedging-point type of policy. Under the environment in which there is uncertainty associated with contamination control, the problem becomes a stochastic dynamic programming problem, for which we propose a simulation based method.

■ SD57

C - Room 2, Level 1

Advances in Modeling and Optimization of Risk

Cluster: Risk Management
Invited Session

Chair: Paul Krokhmal, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States of America, krokhmal@engineering.uiowa.edu

1 - Deviation Measures: Theory and Applications
Michael Zabarankin, Associate professor, Stevens Institute of Technology, Castle Point on Hudson, Hoboken, NJ, 07030, United States of America, Michael.Zabarankin@stevens.edu

The talk surveys recent progress in the theory and application of general measures of deviation.

2 - Risk Management Techniques for Fixed Charge Network Flow Problems with Uncertain Arc Disruptions
Vladimir Boginski, University of Florida, Shalimar, FL, United States of America, boginski@reef.ufl.edu, Artyom Nahapetyan, Alexey Sorokin

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 disruptions. We demonstrate that efficient heuristics for finding good quality solutions (within less than 5% from optimality on becnchmark instances) can be utilized, and present computational results for large and dense networks.

3 - Serial Chain Merger Evaluation Model and Application to Mortgage Banking
Dash Wu, Assisstant Professor, Reykjavik University and University of Toronto, Nauthólsvìk, Venus, 2, Iceland, 1 Spadina Crescent Room 205,Toronto, ON, toronto, Canada, DWu@rotman.utoronto.ca, John Birge

Mortgage banking operations can be viewed from the supply chain perspective. This paper describes a series-chain-merger DEA model to assess potential gains from the merger of different chain operations. We show that in our framework the merger of different chains with many sub-chains is efficient within the DEA paradigm if and only if the mergers of sub-chain members are all efficient. A case study is conducted.

■ SD58

C - Room 3, Level 1

Recent Development in Quantitative Finance

Cluster: Quantitative Finance
Invited Session

Chair: Xin Guo, Associate Professor, University of California Berkeley, IEOR, Berkeley, CA, 94720, United States of America, xinguo@ieor.berkeley.edu

1 - Sequential Importance Sampling And Resampling for Portfolio Credit Risk
Kay Giesecke, Stanford University, 414 Terman Center, Stanford, CA, United States of America, giesecke@stanford.edu, Dmitry Smelov

We formulate and evaluate a sequential Monte Carlo method for estimating rare-event probabilities in dynamic, intensity-based point process models of portfolio credit risk. The method uses a resampling scheme to track the zero-variance importance measure associated with the event of interest. Numerical results illustrate the performance of the method, and highlight its advantages over other simulation schemes recently developed for estimating portfolio credit risk.

2 - Dynamic Bertrand Oligopoly
Andrew Ledvina, Princeton, Sherrerd Hall, Princeton University, Princeton, NJ, 08544, United States of America, aledvina@princeton.edu, Ronnie Sircar

We study continuous time Bertrand oligopolies in which a small number of firms producing similar goods compete with one another by setting prices. We first analyze a static version of the game, and then we analyze the dynamic game which results in a nonzero-sum stochastic differential game. We characterize certain qualitative features of the game using an asymptotic approximation in the limit of small competition. The equilibrium of the game is further studied using numerical solutions.

3 - Optimal Contracting Under Incomplete Information
Agostino Capponi, California Institute of Technology, 1200 E. California Blvd., Pasadena, CA, 91125, United States of America, agcappo@gmail.com, Jaksa Cvitanic

We extend the classical contracting theory in continuous time by assuming that the outcome process controlled by the agent can only be observed with noise. Thus, both agent and principal have to filter the observations when deciding on the optimal contract. Unlike in the classical case, the optimal effort and fee paid to the agent depend on the contracting time horizon. Their relationship, while still linear, is now influenced by time horizon, riskiness of the project and intensity of noise.

4 - Blind Portfolio Auctions via Intermediaries
Benjamin Van Roy, Associate Professor, Stanford University, Terman 315, Stanford University, Stanford, CA, 94305, United States of America, bvr@stanford.edu, Michael Padilla

A large volume of assets are sold by institutional investors to execution service providers through blind portfolio auctions. The associated uncertainty creates inefficiencies. We propose a mechanism that makes use of a trusted intermediary to improve efficiency, and demonstrate significant increases in seller revenue, equivalent agent payoff, and total equivalent social welfare.

■ SD59

H - Salon A, 4th Floor

Doing Good with Good OR Student Competition

Cluster: Doing Good with Good OR Student Competition
Invited Session

Chair: John Fowler, Arizona State University, School of Computing, Informatics, and Decision Systems Engineering, Tempe, AZ, United States of America, john.fowler@asu.edu

Co-Chair: James Cochran, Louisiana Tech University, Department of Marketing & Analysis, P.O. Box 10318, Ruston, LA, 71272, United States of America, jcochran@cab.latech.edu

1 - Strategic Planning for Disaster Recovery with Stochastic Last Mile Distribution
Carleton Coffrin, PhD Student, Brown University, 115 Waterman Street, Box 1910, Province, RI, 02906, United States of America, cjc@cs.brown.edu, Pascal Van Hentenryyck, Russell Bent

We consider the single commodity allocation problem (SCAP) for disaster recovery. SCAPs are stochastic optimization problems that combine resource allocation and warehouse routing. This work formalizes the specification of SCAPs and presents a multi-stage hybrid-optimization algorithm that utilizes the strengths of mixed integer programming, constraint programming, and large neighborhood search.

2 - Prostate Cancer Screening: What is the Societal Benefit?
Jingyu Zhang, North Carolina State University, 375 Daniels Hall, 111 Lampe Dr, North Carolina State University, Raleigh, NC, 27695, United States of America, jzhang2@ncsu.edu, Brian T. Denton, Hari Balasubramanian, Brant Inman, Nilay Shah

Prostate cancer is the most common solid tumor that affects American men. PSA is a biomarker used for early detection of prostate cancer. However, due to the imperfect nature of the test, PSA screening is controversial. We present an optimization model for PSA based screening. Using our model we estimate the total societal benefit for PSA based screening in the U.S. Our study sheds light on the debate about whether and how to conduct prostate cancer screening.

3 - Increasing Food Delivery Through Port Simulation and Overland Transportation Route Optimization
Jordan Stone, Georgia Institute of Technology, 765 Ferst Dr, Atlanta, GA, United States of America, jordanstone@gatech.edu, Rene Alvarenga, Dani Slaton

The World Food Programme (WFP) provides year-round aid to food-deficient countries. We developed a shipment scheduling and routing tool to improve WFP land transportation operations in Eastern Africa. Using this tool, WFP can expect a decrease in shipment lead times and costs and increase their efforts to combat worldwide hunger.

■ SD60

H - Salon B, 4th Floor

Decision Analysis Practice Awards Finalists

Sponsor: Decision Analysis
Sponsored Session

Chair: Eric Bickel, Assistant Professor, The University of Texas at Austin, Operations Research / Industrial Enginee, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, ebickel@mail.utexas.edu

1 - Decision Analysis Practice Awards Finalists

Eric Bickel, Assistant Professor, The University of Texas at Austin, Operations Research / Industrial Enginee, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, ebickel@mail.utexas.edu

The DAS Practice Award is given annually to the best application of decision analysis, as judged by a panel of decision analysis academics and practitioners. In this session the finalists will present their work. The winner will be announced during the Decision Analysis Society Awards on Monday.

2 - The Implementation of Decision Analysis at Chevron: 20 Years of Building a DA Culture

Frank Koch, Decision Analysis Practice Leader, Chevron Project Resources Co., 1400 Smith Street, Houston, TX, 77002, United States of America, FGKO@chevron.com, Larry Neal, Brian Putt

Decision analysis has been integrated into Chevron's major capital project development process since the mid-1990's. DA is required for all capital investments greater than $50 million. Currently Chevron has over 50 major projects underway with a total capital investment over $150 billion (Chevron's share). Since 2000 over 12,000 employees have been introduced to DA as part of our capital stewardship strategy, including decision makers from CEO down to project managers. During the past few years Chevron has created a functional organization to manage our decision analysts' careers. Chevron has also developed proprietary decision analysis software based on the best practices of our most experienced analysts. Through our use of decision analysis, our leadership has a clearer understanding of the range of potential outcomes of their decisions and greater alignment on commitment to action.

3 - AISoy 1, A Robot that Perceives, Feels and Makes Decisions

David Rios Insua, Royal Academy of Sciences, Madrid, Spain, david.rios@urjc.es, Diego Garcìa, José M. Vidal, Carlos Pallardó, Ra'l Moreno

AISoy 1 is a new social emotional robot on sale from AISoy Robotics. It may be described as a robot that perceives, feels and makes decisions. We shall describe its architecture, placing emphasis on how decision analytic and Bayesian methods support AISoy 1 actvities when processing information received through its sensors, forecasting the evolution of its environment, adapting its emotional state and choosing the actions to be made.

4 - Neuroscience Trials Australia Uses Decision Analysis to Select Acute Stroke Imaging Software Platform for Extending the Time for Thrombolysis in Emergency Neurological Deficits (EXTEND) Clinical Trial

Leonid Churilov, National Stroke Research Institute, The University of Melbourne, Melbourne, Australia, leonid.churilov@gmail.com, Yoshinari Nagakane, Daniel Liu, Soren Christensen, Henry Ma, Stephen M. Davis, Geoffrey Donnan

Patients with evidence of potentially salvageable brain tissue post onset of ischaemic stroke are likely to be most therapeutically responsive to treatment with tissue Plasminogen Activator (tPA). A complex combination of Magnetic Resonance Imaging (MRI) scans could be used to identify this salvageable tissue and a variety of software platforms for its rapid identification are now available. In this presentation we discuss how multi-attribute rating procedures followed by sensitivity analyses were successfully used to select the most appropriate imaging software platform for a multi-centre acute stroke clinical trial aimed at increasing the number of patients eligible for stroke treatment.

■ SD63

H - Room 404, 4th Floor

Decision Analysis to Decision Influence

Sponsor: Decision Analysis
Sponsored Session

Chair: Prakash P. Shenoy, Distinguished Professor, Kansas University Business School, 1300 Sunnyside Ave, Summerfield Hall, Lawrence, KS, 66045-7601, United States of America, pshenoy@ku.edu

1 - On Solving Hybrid Influence Diagrams Containing Deterministic Variables

Prakash P. Shenoy, Distinguished Professor, Kansas University Business School, 1300 Sunnyside Ave, Summerfield Hall, Lawrence, KS, 66045-7601, United States of America, pshenoy@ku.edu, Yijing Li

We describe a framework and an algorithm for solving hybrid influence diagrams containing deterministic variables. Hybrid influence diagrams are influence diagrams with a mix of discrete, continuous, and deterministic chance variables. A continuous chance variable is said to be deterministic if its conditional distributions have zero variances.

2 - The Doctor and the Statistician: Practical Use Value of Information for Fast Track Cancer Treatment

Stuart Harris, Director Pharmaceutical DA Consulting, Decision Frameworks, L.P., Washington, DC, United States of America, StuartHarris@DecisionFrameworks.com

In this real world example, an oncology physician sees compelling results in an underpowered Phase I study and wants to accelerate development. But the biostatistician feels it would be foolish. This presentation introduces a practical framing and VOI work-flow to evaluate early, less powered, trial designs to mitigate risk or kill poor compounds early. A fast track for cancer treatment case example illustrates the approach and introduces an easy to understand management summary report.

3 - Effectively Communicating Analytic Methods for Non Analyst Decision Makers: A Case Study

Jay Andersen, Decision Sciences, Eli Lilly and Co., Indianapolis, IN, United States of America, jsa@lilly.com

At times, the analytic methods of the portfolio advisor do not produce the desired result. What seems straightforward to the advisor appears puzzling to the decision maker and leads to less clarity, not more. This discussion will focus on taking the decision maker's perspective, and will examine four case studies: one that was effective, two that were not, and one that is in progress.

■ SD68

H - Room 415, 4th Floor

New Technology Management

Sponsor: eBusiness
Sponsored Session

Chair: Byung Cho Kim, Virginia Tech, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, bck@vt.edu

1 - Simultaneous or Sequential Launch of New IT

Byung Cho Kim, Virginia Tech, 1007 Pamplin Hall (0235), Blacksburg, VA, 24061, United States of America, bck@vt.edu, Hemant Bhargava, Daewon Sun

This paper examines product introduction strategies of new IT. We investigate whether simultaneous or sequential launch is better for a manufacturer of new IT under monopoly. Inspired by Apple's introduction of iPod Touch, a lower-quality version of iPhone, we aim at understanding the incentive of a monopolist to provide a full-quality version first then a reduced-quality version later. We examine how uncertain third parties' application development affects Apple's product launch strategy.

2 - Efficient Structures for Innovative Social Networks

Amitabh Sinha, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, amitabh@umich.edu, William Lovejoy

What lines of communication in an organization are most productive in the ideation phase of innovation? We investigate this with a recombination and selection model of knowledge transfer operating through a social network. We find that ideation is accelerated when agents churn through a large set of conversational partners, which begets short path lengths and eliminates information bottlenecks. The idealized core-periphery graphs emerge as an important family on the time-cost efficient frontier.

3 - Condition Monitoring of Enterprise Systems Enhanced by Wireless Communication and Cloud Computing

Radu Babiceanu, Assistant Professor, University of Arkansas at Little Rock, Little Rock, AR, 72204, United States of America, rfbabiceanu@ualr.edu

The importance of condition monitoring and fault diagnosis is growing continuously due to the increase in criticality for reliability and safety requirements for large-scale industrial systems. This work presents a systems engineering approach for the integration of several relatively new technologies, such as RFID, Wireless Sensor Networks, and Cloud Computing with the objective of delivering accurate real-time status information, as well as providing system lifetime prediction capabilities.

4 - Applying the IS Success Model and Flow Theory to Explain Consumer Behavior in e-Brokerage Services

David Ding, Assistant Professor, University of Houston, T2-230C, Technology II Building, Houston, TX, 77204, United States of America, xding@central.uh.edu

In this study, we test constructs from IS and psychology in an integrated theoretical framework. Specifically, we examine how system characteristics affect the cognitive states of flow experience, which in turn determines customer satisfaction and intention to use. We empirically test the framework with responses from online investors. Our empirical results clarify the important antecedents and consequence of consumer behavior in e-brokerage services.

■ SD69

H - Salon F, 6th Floor

Panel Discussion: Roundtable Session II - On the Collaborative Railroad Research

Sponsor: Railway Applications
Sponsored Session

Moderator: Chris Barkan, Professor, University of Illinois at Urbana-Champaign, 205 N Mathews RM1203, Urbana, IL, 61801, United States of America, cbarkan@illinois.edu

Moderator: Teodor Gabriel Crainic, CIRRELT, 2920, Chemin de la Tour, Montreal, QC, H3T 1J4, Canada, TeodorGabriel.Crainic@cirrelt.ca

1 - Panel Discussion: On the Collaborative Railroad Research

Panelists: Homarjun Agrahari, Sr. Operations Research Specialist, BNSF Railway, 6308 Kristen Dr., Fort Worth, TX, 76131, United States of America, homarjun.agrahari@bnsf.com, Chris Barkan, Professor, University of Illinois at Urbana-Champaign, 205 N Mathews RM1203, Urbana IL 61801, United States of America, cbarkan@illinois.edu, Dharma Acharya, AVP - Operations Research, CSX, 500 Water St. J250, Jacksonville FL 32202, United States of America, Dharma_Acharya@CSX.com, Pooja Dewan, BNSF Railway Company, Ft. Worth TX, United States of America, Teodor Gabriel Crainic, UQAM, C.P. 6128, succursale Centre-ville, Montreal, Canada John Gray, Association of American Railroads, United States of America

Different railway companies end up solving same problems in isolation in the absence of a collaborative research environment. Individual research not only costs more but it also takes more time for breakthroughs since research findings are not shared at all or shared too late. In the round table, experts from academia, industry and government will share their views on various research collaboration and IP rights sharing settings, and their pros and cons. The session will conclude with a panel discussion on future directions and the role RAS/INFORMS/Government can play in facilitating such research collaborations.

■ SD70

H - Salon G, 6th Floor

Aviation Environmental Impact Mitigation

Sponsor: Aviation Applications
Sponsored Session

Chair: Karen Marais, Assistant Professor, Purdue University, 701 West Stadium Ave, W Lafayette, IN, 47907, United States of America, kmarais@purdue.edu

1 - Scheduling of Runway Operations for Reduced Environmental Impact

Gustaf Solveling, Graduate Research Assistant, Georgia Institute of Technology, 765 Ferst Dr NW, GA Tech ISyE, Atlanta, GA, United States of America, gustaf.solveling@gatech.edu, Senay Solak, John-Paul Clarke, Ellis Johnson

In this study, we derive several insights about the value of environmental optimization for runway scheduling. More specifically, using actual flight data we compare environmentally optimal schedules with first-come-first-serve based policies and fuel-optimal schedules. We determine that while significant savings in environmental costs can be achieved through environmentally optimal schedules, these savings are not much different than those obtained through fuel-optimal schedules.

2 - Estimation of Aircraft Taxi-out Fuel Burn Through Analysis of Flight Data Recorder Information

Hamsa Balakrishnan, Massachusetts Institute of Technology, 77 Massachusetts Ave., 33-328, Cambridge, MA, 02139, United States of America, hamsa@mit.edu, Harshad Khadilkar, Tom Reynolds

Aircraft taxi processes result in fuel burn, emissions and surface delays. The objective of this work is to estimate aircraft taxi-out fuel burn, given its trajectory on the ground. A fuel burn model is developed through regression analysis of archived Flight Data Recorder information from over 2000 flights of 9 different aircraft types. The statistical significance of several factors such as taxi time, stops, and turns is studied, and the results for different classes of aircraft are compared.

3 - Environmental Feasibility of Alternative Jet Fuels

James Hileman, Principal Research Engineer, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 33-115, Cambridge, MA, 02139, United States of America, hileman@mit.edu, Russell Stratton, Matthew Pearlson, Christoph Wollersheim

This study assessed the feasibility of reducing GHG emissions from the aviation industry through the use of alternative fuels. The focus was on the life cycle greenhouse gas emissions from the production of jet fuels from conventional fossil sources, terrestrial biomass, and renewable oils. This information was supplemented with economic, land and water impacts to understand the potential limits on alternative fuel production. The briefing will present insights gained from these examinations.

4 - Operational Strategies to Mitigate the Environmental Impact of Aviation

Karen Marais, Assistant Professor, Purdue University, 701 West Stadium Ave, W Lafayette, IN, 47907, United States of America, kmarais@purdue.edu, Tom Reynolds, John Hansman, Delri Muller, Payuna Uday, Jonathan Lovegren

Changing aircraft operational procedures can be used to mitigate aviation's environmental impacts in shorter time frames with existing aircraft types. This work compares the relative benefit of these improvements to identify priorities for implementation. The research includes a list of the most promising environmental impact reduction measures, together with a quantitative assessment of their environmental impact reduction potential and barriers to implementation.

■ SD71

H - Salon H, 6th Floor

Statistical Methods in DEA

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Andrew Johnson, Texas A&M University, Department of Industrial and Systems Eng, College Station, TX, 77840, United States of America, ajohnson@tamu.edu

1 - Nonparametric Estimation and Statistical Tests of Components of Productivity Change

Rajiv Banker, Temple University, Philadelphia, PA, United States of America, banker@TEMPLE.EDU, Ram Natarajan, Srinivasan Parthasarathy

We describe how productivity change and technical change can be measured using Data Envelopment Analysis (DEA) and provide statistical justification for two commonly used tests, the Student's T-test and the sign test to evaluate whether productivity and technical change has occurred. We also examine the performance of the test statistics developed in this paper through extensive Monte Carlo simulations. We show that test statistics derived from the computationally simple, one-shot metrics perform better than those derived from estimators that are based on computationally more intensive, bootstrap procedures. This finding holds in the presence of noise, is robust to small sample sizes, as well as when the production correspondence involves multiple inputs.

2 - Multiple Variable Proportionality in Data Envelopment Analysis

Wade D. Cook, York University, Toronto, ON, Canada, wcook@schulich.yorku.ca, Joe Zhu

Data envelopment analysis (DEA) provides an optimization methodology for deriving an efficiency score for each member of a set of peer decision making units. Under the original DEA model of Charnes, Cooper and Rhodes (1978) it was assumed that there are constant returns to scale (CRS). This idea was later extended by Banker, Charnes and Cooper (1984) to the more general case that allowed for variable returns to scale (VRS). In both of these structures, it is assumed that the returns to scale (RTS) classification, consistent with the classical definition, applies

to the entire (input, output) bundle. In many settings it can be the case that the output bundle can be separated into distinct subgroups or business units wherein an RTS-type behavior may be different for one subgroup than for another. We refer to such situations as involving multiple variable proportionality (MVP). Examples of MVP occur when there are different product groupings in a manufacturing facility, different wards in hospitals, and so on. Identification of such differential behavior can provide management with important insights regarding the most productive proportionality size (MPPS) in each of those components. In the current paper we introduce DEA-based tools that address those situations where MVP exists.

3 - How to Test the Effects of Operational Conditions and Practices on Productive Performance?

Andrew Johnson, Texas A&M University, Department of Industrial and Systems Eng, College Station, TX, 77840, United States of America, ajohnson@tamu.edu, Timo Kuosmanen

Johnson and Kuosmanen (2009) developed a new method for the joint estimation of nonparametric DEA-style production frontiers and the effects of contextual variables, which is root-n consistent and asymptotically efficient. This paper explores the practical aspects of statistical inferences: computation of standard errors, significance tests, and confidence intervals. We show how total inefficiency can be decomposed to the components explained by the context and the unexplained inefficiency.

■ SD72

H - Salon J, 6th Floor

Network Reliabilty and Travel Behavior Under Uncertainty

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Lei Zhang, Assistant Professor, Department of Civil and Environmental Engineering University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu

1 - A Lagrangian Substitution Based Approach for Finding the Most Reliable Path with Strong Spatial Correlation

Tao Xing, Graduate Research Assistant, University of Utah, Department of Civil Engineering, Salt Lake City, UT, 84112, United States of America, tao.xing@utah.edu, Xuesong Zhou

This talk presents a lower bound-based approach for finding the most reliable path with possible strong spatial correlations. A Lagrangian substitution method is implemented with heuristic updating technique to reformulate the non-additive and non-convex problem and to reduce the gap between the close-to-optimal solution and the lower bound.Furthermore, we propose a stochastic sampling-based solution algorithm to incorporate the weak or strong spatial correlation among link travel times.

2 - Understanding the Impact of Network Supple Changes to Departure Time and Route Choice Through a Dynamic Traffic Assignment Approach

Shuo Wang, University of Arizona-Tucson, Tucson, AZ, United States of America, wangshuo@email.arizona.edu, Mark Hickman, Yi-Chang Chiu

This talk presents a departure and route choice model and algorithm for integrated corridor management due to short-term or long-term network supply changes. By adapting departure and route choice, commuters aim to minimize their generalized cost - travel time, schedule delay and departure time difference - in the adaptation process in the dynamic user equilibrium framework.

3 - Modeling Within-day Activity Schedule Adjustment Decisions Considering Time-varying Network Conditions

Yunemi Jang, University of Arizona-Tucson, Tucson, AZ, United States of America, yunemi@email.arizona.edu, Yi-Chang Chiu

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 Rule-based Model of Route Choice Under Uncertainty: Do Travelers Choose to be Reliably Congested?

Lei Zhang, Assistant Professor, Department of Civil and Environmental Engineering University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, lei@umd.edu

We model travelers' route choices under network supply-demand uncertainty with a positive rule-based approach. Individual decision-making processes with regard to route search and route choice are modeled with a consistent set of empirically derived if-then rules. Results show that the impacts of supply- and demand-side uncertainties on travel time variability are not additive. While many travelers search for alternative routes under network uncertainty, much fewer travelers actually change routes. Findings also suggest that travelers' behavioral rules lead to reduction in travel time variability, but not always reduction in absolute travel time - it appears that they end up with a reliably-congested travel experience.

■ SD73

H - Salon K, 6th Floor

Vehicle Routing III: Other Talks on Vehicle Routing

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Michel Gendreau, CIRRELT, C.P. 6128, Succursale Centre-ville, Montreal, QC, Canada, Michel.Gendreau@cirrelt.ca

1 - Unfeasible Solutions Management in Vehicle Routing Problems with Hard Time Windows

Michel Gendreau, CIRRELT, C.P. 6128, Succursale Centre-ville, Montreal, QC, Canada, Michel.Gendreau@cirrelt.ca, Teodor Gabriel Crainic, Thibaut Vidal, Christian Prins

Recent heuristics for the vehicle routing problem with time windows often rely on unfeasible solutions to enhance exploration of the search space. Through this talk, several relaxations and penalty frameworks as soft time-windows, allowable return in time, or flexible travel times will be analyzed. Emphasis is put on efficient local search design through theoretical and empirical analyses.

2 - Evaluating Operating Costs in Routing Problems with Fixed Appointment Times

Ashlea Bennett, Assistant Professor, University of Arkansas at Fayetteville, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, ashlea@uark.edu, Behrooz Kamali, Alan Erera

In fixed appointment time routing problems, each customer must be assigned an appointment time belonging to an allowable menu of equally-spaced times. They have application in businesses that must visit their customers at fixed times when the customer is required to be present. We evaluate the costs of offering fixed appointment times, which can improve customer service at the cost of reduced route flexibility, and develop heuristics for scheduling customers at fixed appointment times.

3 - Strategic Information Collection in System-optimum Assignment and Network Routing Problems

Natalia Ruiz, The University of Texas-Austin, Austin, TX, United States of America, natiruizjuri@gmail.com

We introduce a new approach to utilizing real time information in problems involving vehicle routing on networks with stochastic arc costs. The proposed method account for the capability of vehicles to collect information as they travel, which is used to refine routing decisions online. The system expected cost becomes a result of the combination of routing costs and information impacts, in virtue of which optimal solutions may differ from, and improve upon, those derived from traditional models.

4 - The Capacitated Vehicle Routing Problem with Backhauls on Trees

Roshan Kumar, The University of Texas at Austin, 1616 Guadalupe Street, Austin, TX, 78701, United States of America, roshan@austin.utexas.edu, Travis Waller, Avinash Unnikrishnan

A special case of the Capacitated Vehicle Routing Problem (CVRP), where the network is constrained to have a tree structure, is studied here (TCVRP). We explore a variant of the TCVRP, where the nodes are divided in to two subsets - linehaul and backhaul nodes. Linehaul nodes are nodes that require delivery from the depot; and backhaul nodes have supply that needs to be picked up and transported to the depot. Also, linehaul nodes have to be serviced before backhaul nodes in any vehicle tour. We derive conditions for a lower bound on the problem and explore various properties of the problem. We formulate the problem as an Integer Program and also present an approximation algorithm which gives a feasible solution to the problem. Finally, we conduct numerical experiments to evaluate the efficiency of the proposed algorithm.

■ SD74

H - Room 602, 6th Floor

Data Fusion and Route Choice in Real Time Stochastic Networks

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Alain Kornhauser, Princeton University, 229 Sherrerd Hall (ORFE Building), Princeton, NJ, United States of America, alaink@princeton.edu

1 - Data-driven Aggregation for Path Travel Time Distribution

Ke Wan, Princeton University, 228 Sherrerd Hall (ORFE Building)., Princeton, NJ, United States of America, kwan@princeton.edu

Data driven scenario analysis and scenario-wise parameter estimation via lasso is the main methodology for path travel time distribution estimation. The scenario is explored according to available link-based observations. Within each scenario, the dependence structure between link travel times is modeled as a lagged Gaussian copula. The L1-constrain-minimization (Lasso) method is used for parameter estimation. The scheme is presented and properties of large data set are shown.

2 - Travel Time Derivatives: Market Analysis and Pricing

Ke Wan, Princeton University, 228 Sherrerd Hall (ORFE Building)., Princeton, NJ, United States of America, kwan@princeton.edu

In this paper, the travel time derivative is introduced as a new hedging tool against transportation related risk, a promising tool to achieve portfolio risk diversification, a new form of dynamic road toll to change travelers' behavior. The potential market participants are analyzed, main products are designed and models for underlying travel time process and pricing methods are introduced.

3 - Travel Time Reliability Evaluation Based on Fuzzy Logic

Xiongfei Zhang, PhD candidate, Tsinghua University,Beijing, China, 1241 Engineering Hall, 1415 Engineering Dr, Madison, WI, 53706, United States of America, xzhang223@wisc.edu, Rachel He, Min Liu, Bin Ran, Qixin Shi

This paper makes an effort to evaluate travel time reliability incorporating as many characteristics of travel time distribution as possible based on fuzzy logic. The basic rules are: (1) the larger the variance is, the more unreliable the travel time is; (2) the larger the distribution skews to the left, the more unreliable the travel time is; (3) the larger the travel times of unlucky travelers are, the more unreliable the travel time is. The proposed methodology is tested with field data.

Monday, 8:00am - 9:30am

■ MA01

C - Ballroom D1, Level 4

Renewable Energy and Environmental Policies

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50014, United States of America, lzwang@iastate.edu

1 - Equilibrium Bidding Strategies in Electricity and Cap-and-trade Markets

Vishnu Nanduri, Assistant Professor, University of Wisconsin-Milwaukee, Department of Industrial Engineering, 3200 N. Cramer St., P.O. Box 784, Milwaukee, WI, 53201, United States of America, vnanduri@uwm.edu

With the introduction of cap-and-trade markets in the US, regulators and market participants are in dire need of modeling methodologies to make bidding strategy decisions. These decisions have become very complicated due to the new markets that have been created by emissions policies, especially under restructured settings. We develop a game-theoretic model to obtain optimal bidding strategies in such environments.

2 - Biofuels and Batteries: Technology, Transportation, and Climate Change

Erin Baker, Associate Professor, University of Massachusetts Amherst, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu, Jeff Keisler

We present expert views on prospects for advancements for these two transportation technologies, and then show how they will affect the marginal cost of abatement under different scenarios.

3 - Optimization Challenges for Energy Systems with CO2 Emission Targets

Steffen Rebennack, Assistant Professor, Colorado School of Mines, Division of Economics & Business, Boulder, CO, United States of America, steffen@ufl.edu, Mario Pereira, Panos Pardalos

The reduction of CO2 emissions in the electricity sector poses several challenges when a CO2 emission cap is imposed. On the one hand, policy makers face the problem of choosing the "right" level of CO2 emission allowances with respect to environmental goals and economic tractability and, on the other hand, the electric utilities have to cope with uncertain CO2 prices in case of a Cap-and-Trade system. We propose two stochastic programming formulations to cope with these problems.

4 - Comparing the Effectiveness of Cap-and-trade and Carbon Taxes Policies in Generation Expansion Plan

Yanyi He, Iowa State University, 3426 Orion Drive, Apt. 210, Ames, IA, 50010, United States of America, heyanyi@iastate.edu

We compare the effectiveness of Cap-and-trade and carbon taxes policies in the context of generation capacity expansion. Game theoretic models are used to integrate the policies. The most efficient tax policies and variations are obtained using the inverse equilibrium models. Cap-and-trade and carbon taxes are compared by five criteria: carbon price and subsidy, renewable portfolio, total energy generation, generation companies' and grid owner's total profit, and government revenue.

■ MA02

C - Ballroom D2, Level 4

Joint Session Energy/ ENRE Energy: Impacts of Supply Uncertainty on Power System Planning and Operations

Cluster: Energy: Modeling the Interface Between Markets and Operations/ Energy, Natural Resources and the Environment Invited Session

Chair: Ramteen Sioshansi, Assistant Professor, The Ohio State University, 240 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu

1 - Transmission Planning Under Uncertainty: A Two-stage Stochastic Modelling Approach

Benjamin Hobbs, Professor/Sr. Research Associate, The Johns Hopkins University DoGEE/University of Cambridge EPRG, 313 Ames Hall, 3400 No. Charles St., Baltimore, MD, United States of America, bhobbs@jhu.edu, Harry van der Weijde

A stochastic two-stage MIP is applied to a stylised representation of the Great Britain (GB) transmission network for 2010-2030 under renewable energy, load, fuel price, and policy uncertainties. We identify robust first-stage investments, and estimate the value of information in transmission planning, the costs of ignoring uncertainty and the option value of transmission investment alternatives.

2 - The Analysis of Electricity Storage Location Sites in an Electric Transmission Grid

Andrew L. Liu, Assistant Professor, Purdue University, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, andrewliu@purdue.edu, Tom Brady

A significant issue of wind power is its variability in output. Large-scale storage could lead to cost and reliability benefits if the interface locations are chosen wisely. The location of storage relative to demand or to supply becomes a key research question. An electricity transmission network model is used to examine the potential impact of storage locations in the grid. This talk describes a stochastic programming based model to analyze the siting issues of storage capacity into a grid.

3 - Optimal Sizing and Operations of a Storage Facility with Intermittent Supply

Pavithra Harsha, Massachusettes Institute of Technology, 77 Mass. Avenue, 32D-714, Cambridge, MA, United States of America, pavithra@mit.edu, Munther Dahleh, Dimitri Bertsekas

We address the problem of optimal sizing of a storage facility to mitigate the effects of intermittent supply with renewable generation. We present fundamental trade-offs between the storage size and the investment cost given the distribution of renewable generation under different ownership structures of the storage facility. We also propose optimal management strategies in an energy market setting and discuss experimental results on real data.

4 - Evaluating the Impact of Demand Response and Stochastic Programming on the Cost of Wind

Ramteen Sioshansi, Assistant Professor, The Ohio State University, 240 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu, Seyed Madaeni

We use a stochastic unit commitment and dispatch model to investigate the relative benefits of real-time demand response (for instance, through real-time pricing) and stochastic programming on reducing wind integration costs. We show that while both demand response and stochastic programming are valuable, demand response offers higher cost reductions.

■ MA03

C - Ballroom D3, Level 4

Forestry I: Harvest and Transportation Planning

Sponsor: Energy, Natural Resources and the Environment//Forestry Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Avenue, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Assessing Robustness of Optimization Models in Forest Supply Chain Management

Jorge Vera, Pontificia Universidad Catolica de Chile, Ave Vicuna Mackenna 4860, Santiago, Chile, jvera@ing.puc.cl, Pamela Alvarez

Supply chain management in the forest industry has been supported extensively by means of optimization models containing several uncertain elements. A robust model should be able to generate robust solutions which remain valid even when data is uncertain, without incurring a considerable loss in revenue. In this work we study factors affecting problem robustness and investigate the impacts of these factors on the inter-temporal decision process for planning operations in the forest industry.

2 - Road Investment and Harvest Planning

Mikael Rönnqvist, Norwegian School of Economics and Business Administration, Helleveien 30, Bergen, Norway, Mikael.Ronnqvist@nhh.no, Mikael Frisk, Patrik Flisberg

The forest road network is influenced by the climate, especially rainfall and thaw causing accessibility problems. A difficult task is to decide which investment in the road network that gives the highest return, taken into account future harvesting, changes in climate and also how road investments can interplay with harvesting, timber storage and the use of CTI trucks. We present an optimization model and results obtained from a decision support system developed in Sweden.

3 - Collaborative Logistics in the Forest Industry

Sophie D'Amours, University Laval, Department of Mechanical Engineering, Quebec, Canada, Sophie.Damours@gmc.ulaval.ca, Jean-Francois Audy, Jean Favreau, Philippe Marier, Louis-Martin Rousseau

An Internet based system developed to support collaborative logistics between forest companies in Canada is presented. These companies share their transportation needs and plan together their transportation activities to gain network economy. The presentation defines the needs of these companies in terms of collaborative logistics, presents the system architecture, the planning method and reports on two industrial implementations. Finally, issues related to benefit sharing will be discussed.

4 - Structuring a Strategic Approach to Forest Industry Planning for the Forest Value Chain

Eldon Gunn, Department of Industrial Engineering, Dalhousie University, Halifax, NS, Canada, eldon.gunn@Dal.Ca

A forest value chain perspective forces a change in the traditional approach to forest strategic planning. This paper describes an initiative currently underway in Canada for value chain optimization in the forest industry with a particular focus on the issues of forest strategy and industry structure strategy. The considerable uncertainties in the markets and the environment suggest that this needs to be embedded in a scenario planning framework.

■ MA04

C - Ballroom D4, Level 4

Forecasting for Wind and Solar Energy

Cluster: Clean Energy
Invited Session

Chair: Joseph Bockhorst, Assistant Professor, University of Wisconsin, Milwaukee, 3200 N. Cramer St, Milwaukee, WI, 53211, United States of America, joebock@uwm.edu

1 - Conditional Linear Gaussian Models for Short-horizon Wind Forecasting

Chris Barber, University of Wisconsin- Milwaukee, 2925A E Kenwood Blvd, Milwaukee, WI, United States of America, barberchris01@gmail.com, Joseph Bockhorst

Accurate short-term wind forecasts (STWF) are essential for efficient integration of wind power. We present an automated approach to STWF based on conditional linear Gaussian models. Our method naturally handles missing observations, and considers dynamic dependencies by learning weather regimes that affect the wind. In an empirical evaluation on publicly available wind data from two geographical regions, our approach makes significantly more accurate predictions than baseline models.

2 - Improved Statistical Methods for Wind Power Forecasting

Audun Botterud, Energy Systems Engineer, Argonne National Laboratory, Decision and Information Sciences Div., 9700 S. Cass Ave., Bldg. 221, Argonne, IL, 60439, United States of America, abotterud@anl.gov, Ricardo J. Bessa, Vladimiro Miranda, Jianhui Wang

We discuss the use of statistical models for short-term wind power forecasting and present a framework for comparison of different online adaptive training methods. Using data from a real wind farm, we demonstrate how entropy concepts from information theoretic learning can improve wind power forecasts. We argue that the choice of training criteria to a large extent depends on the forecast user, and show that minimizing the forecast error is not necessarily the optimal choice.

3 - Wind Power Forecasting using Numerical Weather Prediction Models

Emil Constantinescu, Computational Mathematician, Argonne National Laboratory, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, emconsta@mcs.anl.gov, Victor Zavala, Mihai Anitescu

In this presentation we shall discuss wind power forecast and uncertainty using numerical weather prediction (NWP) models with applications in optimal management of energy systems. This strategy consists in using numerical dynamical models to forecast ambient conditions. We shall present the mathematical challenges that are associated with quantifying uncertainty in weather forecasts when using NWP models and discuss its merits as well as its impact in a stochastic optimization framework.

4 - Renewable Energy Forecast Information for a Smarter Electric Power Grid

Eric Grimit, Senior Scientist, 3TIER, 2001 6th Avenue, Suite 2100, Seattle, WA, 98121, United States of America, egrimit@3tier.com

This talk will review the state-of-the-art in wind and solar power forecasting, which is a critical component to the success of an efficient and smart national electric power grid. Focus will be placed on the primary short-horizon forecasting challenges, including: numerical weather prediction, meteorological data assimilation, robust statistical methods that handle very large sets of predictor variables that can occasionally go missing, the issue of metrics, and the human factors element.

5 - Systems-based, Geographic Analysis of Photovoltaic Generation Variability

Ross Collins, Massachusetts Institute of Technology, 290 Payson Rd., Belmont, MA, 02478, United States of America, ross.collins8j@gmail.com, Kenneth Crowther

This research models how geographic dispersion of PV installations affects the reliability of electricity generated from the total PV network over time, as measured by generation variance. Using NREL data, beta probability distributions of sunlight in five different regions are constructed. Optimal parameters are calculated using a fitting method that minimizes the K-S test statistic. PV generation from various configurations across these regions is simulated over 100,000 days.

6 - Predictive Analytics for Wind Energy Forecasting

Kashif Gill, Senior Atmospheric Scientist, WindLogics, Inc, 1021 Bandana Blvd. E., # 111, St Paul, MN, 55108, United States of America, Kashif.Gill@windlogics.com, Cathy Finley, Dennis Moon

Wind/energy forecasting is critical for accurate estimation of future wind/energy resource, returns, and load allocations. In this paper, it can be termed as the "downscaling" of the coarse-scaled Numerical Weather Prediction models to the wind farm location. A combinatorial approach employing Support Vector Machines and Evolutionary Computing schemes is used herein. This paper describes an efficient and effective method for training SVM using Multi-Objective Evolutionary Optimization approach.

■ MA05

C - Ballroom D5, Level 4

Combinatorial Auctions and Exchanges

Cluster: Auctions and Game Theory
Invited Session

Chair: Bob Day, University of Connecticut, 2100 Hillside Road, Unit 1041, Storrs, CT, 06269-1041, United States of America, Bob.Day@business.uconn.edu

1 - Analysis of the A+B Bidding Mechanism for the Procurement of Transportation Construction Services

Diwakar Gupta, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, guptad@me.umn.edu

We characterize contractors' equilibrium bidding strategy and the effect of certain discretionary parameters set by state transportation agencies, when the latter use the A+B mechanism to procure construction services. We show that contractors' incentives are to bid shorter-than-expected completion times and that the lowest-cost bidder may not win. Data shows that many contractors are not bidding shorter completion times. We discuss future impact as more contractors begin to bid strategically.

2 - The Division of Surplus in Efficient Combinatorial Exchanges

Bob Day, University of Connecticut, 2100 Hillside Road, 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 core-selected payments that match competing 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.

3 - Sort-cut: A Pareto Optimal and Semi-truthful Mechanism for Multi-unit Auctions with Budget-constrained Bidders

Isa Hafalir, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States of America, isaemin@cmu.edu, R. Ravi, Amin Sayedi

Motivated by sponsored search auctions with hard budget constraints given by the advertisers, we study multi-unit auctions of a single item. We propose Sort-Cut, a mechanism which does the next best thing from the auctioneer's point of view, that we term semi-truthful. We prove that some equilibrium of the proposed mechanism optimizes the revenue over all Pareto-optimal mechanisms.

■ MA06

C - Ballroom E, Level 4

Tutorial: Online Optimization

Cluster: Tutorials
Invited Session

Chair: Patrick Jaillet, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge, MA, United States of America, jaillet@mit.edu

1 - Online Optimization
Patrick Jaillet, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge, MA, United States of America, jaillet@mit.edu, Michael Wagner

There are many situations in which present actions must be made and resources allocated with incomplete knowledge of the future. It is not clear in this setting how to measure the quality of a proposed decision strategy. One approach is to devise some probabilistic model of the future and act on this basis. Online optimization compares the performance of a strategy that operates with no knowledge of the future (on-line) with the performance of an optimal strategy that has complete knowledge of the future (off-line). In this tutorial, we give an overview of the state of the art of this approach relevant to operations research and management science.

■ MA07

C - Ballroom F & G, Level 4

Tutorial: Optimization via Simulation Over Discrete Decision Variables

Cluster: Tutorials
Invited Session

Chair: Barry L Nelson, Professor and Chair, Northwestern University, Department Industrial Engr. & Mgmt. Sci., 2145 Sheridan Road, C210, Evanston, IL, 60208-3119, United States of America, nelsonb@northwestern.edu

1 - Optimization via Simulation Over Discrete Decision Variables
Barry L Nelson, Professor and Chair, Northwestern University, Department Industrial Engr. & Mgmt. Sci., 2145 Sheridan Road, C210, Evanston, IL, 60208-3119, United States of America, nelsonb@northwestern.edu

Both the simulation research and software communities have been interested in optimization via simulation (OvS), by which we mean maximizing or minimizing the expected value of some output of a stochastic simulation. Continuous-decision-variable OvS, and gradient estimation to support it, has been an active research area with significant advances. However, the decision variables in many operations research and management science simulations are more naturally discrete, even categorical. In this tutorial we describe some of the research directions and results available for discrete-decision-variable OvS, and provide some guidance for using the OvS heuristics that are built into simulation modeling software.

■ MA08

C - Room 11A, Level 4

Supply Network Planning and Scheduling

Sponsor: Location Analysis
Sponsored Session

Chair: Lian Qi, Rutgers Business School, 1 Washington Park, Newark, NJ, 07059, United States of America, lianqi@business.rutgers.edu

1 - A New Heuristic Formulation for the Competitive Facility Location Problem
Tolga Seyhan, Research Assistant, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, tolgaseyhan@gmail.com, Lawrence V. Snyder

We consider a facility location problem under Stackelberg competition where two players sequentially locate their facilities in order to capture the maximum customer demand. We propose a model where the follower is assumed to employ a greedy add heuristic as his response and formulate a mixed integer programming model that solves the leader's problem under this assumption. We show the effectiveness of the approach through numerical study and discuss further extensions of the proposed model.

2 - A Partial Relaxation Based Scheduling Algorithm for Multi-Echelon Shipping Network with Deadlines
Gang Wang, PhD Student, Rutgers Business School, Department of SCM and Marketing Sciences, 1 Washington Park, Newark, NJ, 07102, United States of America, gangwang@pegasus.rutgers.edu, Lei Lei

We study the problem of scheduling a capacitated multi-echelon supply chain network with shipping delivery deadlines. We introduce a partial relaxation heuristic that finds good feasible solutions with remarkably less computation time as compared to the CPLEX. Empirical observations from over 800 randomly generated test cases are also reported.

3 - Integrated Planning Decisions for Public Rail Transportation
Chase Rainwater, University of Arkansas, INEG Department, Fayetteville, AR, 72701, United States of America, cer@uark.edu, Jeff Gwaltney

Passenger rail has the potential to alleviate U.S. highway congestion and reduce dependence on fossil fuels. Consequently, there has been a revival of interest in rail development projects nationwide. In this work, we present a class of problems that integrate many of the planning decisions, including station location, that are essential to the development of rail systems. We study these problems from a mathematical programming perspective with a focus on solution approaches.

■ MA09

C - Room 11B, Level 4

Service Operations and Entrepreneurial Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Guillaume Roels, Assistant Professor, University of California-Los Angeles, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, guillaume.roels@anderson.ucla.edu

1 - Hiring Under Resource Constraints
Onesun Yoo, University of California, Los Angeles, CA, United States of America, onyoo@anderson.ucla.edu, 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 - An Empirically-based Framework for Patient Flow Analysis in Hospitals
Mor Armony, Stern School of Business, New York University, New York, NY, United States of America, marmony@stern.nyu.edu, Galit Yom-Tov, Avishai Mandelbaum, Yariv N. Marmor, Yulia Tseytlin

Improving patient flow in hospitals has been an area of interest for practitioners and academics alike. In this work, based on observations from patient level flow data in a large Israeli hospital, we address questions such as: To what extent may various parts of the hospital be studied in isolation? Is there a correlation between quality of care and speed of service? How is service rate of hospital staff affected by their workload?

3 - Minimizing the Total Weighted Flow Time in Container Scheduling
Kangbok Lee, New York University, 44 West 4th Street, New York, NY, United States of America, klee3@stern.nyu.edu, Byung-Cheon Choi, Dirk Briskorn, Joseph Leung, Michael Pinedo

We consider the problem of shipping containers from their origination ports to their destination ports. Ships have capacities and fixed routing schedules and each ship visits various ports. The goal is to assign containers to ships such that the total weighted flow time is minimized. We discuss the computational complexity of various special cases of the problem and analyze some heuristics.

4 - Productivity and Economic Trends: From Manufacturing to Services
Uday Karmarkar, Professor, UCLA Anderson School, 110 Westwood Plaza, Box 951481, Los Angeles, CA, 90095, United States of America, uday.karmarkar@anderson.ucla.edu, Hosun Rhim

The shift from manufacturing to services has been explained by differential productivity growth rates. We formulate a Walrasian model of an economy with independent agents making production and consumption decisions. We show that productivity changes can result in either growth or decline of industry sectors, depending on demand satiation levels.

■ MA10

C - Room 12A, Level 4

Models of Strategic Consumer Behavior

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Laurens Debo, University of Chicago, Chicago, IL, United States of America, laurens.debo@chicagobooth.edu

1 - Are You Willing to Click? On the Value of Advance Information When Selling to Strategic Customers

Tingliang Huang, Kellogg School of Management, Northwestern University, Leverone 529, Jacobs Center, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, tingliang-huang@kellogg.northwestern.edu, Jan Van Mieghem

Motivated by the fast growing practice of web analytics, we study whether strategic customers are willing to click and thereby reveal their advance demand information. Using newsvendor models that incorporate customers who realize their clicks are tracked, we evaluate how embracing the Internet information channel with click tracking compares to related traditional operations and marketing strategies such as quantity commitment, availability guarantees, quick response and advance selling.

2 - Open Operations: using Customer Voting for Assortment Planning

Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu, Simone Marinesi

We examine the use of a customer voting system to support assortment planning decisions. In such a system, customers can indicate if they want a product to be included in the firm's offering and the firm can use that information to make subsequent assortment planning and pricing decisions. We explore alternate voting systems, analyse the trade-offs and provide prescriptions on design of these voting systems.

3 - The Perils of Commitments

Ali Parlakturk, Assistant Professor, University of North Carolina at Chapel Hill, Chapel Hill, United States of America, pturk@unc.edu, Mustafa Onur Kabul

The extant work has shown that ability to make commitments increases profitability in the face of strategic customers. However, examples of commitments are not common in practice. In the paper, we show that considering the supply chain relations can explain why firms shy away from commitments.

4 - Retailers' Asymmetric Assortment Choices in the Presence of Uncertain Consumer Preferences

Haoying Sun, The University of Texas at Austin, McCombs School of Business, Austin, TX, United States of America, haoying.sun@PhD.mccombs.utexas.edu, Steve Gilbert

For many experiential products, consumers differ in term of whether they know their product preferences before visiting a store to try them. We show that this consumer heterogeneity creates an opportunity for retailers to segment the market using asymmetric assortment breath, i.e., one retailer carries broader assortments and the other carries narrower assortments. Thus, the two symmetric retailers avoid the head-on price competition that could result from symmetric assortment breath.

■ MA11

C - Room 12B, Level 4

Advances in Inventory Modeling

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Nesim Erkip, Prof., Bilkent University, Department of IE, Ankara, 06800, Turkey, nesim@bilkent.edu.tr

1 - Using Pipeline Information in a Multi-echelon Spare Parts Inventory System

Tarkan Tan, T.Tan@tue.nl, Ingrid Reijnen, Christian Howard, Johan Marklund

We consider a single-item two-echelon inventory system with multiple local warehouses and a support warehouse. In case of a stock out, the pipeline information is used and a customer is backordered if a replenishment order is due within a certain time limit; otherwise the demand is transferred to the support warehouse. We first show some analytical results for the evaluation of a given policy, and then we propose a heuristic for the evaluation and optimization of the system.

2 - A Life-Cycle Inventory Problem

Nesim Erkip, Prof., Bilkent University, Department of IE, Ankara, 06800, Turkey, nesim@bilkent.edu.tr

We consider an inventory problem for the life-cycle of a part. We assume that there are two main phases, each with a different demand rate. The first phase is when the part is steadily used for assembly, and the second phase represents the periods when the part is no longer used as an input for manufacturing, but has a stochastic demand as a spare part until the warranty period. We model the overall inventory problem to reflect the behavior of the suppliers.

3 - Dynamic Inventory Replenishment Decisions with Bayesian Learning of Supply Yield Uncertainty

Esma Gel, Associate Professor, Arizona State University, Industrial Engineering, SCIDSE, Tempe, AZ, 85281, United States of America, Esma.Gel@asu.edu, Sibel Salman, Emre Sancak

We consider a periodic review replenishment problem with yield uncertainty, where the quantity the supplier ships in response to an order is random, and obeys a binomial yield model with unknown parameter. We propose a Bayesian learning scheme, where the yield distribution is updated over time. We formulate the problem as a finite-horizon stochastic dynamic programming model, and demonstrate the effectiveness of learning through comparisons with perfect information and no information cases.

4 - A Hybrid Policy for the Inventory Control of Medical Supply Items

Osman Alp, Bilkent University, Bilkent University, Industrial Engineering Department, Turkey, osmanalp@bilkent.edu.tr, Gokce Akin

In hospitals, medical supply items are maintained through a two echelon inventory system. Upper echelon is the warehouse and the lower echelon is a nurse station. Demand is continuously observed during the day and night time. Replenishment is possible at any time during the day but not possible during the night. We propose to implement (r, Q) policy during the day time and (T, S) policy to cover the night time demand. We analyze single and multiple item cases.

■ MA12

C - Room 13A, Level 4

Supply Chain Risk Management

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Lauren Davis, Assistant Professor, North Carolina A&T State University, 1601 E. Market St., 424 McNair Hall, Greensboro, NC, 27411, United States of America, lbdavis@ncat.edu

1 - Promotions, Operations Cost, and Profit in a Two-Stage Supply Chain

Joseph Geunes, University of Florida, Industrial and Systems Engineering Department, Gainesville, FL, 32611, United States of America, geunes@ise.ufl.edu, Yiqiang Su

We consider a two-stage supply chain in which a retailer periodically promotes a product. Promotions affect the total retailer demand and the timing of existing customer demands, as well as the retailer's replenishment policy. We consider a stylized model of supply chain profit as a function of the promotion parameters, and examine the degree of variance amplification, or bullwhip effect, that results from the combination of order batching and promotions at the maximum supply chain profit level.

2 - Inventory Control Under Supplier Risk

S. Sebnem Ahiska, Assistant Professor, Galatasary University, Industrial Engineering Department, Ciragan Cad. No:36 34357 Ortakoy, Istanbul, Turkey, sahiska@gsu.edu.tr, Russell King, Don Warsing, Yingying Wang

We characterize the optimal or near-optimal periodic review inventory control policies for a retailer who orders product from either of two suppliers, or both, to stock inventory to satisfy stochastic demand. Each supplier exhibits a risk that the fulfillment of its order may be delayed. We present both analytical and computational results to explore the impact of changes in supplier reliability on the policy parameters and policy structure.

3 - Transfer Pricing and Offshoring in Global Supply Chains

Srinagesh Gavirneni, Cornell University, 325 Sage Hall, Ithaca, NY, 14853, United States of America, nagesh@cornell.edu, Laurens Debo, Masha Shunko

We study how global firms use sourcing and transfer pricing strategies to leverage tax advantages and cost differences between firms' divisions in the presence of exchange rate uncertainty. We analyze the impact of supply chain flexibility on the above-mentioned strategies and see how global firms can overcome information asymmetry using linear contracts with local divisions.

■ MA13

C - Room 13B, Level 4

Inventory and Capacity Management

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Tim Huh, Assistant Professor, Sauder School of Business, University of British Columbia, 2053 Main Mall, Vancouver, V6T1Z4, Canada, tim.huh@sauder.ubc.ca

Co-Chair: John Muckstadt, Acheson/Laibe Professor of Business Management and Leadership Studies, Cornell University, 286 Rhodes Hall, Ithaca, NY, 14853, United States of America, jam61@cornell.edu

1 - A Dynamic Programming Model of the United States' Public Health Emergency Distribution Network
Kathleen King, Cornell University, 257 Rhodes Hall, Ithaca, United States of America, kak59@cornell.edu, John Muckstadt

When a large public health emergency, such as a bioterrorist attack or pandemic, occurs, vaccines, antibiotics, or other countermeasures must be distributed to the affected population. We present a dynamic programming model of the supply chain that moves the necessary materials to those who need them. We will describe several approximate solution technique and discuss how the model can be used to assist policy makers in preparing for public health emergencies.

2 - Maintenance Scheduling for Modular Systems-New Model and Algorithms
Eric Zarybnisky, Doctoral Candidate, USAF AFIT/CI, 60 Oakland Street Ext., Natick, MA, 01760, United States of America, ejz@MIT.EDU, John Muckstadt, Retsef Levi, Thomas Magnanti

Motivated by aircraft engine maintenance, we consider maintenance scheduling for modular systems. Scheduling these activities is challenging because of the submodular cost structures that capture the dependencies between various components and modules in the system. This gives rise to a combinatorial problem that can be formulated as an integer program but is computationally intractable. We propose near-optimal approximation algorithms and analyze their worst-case and computational performance.

3 - Optimal Lateral Transshipment Policy for a Quick Response Warehouse
Sandra Van Wijk, Eindhoven University of Technology, P.O. Box 513, 5600 MB, Eindhoven, Netherlands, A.C.C.v.Wijk@tue.nl, Geert-Jan Van Houtum, Ivo Adan

We study a multi-location inventory model where, in case of stock-outs, emergency lateral transshipments can take place from a so-called quick response warehouse. We characterize and proof the structure of the optimal policy, we prove conditions under which it simplifies, and we evaluate the performance of simple heuristics as approximations for the optimal policy.

4 - Joint Pricing and Capacity Decision of Vertically Differentiated Products and Production Priority
Sandra Transchel, The Penn State University, University Park, State College, PA, United States of America, sxt37@psu.edu

We consider a joint pricing and capacity decision problem of two vertically differentiated products produced with a shared capacity. Both price and capacity decisions have to be made under demand uncertainty. We introduce new price elasticity concepts which provide a framework to derive structural results as submodularity and concavity. Moreover, we study benefits of centralization and show how product differentiation affects price and capacity decision compared to a unified pricing strategy.

■ MA14

C - Room 14, Level 4

Supply Chain Management II

Contributed Session

Chair: Boray Huang, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Singapore, Singapore, isehb@nus.edu.sg

1 - The Impact of Sharing Customer Returns Information in a Supply Chain With/Without a Buyback Policy
Jing Chen, Assistant Professor, University of Winnipeg, 515 Portage Avenue, Winnipeg, MB, R3B 2E9, Canada, je.chen@uwinnipeg.ca

We examine a problem in a manufacturer Stackelberg supply chain where the retailer faces customer returns and uncertain demand. We show that the manufacturer incurs a significant profit loss if it fails to account for customer returns in the wholesale price decisions with/without offering a buyback policy. We investigate when the retailer would like to share customer returns information. The incentives of sharing this information and issues raised in sharing this information are also discussed.

2 - Planning Safety Stocks in Biopharmaceutical Supply Chains
Yao Ma, University of California, IEOR Department, Berkeley, CA, United States of America, mayao@berkeley.edu, Robert Leachman

We consider a supply chain with a stream of interchangeable production orders with i.i.d. lead times and i.i.d. rejection probabilities. Consecutive orders frequently cross over. We develop analytical formulas for safety stock in this case. Required safety stock is much reduced from that from formulas assuming orders don't cross.

3 - A Stochastic Process Study of Two-echelon Two-retailer Supply Chain Joint Inventory Decisions with Bulky Demand
Mingzhou Jin, Associate Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, mjin@ise.msstate.edu, Hossein Parsa

In a single-item two-echelon supply chain, stochastic bulky demands with random sizes arrive at the retailer. Both the vendor and retailer are assumed to implement a base-stock inventory policy, in the decentralized or centralized case. Approximations for the renewal function and its integral are introduced to obtain optimal policies. Numerical results show that potential cost savings can be obtained by centralization under certain cost structures.

4 - Innovations in Supply Chains: Impact of Competitions
Jingqi Wang, Northwestern University, 1725 Orrington Ave, Apt 311, Evanston, IL, 60201, United States of America, jingqi-wang@kellogg.northwestern.edu, Hyoduk Shin

We explore the impact of competitions on the investment in innovation for upstream innovative-component providers in a supply chain. We show that competition between substitute innovative-component providers increases overall investments in innovation. However, the impact of competition between downstream retailers on investment depends on the intensity of downstream competition; under intense downstream competition, it increases investment of innovative-component providers, whereas under relatively weak downstream competition, the opposite holds.

5 - Analysis of a Learning and Quitting Service Queue
Boray Huang, Assistant Professor, National University of Singapore, 1 Engineering Drive 2, Singapore, Singapore, isehb@nus.edu.sg, Jingui Xie, Qi-Ming He

We study a general service queue with learning capability. In this queue, the service agent can learn from past experience and improve his/her performance over time. However, once the agent acquires sufficient experience, he/she may quit and hop to another job. Our research explores the impact of the learning and quitting behavior on the general performance of a service queue.

■ MA15

C - Room 15, Level 4

Modeling the Psychology of B2B Relationships

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Noah Lim, University of Wisconsin-Madison, 975 University Avenue, Madison, WI, United States of America, nlim@bus.wisc.edu

1 - Designing Multi-Person Tournaments with Asymmetric Contestants: Theory and Experimental Evidence
Hua Chen, University of Houston, Department of Marketing, University of Houston, 334 Melcher Hall, Houston, TX, 77054, United States of America, hchen26@uh.edu, Sung Ham, Noah Lim

We show theoretically that in an asymmetric multi-person tournament increasing the number of prizes will not increase favorites' effort nor decrease the underdogs' effort. However, in a 3-person tournament with 2 favorites, favorites increase effort when the number of prizes changes from 1 to 2. We build a generalized model that allows for psychological losses from losing for favorites and psychological gains from winning for underdogs tracks the experimental results better than standard model.

2 - Price Delegation to the Sales Force: An Experimental Investigation
Sung Ham, Assistant Professor, Kent State Unviersity, College of Business Administration, P.O. Box 5190, Kent, OH, 44242-0001, United States of America, sham@kent.edu

An important decision facing managers is whether to delegate the pricing decision to the sales force. Although several studies have addressed this issue theoretically, there is currently very little empirical research that can guide managers on how or when to delegate. This research aims to address the extant gap in the literature by putting forth an experimental test of the price delegation theory in a game-theoretic framework.

3 - Competitive Implications of Haggling: A Theoretical and Experimental Investigation
Paola Mallucci, PhD Candidate, University of Minnesota, 321 19th Ave S, Rm 3-150, Minneapolis, MN, 55455, United States of America, mallu004@umn.edu, Tony Haitao Cui, Z. John Zhang

Firms in many markets post their prices, but also allow consumers to haggle on prices. Using a Bertrand duopoly Nash bargaining model, we investigate how haggling can mitigate price competition between firms and find that firms can collude tacitly if the number of hagglers in the market is sufficiently large. Follow-up experimental studies suggest that list prices are significantly higher than marginal costs and the other firm's list price has a positive weight on subjects' outside option.

4 - Tiers in Consumer Fractional Ownership Markets
Yu Wang, Assistant Professor of Marketing, University of Texas at Dallas, 800 West Campbell Rd., SM32, Richardson, TX, 75080, United States of America, yuwang@utdallas.edu, Ernan Haruvy

In fractional ownership arrangements, property owners can exchange their usage right through a secondary matching market. We investigate a tiered matching structure that restricts upgrading, thus simultaneously curbing gaming of the matching market and allowing all property owners to participate in the subsequent matching market. We test the theory using laboratory experiments. We find that the theory performs well in predicting agents' behavior and market outcomes.

■ MA16

C - Room 16A, Level 4

Scheduling and Dispatching in Semiconductor Manufacturing

Cluster: Semiconductor Manufacturing
Invited Session

Chair: Tanju Yurtsever, Principle CIM Engineer, Maxim Integrated Products, 14900 Spillman Ranch Loop, Austin, TX, 78738, United States of America, Tanju.Yurtsever@maxim-ic.com

1 - Impact of Decision Variables on the Quality of Scheduling Solutions in Semiconductor Manufacturing
Tanju Yurtsever, Principle CIM Engineer, Maxim Integrated Products, 14900 Spillman Ranch Loop, Austin, TX, 78738, United States of America, Tanju.Yurtsever@maxim-ic.com, Jennifer Johns, Erhan Kutanoglu

This paper addresses the scheduling of lots for multiple steps in diffusion area. There are several decision variables that can have a huge impact on the objective metrics, some of these include: amount of time batch should wait for incoming lots, scheduling lots that do not batch well, scheduling preventive maintenance task, variability in process times. In the paper, we will go into detail about how these decision variables affect the quality of the solution and how we used parametric analysis.

2 - Optimal Dedication Strategy in Freescale Semiconductor
Yiwei Cai, Freescale Semiconductor, 3501 Ed Bluestein Blvd, Austin, TX, 78721, United States of America, Yiwei.Cai@freescale.com

In semiconductor manufacturing, machines may have hundreds of recipes. Hardware configurations and other considerations may limit which recipes are configured to run on a machine. As the loadings change, the recipe management strategy may need to change. A poor recipe management strategy can lead to machine idle time and increased cycle time. This paper describes how the simulation and optimization models are used in Freescale Semiconductor to identify the optimal recipe dedication strategy.

3 - Line Balance and SWIP in Semiconductor Manufacturing
Dilek Anilturk, Industrial Engineer, Freescale Semiconductors Inc., 3501 Ed Bluestein Blvd, Austin, TX, 78725, United States of America, dilekanilturk@freescale.com

This presentation addresses the line balance and SWIP (Standard Work In Progress) terminology used in Freescale's ATMC fab. We utilized the Theory of Constraints "Drum-Buffer-Rope" methodology to regulate the flows of lots through the factory at full capacity of the most restricted resource or bottleneck. We also used the SWIP methodology to define the minimum WIP required and pull the lots to the tools, if the available WIP at the tool is below the minimum WIP requirements.

■ MA17

C - Room 16B, Level 4

Panel Discussion: OR/MS Consulting - The Challenges

Cluster: Practice of OR/MS
Invited Session

Moderator: G. Jack Theurer, President, G. Theurer Associates Inc., 215 West 92nd St., Suite 7F, New York, NY, 10025, United States of America, theurer@aol.com

1 - OR/MS Consulting - The Challenges
Panelists: Allen Butler, President, Daniel H. Wagner Associates, Inc., 2 Eaton Street, Suite 500, Hampton VA 23669, United States of America, Allen.Butler@va.wagner.comG. Jack Theurer, President, G. Theurer Associates Inc., 215 West 92nd St., Suite 7F, New York, NY, 10025, United States of America, theurer@aol.com, Warren Lieberman, President, Veritec Solutions Inc., 824 Miramar Terrace, Belmont 94002-2222, United States of America, warren@veritecsolutions.com, Douglas A. Popken, Principal Consultant, Systems View, 2127 Mountain Maple Ave., Highlands Ranch CO 80129, United States of America, dpopken@systemsview.com, Douglas A. Samuelson, President and Chief Scientist, InfoLogix, Inc., Annandale VA, United States of America, samuelsondoug@yahoo.com.

Five well-respected and seasoned OR/MS consultants who have combined over 100 years experience consulting to a wide variety of businesses will highlight the challenges they have faced and strategies and tactics employed to overcome them. G. Jack Theurer will moderate the panel discussion.

■ MA18

C - Room 17A, Level 4

Tutorial: Why Python is Such a Cool Language for Optimization and Scientific Computing

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: William Hart, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, United States of America, wehart@sandia.gov

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Python for Optimization Tutorial - Introduction
William Hart, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, United States of America, wehart@sandia.gov

In recent years, Python has been making steady inroads into the world of mathematics and scientific computing. With its numerous mathematical libraries, for example Numpy, Scipy, and MatPlotLib, it offers much of the same functionality as MATLAB, basically for free, as Python is open-source. For optimization there are also now many libraries available to choose from: PYOMO, PULP-OR, GUROBI, CPLEX, LPSOLVE, and MPL, many of which offer seamless integration of optimization modeling with Python.

2 - Python for Optimization Tutorial - Language Features
David Woodruff, Professor, University of California Davis, Davis, CA, United States of America, dlwoodruff@ucdavis.edu

For those that have not seen or used Python before, we will start the session with a short tutorial, that will demonstrate the many features of Python that make it such a cool language. We will cover how Python can be used as an interactive calculator, command language, scripting language, as well as a full application framework. We will also show some of the advanced features of the Python language, such as lists, dictionaries, slicing, list comprehensions, magic methods, and import modules.

3 - Python for Optimization Tutorial - Examples and Applications
Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

In the second part of the tutorial, we will demonstrate several examples on to how to build and deploy optimization applications with Python. Many of the examples will be based on our own libraries MPLPY and PYOMO, but we will also be showing examples with other Python libraries, such as GUROBI, CPLEX and PULP-OR, while pointing out the differences between them.

4 - Python for Optimization Tutorial - Advanced Topics
Jean-Paul Watson, Sandia National Laboratories, jwatson@sandia.gov

We conclude the tutorial series by introducing two "advanced topics" in algorithm design using Python. The first involves the design and implementation of generic decomposition algorithms for stochastic programming, including Progressive Hedging and the L-shaped method. The second involves the use of the Python "Pyro" remote objects package to implement and deploy distributed computing solutions.

■ MA19

C - Room 17B, Level 4

Choice Modeling in Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Huseyin Topaloglu, Associate Professor, Cornell University, School of OR&IE, Ithaca, United States of America, ht88@cornell.edu

1 - Assortment Optimization with Mixtures of Logits
Huseyin Topaloglu, Associate Professor, Cornell University, School of OR&IE, Ithaca, United States of America, ht88@cornell.edu, Paat Rusmevichientong, David Shmoys

We consider an assortment problem with multiple customer classes. The demand from each customer class follows a multinomial logit choice model, and the total demand is given by a mixture of logits. The goal is to choose an assortment of products that maximizes the expected profit across all customer classes. We establish an approximation guarantee for assortments consisting of products with the highest profits, and show that such assortments are optimal for an additive utility model.

2 - Robust Logit Assortments
Paat Rusmevichientong, Cornell University, School of ORIE, Ithaca, United States of America, paatrus@cornell.edu, Huseyin Topaloglu

We analyze a robust assortment optimization problem under the multinomial logit choice model. The model parameter is assumed to be unknown and we use an uncertainty set to capture the possible values for the unknown model parameter. We show that the robust assortment can be found efficiently and it includes more products as the uncertainty set grows. Therefore, larger product variety serves as a safety buffer against larger parameter uncertainty.

3 - Near-Optimal Algorithms for Assortment Planning Under Dynamic Substitution and Stochastic Demand
Retsef Levi, Associate Professor of Management, Massachusetts Institute of Technology, Sloan School of Business, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, retsef@mit.edu, Vineet Goyal, Danny Segev

We consider a single-period assortment planning problem under a dynamic-substitution model with stochastic demand and give a polynomial time approximation scheme for the problem under fairly general assumptions. Our algorithm computes an assortment containing only a small number of product types and obtains near-optimal revenue. We also present several complexity results for the problem that indicate that our assumptions are almost 'necessary' to solve it efficiently.

■ MA20

C - Room 18A, Level 4

New Frontiers in Revenue Management Applications

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Pelin Pekgun, Manager, Analytical Services, JDA Software Group, 1090 Northchase Pkwy, Suite 300, Marietta, GA, 30067, United States of America, Pelin.Pekgun@jda.com

1 - Rent Optimization for Self-Storage Industry
Utku Yildirim, Principal, Prorize LLC, 3475 Lenox Rd, Suite 400, Atlanta, ga, 30326, United States of America, uyildirim@prorize.com, Ahmet Kuyumcu

Pricing self-storage units has many unique challenges: low data volume, uncertain length of stay, complex product structure, competitive prices, market segmentation, forecasting, sensitivity estimation, and rent optimization. In addition, pricing strategy largely depends on whether a given unit is currently vacant or occupied. This presentation reviews fundamental aspects of rent optimization for the self-storage industry.

2 - Hotel Demand Modeling and Data Challenges
Alex Chien, SAS, Institute Inc, Sas Campus Drive, Cary, NC 27513, Alex.Chien@sas.com

Operational practices in hotels, inconsistency in recording events, misaligned customer segmentations and many more unknown factors cause unreliability in data. This in turn creates unexplained demand fluctuations and non intuitive price patterns that heavily impact the demand model quality. Examples of such data challenges and analytical approaches to handle such data anomalies to mitigate adverse impacts on demand model quality will be discussed.

3 - Impact of Demand Model on Hotel Price Optimization Performance
Seonah Lee, OR Consultant, Revenue Analytics, 3100 Cumberland Blvd, Suite 1000, Atlanta, GA, 30339, United States of America, slee@revenueanalytics.com

Accurately representing price-demand relationship is critical for the success of a price optimization system. In practice, the choice of demand model is largely driven by ease of estimation and model fit without considering the impact on price optimization. We investigate the goodness of fit of different linear demand models using actual hotel data. We also compare the performance of price optimization with demand models of varying accuracy through simulation.

4 - Advertisement Placement Optimization in Radio Broadcasting
Fion Choi, JDA Software Group, Inc., 1090 Northchase Pkwy NE, Suite 300, Marietta, GA, 30067, United States of America, Fion.Choi@jda.com, Emrah Uyar

Selling airtime to advertisers is a source of revenue to radio networks. We study the revenue management problem of optimally scheduling advertisements in order to maximize revenue, while respecting the advertisers' requirements and accommodating preferences. We discuss the characteristics of the model and how some of them, such as the flexibility in shifting demand from one market to another, pose challenges to solving the problem.

■ MA21

C - Room 18B, Level 4

Service Systems and Analytics

Sponsor: Service Science
Sponsored Session

Chair: Abjijit Bost, abose1t@yahoo.com

1 - Service Design and the Insurance Puzzle: The Market of Luck?
Christina Aperjis, HP Labs, 1501 Page Mill Rd, Palo Alto, 94304, United States of America, christina.aperjis@hp.com, Filippo Balestrieri

We study the optimal contract design problem of a service provider operating in a heterogeneous market. Customers differ in terms of their preferences and their costs to be served, both of which are ex-ante unobservable to the service provider. An application is Computer-Accidental-Damage-Protection warranties, where customers differ in terms of risk preferences and exposure to damages. We focus on the "insurance puzzle" according to which ex-post risk and coverage are negatively correlated.

2 - Incorporating Customer Support Feedback in Product Development
Shantanu Bhattacharya, Associate Professor of Operations Management, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, shantanu.bhattacharya@insead.edu, Sameer Hasija

In this paper, we present a model of incorporating feedback from customer support organizations into the product development process of OEMs. In a double moral hazard framework, we characterize the structure of optimal contracts offered by the principal (OEM) and identify cases where renegotiation improves the profits of both firms. We also characterize options based contracts that are renegotiation-proof, and achieve the first best outcome.

3 - Analysis and Predictive Modeling on Talent Retention and Turnover in Service Operations
Jerry Shan, HP Labs, Palo Alto, CA, United States of America, jerry.shan@hp.com, Kay-Yut Chen, Pano Santos, Alex Zhang, Shailendra Jain, Maria-Teresa Gonzalez

Top talents in a company can keep performing at full speed, while turnovers in certain business operations can be abnormally high. What models and methods should we use in identifying the underlying drivers and forecast the attrition rate into the future? In this talk, we will present our modeling work to shed some lights on the question.

■ MA22

C - Room 18C, Level 4

Responsive Disaster and Emergency Management

Sponsor: Service Science
Sponsored Session

Chair: James Van Scotter, Associate Professor of ISDS, Louisiana State University, Department of Info Systems & Decision Science, 3191 Patrick Taylor Hall, Baton Rouge, LA, 70803, United States of America, jvanscot@lsu.edu

1 - Research Project "REPKA": Regional Evacuation - Planning, Control and Adaptation

Katharina Gerhardt, Dr., University of Kaiserslautern, Paul-Ehrlich-Str. 14, Room 438, 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.

2 - Implementation of a Multiobjective Location Model for Emergency Vehicles on a Public Service Network

Oscar Javier Parra Ortega, Professor, Politécnico Grancolombiano, 57th Street #3-00 East, 18th Street #4-51 Apartment 402B, Bogotà, Colombia, oparraor@poligran.edu.co

This article describes an implementation of a modified MEXCLP location model, oriented to minimize the required number of vehicles, along with maximize the coverage of demand points in a public services network. Two mechanisms for the emergency vehicles location, and an extension for relocating are evaluated. Finally, a module for interconnect this implementation with GIS is proposed too.

3 - Distribution of Victims of a Mass Casualty Incident to Multiple Hospitals

Matthew Dean, University of New Orleans, 2000 Lakeshore Drive, New Orleans, LA, United States of America, mddean@uno.edu, Suresh Nair

Triaging victims of a mass casualty incident and subsequently transporting them to area hospitals provides a challenge to the disaster response team. We describe a model that takes into account multiple hospitals and their capacities, victim-specific care times, and transport availability depending on when and where it was dispatched.

4 - Barriers to the Effective Ad hoc Knowledge Networks in Disaster Response

James Van Scotter, Associate Professor of ISDS, Louisiana State University, Department of Info Systems & Decision Science, 3191 Patrick Taylor Hall, Baton Rouge, LA, 70803, United States of America, jvanscot@lsu.edu, Tung Cu, Suzanne Pawlowski

When disasters strike, ad hoc networks facilitate information sharing and coordination among responding organizations and help reduce losses. Unfortunately, differences in goals, control structures, and cultures pose barriers to inter-organizational coordination. We interviewed five panels of emergency responders and created cognitive maps reflecting their representations of the barriers. Results identify critical barriers and interdependencies.

■ MA23

C - Room 18D, Level 4

Complex Service Modeling

Sponsor: Service Science
Sponsored Session

Chair: Ruoyi Zhou, Sr. Research Manager, IBM Research, 650 Harry Road, San Jose, CA, 95120, United States of America, ruoyi@us.ibm.com

1 - Good Complexity and How to Design for It

Victor Tang, Research, Massachusetts Institute of Technology, 55 Deerfield Lane South, Plesantville, MA, 10570, United States of America, victang@alum.mit.edu

Complexity suffers from a bad reputation. But complexity is like cholesterol. There is good cholesterol and there is bad cholesterol. We want more of the good and less of the bad. We present classical principles and results from complexity theory and discuss their significance to service systems. Then we show how complexity can be very useful in the design of service systems. We welcome debate on this proposal.

2 - Modeling Complex Services

Ray Strong, IBM Research, Almaden Research Center, 650 Harry Rd, San Jose, CA, 95120, United States of America, strong@almaden.ibm.com, Sechan Oh, Tobin Lehman, Anca Ivan, Ruoyi Zhou, Ying Tat Leung

We describe a way to use aggregate data to improve the accuracy of predictive cost models for services offered by a service provider composed of a set of service delivery centers for which accurate aggregate cost data is available. The challenge is that the deals often involve multiple delivery centers and multiple kinds of service so that it is not easy to attribute delivery center costs to specific deals.

3 - Modeling the Dynamical Customer-provider Relationship as Center of Service Provisioning

Christoph Heitz, Professor, Zurich University of Applied Sciences, Rosenstrasse 3, Winterhur, 8401, Switzerland, heit@zhaw.ch

The customer-provider relationship is the central element of any service provisioning. Any decision on starting, maintaining, or ending a service relationship is based on expectations on the future nature of this relationship, both from the side of the provider and of the client. Research fields such as game theory, marketing, or management decision support have elaborated this idea. We argue that any model for service systems has to describe the dynamics of the customer-provider relationship.

4 - Customer Experience in the Era of Economic Uncertainty

David Ding, Assistant Professor, University of Houston, T2-230C, Technology II Building, Houston, TX, 77204, United States of America, xding@central.uh.edu

This study examines how economic uncertainty affects customer experience with online financial services during the past recession. Specifically, the objective is to replicate the dual-layer experience model proposed by Ding et al. (2010). Our analysis sheds light on the shift in utilities and values associated with corresponding service system components during the past financial crisis.

■ MA24

C - Room 19A, Level 4

Decision-Making in Nonprofit Organizations

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Tina Wakolbinger, University of Memphis, Memphis, United States of America, tbwklbng@memphis.edu

1 - Public Health Collaboration Landscape: Strategic Collaboration to Improve Public Health Revenues

Feryal Erhun, Stanford University, 380 Panama St, Stanford, CA, 94305, United States of America, ferhun@stanford.edu, Natalie Privett, Pinar Keskinocak, Sergey Sotnikov

Analysis of the relationship between local health department collaboration (LHD) patterns and expenditure per capita has yielded many conclusions. Previous research found that LHD characteristics and collaboration patterns are both crucial in understanding this relationship. Yet the important question remains: How does a LHD make sense of its community network and collaborate strategically to improve its revenues? We provide an answer to this question.

2 - Collaborative Information Sharing in Humanitarian Supply Chains

Tina Wakolbinger, University of Memphis, Memphis, United States of America, tbwklbng@memphis.edu, Frances Fabian

In this paper, we develop a new conceptual model for information management in humanitarian supply chains. The model integrates research in the area of strategic management and operations management and provides insights concerning benefits and risks associated with information sharing between nonprofit organizations. The resulting framework aids nonprofit organizations in deciding which information to share and which measures to take to ensure that information sharing is beneficial.

3 - Supply Chain Network Design for Critical Needs with Outsourcing

Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts Amherst, Isenberg School of Management, Amherst, MA, 01003, United States of America, nagurney@gbfin.umass.edu, Min Yu, Qiang Qiang

We develop a supply chain network design model in the case of critical needs products with relevance to disasters, emergencies, pending epidemics, and attacks affecting national security. By critical needs we mean products that are essential to the survival of the population. The model can handle both the design and redesign problems and yields the optimal link capacities and product volumes under demand uncertainty.

4 - On Redistributing Bikes for Urban Bike Sharing Systems
I-Lin Wang, Associate Professor, Dept of Industrial & Information Management, National Cheng Kung University, No.1 University Rd., Tainan, Taiwan - ROC, ilinwang.ncku@gmail.com

With estimated OD demands for an urban bike sharing system like the Velib in Paris, we propose a two-stage method to redistribute bikes based on a multicommodity network flow formulation. We then calculate the best number and routings for vehicles that redistribute bikes. Further considering bikes with attached ad or not, our methods are modified to redistribute multi-type bikes with minimum costs while providing ad exposure guarantees on certain nodes or arcs, as specified by the ad sponsors.

■ MA25

C - Room 19B, Level 4

Humanitarian Supply Chains: Haiti and Beyond

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Jarrod Goentzel, Research Director, Massachusetts Institute of Technology, 1 Amherst St., E40-359, Cambridge, MA, 02139, United States of America, goentzel@MIT.EDU

1 - Optimizing Food Aid Delivery in Africa for WFP
Ozlem Ergun, Associate Professor, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, GA, United States of America, oergun@isye.gatech.edu, Dani Slaton, Jordan Stone, Rene Alvarenga

The World Food Programme (WFP) provides year-round aid to food-deficient countries. We developed a shipment scheduling and routing tool to improve WFP land transportation operations in the Horn of Africa. With the use of this tool, WFP expects a decrease in shipment lead times and costs when this tool is impemented regionaly.

2 - Transportation Planning for the United Nations Logistics Cluster
Erica Gralla, PhD Candidate, Massachusetts Institute of Technology, 1 Amherst St, E40-211, Cambridge, MA, 02142, United States of America, egralla@mit.edu, Jarrod Goentzel, Jérémie Gallien, Charles Fine

The United Nations Logistics Cluster is charged with coordinating logistics among the dozens or hundreds of agencies that arrive to respond after a disaster. We discuss the development of a prototype tool to assist the cluster in managing common transportation services for these agencies.

3 - Coordination and Collaboration: Supply Chain Challenges in Haiti
Jessica Heier Stamm, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, jheier@isye.gatech.edu, Ozlem Ergun, Pinar Keskinocak, Julie Swann

We describe the logistics efforts of humanitarian organizations involved in response and recovery following the Haiti earthquake. Emphasis is placed on the challenges and opportunities presented by coordination and collaboration within and across organizations.

4 - Estimating Demand: Lessons From a Multi-Sector Needs Assessment in Haiti
Jarrod Goentzel, Research Director, Massachusetts Institute of Technology, 1 Amherst St., E40-359, Cambridge, MA, 02139, United States of America, goentzel@MIT.EDU, Louise Ivers, Marc Zissman, Erica Gralla

In the aftermath of the Haiti earthquake, the US Government, in collaboration with the UN, conducted a needs assessment to understand the progress of the relief effort across sectors such as shelter, food, water, sanitation and health. We describe the challenges of conducting a needs assessment in the urgent and chaotic post-disaster environment and lessons on turning it into an actionable demand forecast.

■ MA26

C - Room 4A, Level 3

Data Mining for Functional Data

Sponsor: Data Mining
Sponsored Session

Chair: Heeyoung Kim, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, United States of America, hykim@gatech.edu

1 - An Interval Bounded Classifier for Functional Data
Heeyoung Kim, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, United States of America, hykim@gatech.edu, Xiaoming Huo, Jianjun Shi

A classification method for functional data is proposed. Our method consists of three stages:(1) A baseline of each class is estimated via convex optimization;(2) An optimal interval that maximizes the difference between the baselines is identified;(3) A classifier based on the optimal interval is constructed. The derived classifier can be computed via a low-order-of-complexity algorithm. To showcase, we apply our method to a set of tonnage curves from stamping processes.

2 - Data Mining Modeling for High-dimensional Mass-spectral Data From Mosquitoes
Jung Hwan Son, Korea University, Anam-Dong, Seongbuk-Gu, Seoul, Korea, Republic of, ringleerang@naver.com, Seoung Bum Kim

In the present study we used a weighted principal components method to select important features in high-dimensional mass spectra obtained from Anopheles gambiae mosquitoes. The experimental results showed that classification models with the selected features yielded lower misclassification rate than the models with the original features.

3 - Spatiotemporal Event Detection in Mobility Network
Rong Duan, AT&T, rongduan@research.att.com

This paper proposes a systematic event detection method that deals with spatial and temporal event in mobility network traffic data. We propose an algorithm to integrate spatial information by aggregating the behavior of temporal data under various areas. Synthetic data are generated to illustrate the procedure and validate the performance. An industrial example from a telecommunication company is also presented to show the effectiveness of the proposed method.

4 - Parsimonious Modeling of Condom Lubricants Profiles From Mass Spectroscopy
Sin Young Kim, Korea University, Anam-Dong, Seongbuk-Gu, Seoul, Korea, Republic of, perkade@naver.com, Seoung Bum Kim

The ability to differentiate the polymers and additives found in condom lubricant can help to catch the criminal in sexual assault cases. In the present study we used mass spectroscopy coupled with data mining algorithms to reduce high-dimensional mass spectra and classify different types of lubricants. Principal component analysis showed some separations among lubricant groups. Classification with the reduced dimensions produced higher classification accuracy than the full dimensional spectra.

■ MA27

C - Room 4B, Level 3

Combinatorial Optimization III

Contributed Session

Chair: Vahideh Manshadi, Stanford University, 36 Angell Ct., Apt. 102, Stanford, CA, 94305, United States of America, vahidehh@stanford.edu

1 - Computational Tools for Graph Decompositions
Chris Groer, Research Scientist, Oak Ridge National Lab, 1 Bethel Valley Road, Oak Ridge, TN, 37831, United States of America, groercs@ornl.gov, Blair Sullivan

Tree and branch decompositions represent a graph in a way that provides a framework for dynamic programming. A large class of NP-Hard problems can be solved to optimality with complexity that is polynomial in the size of the graph, but exponential in the decomposition's width. This talk describes the work we have done in developing a software library for generating and utilizing low width decompositions. We discuss computational results and the potential for parallelizing these computations.

2 - A Branch and Price Algorithm for the Capacity Constrained Lot Size Problem with Setup Times

Silvio Araujo, University Estadual Paulista, Rua Cristovao Colombo, 2265, São Jose do Rio Preto, 15054-000, Brazil, saraujo@ibilce.unesp.br, Zeger Degraeve, Raf Jans

We present a new procedure that obtains high quality lower bounds for the Capacity Constrained Lot Size Problem with Setup Times (CLST). The procedure is based on per period decomposition applied to a transformed network reformulation of the CLST. We develop an improved customized branch-and-bound algorithm to solve the subproblem and hybrid methods to solve the master problem. Finally, we develop a branch-and-price algorithm for the problem. Computational experiments are presented

3 - Scheduling Torpedo Cars by Column Generation in Molten Iron Transportation

Gongshu Wang, The Logistics Institute,Northeastern University, Northeastern University,Shenyang,China, Shenyang, 110004, China, wanggongshu@ise.neu.edu.cn, Lixin Tang

We consider the problem of scheduling torpedo cars encountered in molten iron transportation operations. This problem involves a set of practical complications that have received litter attention. We formulate the problem as a mixed-integer programming and then reformulate it as a set-partition type model using Dantzig-Wolfe decomposition. We propose a column generation based algorithm to solve it. The computational experiment is presented.

4 - Online Stochastic Matching: Online Actions Based on Offline Statistics

Vahideh Manshadi, Stanford University, 36 Angell Ct., Apt. 102, Stanford, CA, 94305, United States of America, vahidehh@stanford.edu, Shayan Oveis Gharan, Amin Saberi

We study a natural variation of bipartite matching problem motivated by online advertising: We are given a bipartite graph; one side of the graph corresponds to a fixed set of bins and the other side represents the set of possible ball types. At each time step, a ball is sampled from a given distribution and it needs to be matched upon its arrival to an empty bin. We present the first algorithm for this problem that improves 1-1/e competitive ratio for the stochastic version in its general form.

■ MA28

C - Room 4C, Level 3

Decision Analysis Approaches 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, 322 Engineering North, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu

Co-Chair: Martin Wortman, Professor, Texas A&M University, College Station, TX, United States of America, wortman@tamu.edu

1 - Using Bayesian Analysis in Milling Profit Optimization

Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61801, United States of America, aliabbas@uiuc.edu, Tony Schmitz

In this talk, we show how Bayesian methods and decision analysis can lead to profit maximization in high-speed milling. Using a single-attribute objective function for profit, we show how to determine the optimal parameter settings (milling speed/axial depth), and how to determine the value of a test for a given work piece in high-speed machining.

2 - Updating Predictive Models: Calibration, Bias Correction, and Identifiability

Paul Arendt, Northwestern University, Evanston, IL, 60208, United States of America, paularendt2012@u.northwestern.edu, Wei Chen

In this talk, we will present a modular Bayesian approach as a comprehensive framework that accounts for many sources of uncertainty in a typical model updating process. The challenge associated with the identifiability issue for distinguishing between uncertain model parameters (calibration) and systematic inadequacies (bias correction) will be presented. Approaches to alleviating the problem will be discussed.

3 - Real-time Prediction of Incipient Surface Variations in Ultraprecision

Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu, Satish Bukkapatnam, Ranga Komanduri, Prahalad Rao, Omer Beyca

Ultra-Precision Machining (UPM) is used in various industries to create mirror-finish surfaces on a variety of metallic parts. Real-time monitoring and control of surface variation in the incipient stages is vital to ensure nanometric range finish in the UPM. A sensor-based real-time monitoring approach, based on predicting and updating the process states from sensor signals using advanced neural network and Bayesian techniques, is applied to detect UPM surface variations in the early stage.

4 - Characterization of Available Production Capacity in Resource in Resource-Matching Networks

Martin Wortman, Professor, Texas A&M University, College Station, TX, United States of America, wortman@tamu.edu, Alex Savachkin

For the class of capacity constrained production/service operations, where resources must be sequentially assembled/combined in serving demand, we present a stochastic model that captures effective-capacity dynamics. We explore this model through a sensitivity analysis, giving insights supporting network design and operations decisions. Particular emphasis is given to mitigating the effects of capacity disruption on demand for service.

■ MA29

C - Room 5A, Level 3

Quality and Reliability in Nano-scale Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Abe Zeid, Northeastern University, 360 Huntington Ave, Boston, MA 02115, United States of America, zeid@coe.neu.edu

Co-Chair: Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

1 - Statistical Characterization of Nanostructured Surfaces Created by Machining Processes

Marcus B. Perry, Department of Information Systems, The University of Alabama, Tuscaloosa, AL, United States of America, mperry@cba.ua.edu, Jeffrey Kharoufeh, Shashank Shekhar, Jiazhao Cai, M. Ravi Shankar

We consider the 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. By analyzing electron microscopy data of samples, it is concluded that cutting speed, rake angle and their interaction are significant contributors to the resulting grain microstructure.

2 - Nonparametric CMOS Dielectric Failure Time Distribution Estimation using Kernel Density Estimation Methods

Wilkistar Otieno, Student, University of South Fl, 4202 E. Fowler Ave, ENB 118, Tampa, fl, 33613, United States of America, wotieno@mail.usf.edu, Geoffrey Okogbaa

Kernel density methods have been used over the past several decades to construct the underlying probability structure of a desired unknown distribution. The performance of a kernel estimator lies on the choice of the kernel type and the bandwidth. In this study, we use the Gaussian kernel to estimate the unknown probability structure of a high-k MOS dielectric film. We discuss a cost optimal iterative procedure for choosing an optimal piece-wise variable bandwidth for failure density estimation.

■ MA30

C - Room 5B, Level 3

QSR Best Student Paper Competition

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

1 - Best Student Paper Award

Best Student Paper Award recognizes excellence among QSR student members. Four finalists for the Best Student Paper Award will be selected to make presentations. The winner will be announced at the QSR business meeting during the conference.

■ MA31

C - Room 5C, Level 3

Prediction Modeling and Analysis for Complex Systems

Sponsor: Data Mining
Sponsored Session

Chair: Norman Kim, Rutgers University, 640 Bartholomew Road, Piscataway, United States of America, norman.kim@gmail.com

Co-Chair: Durai Sundaramoorthi, Assistant Professor, Missouri Western State University, 4525 Downs Drive, Saint Joseph, MO, 64507, United States of America, dsundaramoorthi@missouriwestern.edu

1 - The Network Structural Approach on the Graph Prediction Problem
Chungmok Lee, Postdoctoral Scholar, RUTCOR, 640 Bartholomew Rd, Piscataway, United States of America, chungmok@rci.rutgers.edu, Norman Kim, Minh Pham, Myong Jeong, W. Art Chaovalitwongse

A graph prediction problem is to predict future network structure based on the historical data. The most well-known structural property of social networks may be the power-law of degree distribution, which says that the distribution of node degrees obeys some power-law. In this talk, an optimization approach to predict a future network using the underlined node degree distribution is presented. The proposed approach is tested on a real-life social network example.

2 - A Robust Kernel-based Regression
Norman Kim, Rutgers University, 640 Bartholomew Road, Piscataway, United States of America, norman.kim@gmail.com, Sangheum Hwang, Chungmok Lee, Kyungsik Lee, Myong Jeong

Kernel-based methods such as SVR are popular data mining tools for solving regression problems. In recent years, a robust regression using quadratic mixed integer programming(QMIP) to delete outliers, has been proposed. However, the approach has a drawback that it is not capable of fitting nonlinear regression models. Therefore, we propose a new robust kernel-based method which is capable to represent the nonlinearity of data and is not easily affected by outliers.

3 - A Data-Integrated Simulation to Predict Financial Market Movement
Durai Sundaramoorthi, Assistant Professor, Missouri Western State University, 4525 Downs Drive, Saint Joseph, MO, 64507, United States of America, dsundaramoorthi@missouriwestern.edu, Dung Nguyen, Andrew Coult

The Standard and Poor's 500 Index (S&P500) is one of the commonly used indices on the New York Stock Exchange which reflects the overall market of the United States. The broader objective of this research is to estimate the dynamics of the financial market movement in the United States. It is achieved by developing a data-integrated simulation model to predict S&P500 open and close values for a week.

■ MA32

C - Room 6A, Level 3

Advances in Approximate Dynamic Programming and Reinforcement Learning - I

Sponsor: Computing Society
Sponsored Session

Chair: Marek Petrik, University of Massachusetts Amherst, 140 Governors Drive, Amherst, MA, 01003, United States of America, petrik@cs.umass.edu

1 - Recent Progress in Off-policy Reinforcement Learning
Csaba Szepesvari, University of Alberta, Athabasca Hall 3-11, Edmonton, Canada, szepesva@ualberta.ca

Temporal-difference (TD) based reinforcement learning (RL) algorithms might diverge when used in off-policy settings, seriously limiting their applicability. Recently, Sutton, Szepesvari and Maei introduced a new trick which allows one to design new RL algorithms which inherit the desirable properties of TD algorithms, while avoid their problems. In this talk I will talk about this trick and how it can be used to design new algorithms in reinforcement learning and beyond.

2 - Optimal Stepsizes in Approximate Value Iteration
Ilya Ryzhov, Operations Research and Financial Engineering, Princeton University, Princeton, NJ, 08540, United States of America, iryzhov@princeton.edu, Warren Powell, Peter Frazier

In approximate dynamic programming, random observations are smoothed to estimate the value of being in a state, leading to the problem of choosing a stepsize. We propose a new stepsize rule that is optimal for a basic ADP problem. This is the first rule to explicitly consider the covariance between the current observation and the previous prediction in ADP. We extend the rule to general ADP settings; experimental results show that it produces fast convergence without the need for tuning.

3 - Optimization-based Algorithms for Approximate Dynamic Programming
Marek Petrik, University of Massachusetts Amherst, 140 Governors Drive, Amherst, MA, 01003, United States of America, petrik@cs.umass.edu, Shlomo Zilberstein

Most ADP algorithms iteratively approximate the value function. Although these algorithms can achieve impressive results in some domains, they often require extensive parameter tweaking to work well. We present new more reliable algorithms, which use optimization instead of iterative improvement. These optimization-based algorithms are easy to analyze and offer much stronger guarantees. We present experimental results on management of water discharge from a dam.

■ MA33

C - Room 6B, Level 3

Search and Integrated Methods in Constraint Programming

Sponsor: Computing Society
Sponsored Session

Chair: Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, vanhoeve@andrew.cmu.edu

1 - A Polyhedral Study of the Cumulative Constraint
Tallys Yunes, Department of Management Science, University of Miami, Coral Gables, FL, 33124-8237, United States of America, tallys@miami.edu, Ioannis Mourtos, Dimitrios Magos

The cumulative constraint is used to describe scheduling problems in which a machine can process more than one job at a time. We study the convex hull of feasible solutions to the cumulative constraint and propose families of facet-defining inequalities for a number of special cases. We also present some preliminary computational results obtained with the implementation of our cuts inside a branch-and-cut algorithm for cumulative scheduling.

2 - Checking the Feasibility of Dial-a-Ride Instances using Constraint Programming
Louis-Martin Rousseau, Ecole Polytechnique de Montreal, 6079, Succ. Centre-ville, Montreal, Canada, louis-martin.rousseau@polymtl.ca, Gerardo Berbeglia, Gilles Pesant

We present an algorithm to determine whether a given instance of the Dial- a-Ride Problem is feasible, based on Constraint Programming which is particularly effective to solve feasibility problems. To achieve this, we have modeled the DARP as a Constraint Satisfaction Problem (CSP) and we have then developed filtering algorithms to determine whether or not a partial solution can be extended into a complete solution taking into account different sets of constraints.

3 - Backdoors in the Context of Combinatorial Optimization and Learning
Ashish Sabharwal, Research Associate, Cornell University, 5160 Upson Hall, Ithaca, NY, 14853-7501, United States of America, sabhar@cs.cornell.edu, Bistra Dilkina, Carla Gomes, Yuri Malitsky, Meinolf Sellmann

Backdoor variables are a structural property of combinatorial problems providing insight into the surprising ability of modern constraint solvers to tackle extremely large instances. We extend this notion to optimization problems such as MIP and demonstrate its effectiveness in capturing problem structure in optimization as well. Further, we show that incorporating the notion of "learning" during search, a key feature of modern reasoning engines, results in substantially smaller backdoors.

4 - Scalable Load Balancing in Nurse to Patient Assignment Problems
Jean-Charles Régin, University of Nice-Sophia Antipolis, 2000, Route des Lucioles, Sophia Antipolis, France, jean-charles.regin@unice.fr, Pascal Van Hentenryyck, Pierre Schaus

We consider the daily assignment of newborn infant patients to nurses. The objective is to balance the workload of the nurses. We present constraint programming models for solving instances with hundreds of patients and nurses in a few seconds. They use the spread constraint to minimize the variance and an exact decomposition technique. We show that these models clearly improve a MIP model.

■ MA34

C - Room 7, Level 3

Stochastic Optimization in Energy

Sponsor: Computing Society
Sponsored Session

Chair: Lauren Hannah, Postdoctoral Researcher, Dept of Statistical Science, Duke University, Box 90251, Durham, NC, 27708, United States of America, lhannah@princeton.edu

1 - Stochastic Search for Wind Energy Commitments in the Presence of an Observable State Variable

Lauren Hannah, Postdoctoral Researcher, Dept of Statistical Science, Duke University, Box 90251, Durham, NC, 27708, United States of America, lhannah@princeton.edu

Many stochastic, convex optimization problems have behavior that depends on an observable state variable, including wind energy commitment. We use machine learning to take observations from the joint state-outcome distribution and use them to infer the optimal decision for a given observed state. We propose two solution methods: function based optimization and gradient based optimization. These methods are tested on the hour ahead wind commitment problem.

2 - Dynamic Energy Management for a Smart Grid Consumer

Chin Hon Tan, PhD Student, Department of ISE, University of Florida, 303 Weil, University of Florida, Gainesville, FL, 32611, United States of America, chinhon@ufl.edu, Pramod Khargonekar, Siqian Shen

Smart Grid technologies have opened up various energy purchasing options for consumers. A consumer seeks an optimal energy usage plan given stochastic utility price. We employ DP algorithm for solving the problem, and discuss solution insights with respect to assumptions of energy storage and renewable energy generation devices. We also suggest a variation that optimizes a pricing strategy for utility companies when facing strategic consumers.

3 - Optimizing a Policy for the Storage of Natural Gas with the Approximate Knowledge Gradient

Warren Scott, Graduate Student, Princeton Operations Research and Financial Engineering Department, Sherrerd Hall, Princeton, NJ, 08544, United States of America, wscott@princeton.edu, Warren Powell

We apply the approximate knowledge gradient framework to optimize a natural gas storage policy over continuous parameters. The value of the policy, as a function of continuous parameters, is modeled using Gaussian process regression, and the approximate knowledge gradient is used to sequentially choose parameter settings in which to evaluate the policy in order to efficiently optimize the policy.

■ MA35

C - Room 8A, Level 3

Routing in Queues

Sponsor: Applied Probability
Sponsored Session

Chair: Douglas Down, McMaster University, 1280 Main Street West, Hamilton, Canada, downd@mcmaster.ca

1 - Flexible Server Allocation and Routing for Parallel Queues When the Service Rates are Not Additive

Mark Lewis, Associate Professor, Cornell University, School of ORIE, 226 Rhodes Hall, Ithaca, NY, 14850, United States of America, mel47@cornell.edu, Hyun-Soo Ahn

Customers arrive to 2 parallel stations in accordance with independent Poisson processes. Station dependent holding costs are accrued. When a customer arrives it may join the queue or be routed at cost r to the other station. All service requirements are assumed to be exponential with rate 1. When the servers work at separate stations the service rates are μ, while when the work at same station it is mu_c. The sub-additive (2mu > mu_c) and super-additive (mu_c > 2mu) cases are considered.

2 - Surprising Results on Task Assignment in Server Farms Under High Variability Workloads

Mor Harchol-Balter, Associate Professor, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, harchol@cs.cmu.edu

It is well known that when job size variability is high, short jobs can get stuck behind long jobs. In a server farm setting, this can be avoided by allocating short jobs their own server (or set of servers) to isolate them from long jobs, as in the Size Interval Task Assignment policy (SITA). The SITA policy is very popular in compute server farms, where job size variability is high. This talk questions the above common wisdom by considering job size variability approaching infinity.

3 - Design and Control of Flexible IVR Systems Under Demand Uncertainty

Tolga Tezcan, Assistant Professor, University of Rochester, 305 Schlegel Hall, Rochester, NY, 14627, United States of America, Tolga.Tezcan@simon.rochester.edu, Banafsheh Behzad

We consider a call center model operating under demand uncertainty with an IVR (Interactive Voice Response) system. Our goal is to study the effect of the IVR design in the performance of a call center with the objective of minimizing the total costs associated with staffing and abandonments. We propose an asymptotically optimal solution methodology, using stochastic programming and fluid approximations, for the design and control of these systems when the system size is large.

4 - On Routing to Parallel SRPT Queues

Douglas Down, McMaster University, 1280 Main Street West, Hamilton, Canada, downd@mcmaster.ca

We consider a system of parallel queues, each operating under the Shortest Remaining Processing Time (SRPT) discipline. Using recently developed fluid model approximations for SRPT queues, we give conditions under which the overall performance of the system is not highly sensitive to the choice of routing policy. In particular, we discuss when state independent routing may be effective.

■ MA36

C - Room 8B, Level 3

Online Teaching I

Sponsor: INFORM-ED
Sponsored Session

Chair: Mike Racer, University of Memphis, 334 Fogelman, Memphis, TN, United States of America, mracer@memphis.edu

1 - Online Teaching I - Online Teaching is Becoming a Huge Area of Interest. In This Session, Our Roundtable Discussion Focuses on Best Practices

Mike Racer, University of Memphis, 334 Fogelman, Memphis, TN, United States of America, mracer@memphis.edu

This session is a participative session for determining how INFORMed might play a role in assisting those who are developing their own online courses. Issues such as collaborative development, open courseware, and shared resources will be discussed.

■ MA37

C - Room 8C, Level 3

Analysis and Control of Queueing Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Nilay Argon, University of North Carolina, Department of Statistics and OR, 333 Hanes Hall, CB#3260, Chapel Hill, NC, 27514, United States of America, nilay@email.unc.edu

1 - General Notions of Indexability for Queueing Control and Asset Management

Kevin Glazebrook, Professor, Lancaster University, Department of Management Science, Lancaster University, Lancaster, LA1 4YX, United Kingdom, k.glazebrook@lancaster.ac.uk

We develop appropriately generalised notions of indexability for a class of problems where some divisible resource (manpower, money equipment) is to be allocated dynamically to a collection of stochastic objects requiring it. Project indices are functions of both resource level and state and have a simple and natural interpretation. We illustrate ideas by examples from queueing control and asset management.

2 - Queueing Systems with Appointment-driven Arrivals, Non-punctual Customers, and No-shows

Oualid Jouini, Assistant Professor, Ecole Centrale Paris, Grande Voie des Vignes, Chatenay-Malabry, 92290, France, oualid.jouini@ecp.fr, Saif Benjaafar

We consider appointment driven queueing systems where a finite number of customers arrive over time. Customers are however not necessarily punctual and may also not show up altogether. Customers are not homogeneous in their punctuality and no-shows. We develop an exact analytical approach to obtain various performance measures of interest and illustrate the usefulness of the approach by describing numerical results that examine the impact of not accounting for non-punctuality and no-shows.

3 - Dynamic Control of Unreliable Flexible Servers: The "W" Network and Beyond

Soroush Saghafian, PhD Candidate, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, soroush@umich.edu, Bora Kolfal, Mark Van Oyen

We consider the problem of assigning (unreliable) flexible servers to different customer classes. We show that a version of the cμ rule, "fixed task before the shared," is optimal under some conditions for the network forming a "W". However, the optimal policy is complex. Thus, for general structures, we propose a new rule termed as Largest Expected Workload Cost (LEWC). We find that it performs very well in comparison with four key policies: optimal, LQ, cμ, and generalized cμ (Gcμ).

4 - Priority Scheduling in Queueing Systems with Impatient Customers

Nilay Argon, University of North Carolina, Department of Statistics and OR, 333 Hanes Hall, CB#3260, Chapel Hill, NC, 27514, United States of America, nilay@email.unc.edu, Evin Uzun

We consider queueing systems with several classes of customers who renege from the system if they are not taken into service during their lifetimes. Classes of customers differ in their distributions of rewards, lifetimes, and service times. Our objective is to characterize priority scheduling policies that maximize the total accumulated rewards. We identify several conditions under which a state-independent policy is optimal.

■ MA38

C - Room 9A, Level 3

GO & MINLP in Network Applications

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Brian Lunday, Assistant Professor, Department of Mathematical Sciences, U.S. Military Academy, Department of Math. Sci., Building 601, United States Military Academy, West Point, NY, 10996, United States of America, lunday@vt.edu

1 - Network Optimization of Neuroanatomy

Christopher Cherniak, Professor Emeritus, Committee for Philosophy and the Sciences, Department of Philosophy, University of Maryland, College Park, MD, 20742, United States of America, cherniak@umd.edu

Deployment of connections in the brain is finely optimized to "Save wire". This review focuses on minimization of large-scale costs, e.g., volume for neuron arbors, and wirelength for positioning of connected neural components such as invertebrate ganglia and mammal cortex areas. The examples of optimized neuroanatomy here turn out to include candidates for some of the most complex biological structures known to be derivable purely from simple physical energy-minimization processes.

2 - Optimizing Network Flows with Congestion

Edward Chamberlayne, PhD Candidate, Virginia Tech, Blacksburg, VA, 24061, United States of America, edchambe@vt.edu, Douglas Bish

This paper proposes a cell-based dynamic network flow model that includes the effects of congestion. This type of modeling framework is appropriate for vehicular traffic applications and models both the flow and speed reduction aspects of traffic congestion. We embed this model into a mixed integer linear program that is appropriate for optimizing flows for planning purposes and eliminates some of the undesirable flow properties found in linear program formulations.

3 - Network Flow Interdiction Models and Algorithms with Resource Synergy Considerations

Brian Lunday, Assistant Professor, Department of Mathematical Sciences, U.S. Military Academy, Department of Math. Sci. (Building 601), United States Military Academy, West Point, NY, 10996, United States of America, lunday@vt.edu, Hanif Sherali

We model and solve the network interdiction problem of minimizing the maximum flow through a network from a given source and terminus, while incorporating different forms of superadditive synergy effects between resources applied to the arcs in the network. Considering linear, concave and nonlinear, and general synergy relationships, we develop and test effective solution procedures for the underlying problems, compared to the performance of selected leading commercial solvers.

■ MA39

C - Room 9B, Level 3

Mixed Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Oktay Gunluk, IBM Research, TJ Watson Research Center, Yorktown Heights, NY, United States of America, gunluk@us.ibm.com

1 - Two Dimensional Lattice-free Cuts and Asymmetric Disjunctions for Mixed-integer Polyhedra

Oktay Gunluk, IBM Research, TJ Watson Research Center, Yorktown Heights, NY, United States of America, gunluk@us.ibm.com, Sanjeeb Dash, Santanu Dey

We study the relationship between 2D lattice-free cuts and various types of disjunctions. Recently, Li and Richard (2007) studied t-branch split disjunctions of mixed-integer sets. Balas (2009) initiated the study of cuts from 2-branch split disjunctions. We study these cuts (and call them cross cuts) for the two-row continuous group relaxation, and for general MIPs. We also consider cuts obtained from asymmetric 2-branch disjunctions which we call crooked cross cuts.

2 - New Cutting Planes for Separable Piecewise Linear Optimization and Extensions

Ismael De Farias, Texas Tech University, Lubbock, TX, United States of America, ismael.de-farias@ttu.edu

We give new inequalities valid for the separable piecewise linear optimization polytope. We strengthen the inequalities for the case where some of the variables are semi-continuous. We report on extensive computational experimentations on the use of the cuts in a branch-and-cut scheme.

3 - Sensor Placement in Water Networks: An Interdiction Model

Scott DeNegre, OR Analyst, Technomics, Inc, 201 12th St South, Suite 612, Arlington, VA, 10002, United States of America, sdenegre@technomics.net, Ted Ralphs

We consider the problem of sensor placement optimization in water networks. Recent models have assumed a single decision-maker and used a MIP to determine a minimum expected contamination impact solution. We relax this assumption and employ MIP Interdiction to find the solution that minimizes worst-case impact. The models will be compared and computational results will be provided.

4 - Basis Reduction, and the Complexity of Branch-and-bound

Mustafa Tural, IMA / Telcordia Technologies, 16 Holly Ct, Highland Park, NJ, 08904, United States of America, tural@email.unc.edu, Gabor Pataki, Erick B. Wong

We show that the classical branch-and-bound method is theoretically efficient, if we apply a simple transformation to the constraint matrix to make the columns short and near orthogonal. Surprisingly, with high probability the reformulation of bounded integer programs get solved at the root node. Our main result generalizes earlier work on the solvability of low density subset sum problems. On the practical side, we find that reformulations of random integer programs become easier for commercial solvers, as the size of the coefficients grow.

■ MA40

C - Room 9C, Level 3

Optimization Software for Problems Arising in Machine Learning

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: Katya Scheinberg, Research Sceintist, Columbia University, Mudd Bldg, 500 W 120th street, New York, NY, 10027, United States of America, ks79@columbia.edu

1 - Fast Alternating Linearization Method for Sparse Inverse Covariance Selection

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

Learning the structure of the genetic regulatory network is usually transformed to estimating a sparse inverse covariance (SICS) matrix from the sample data. We propose a novel first-order method based on alternating linearization technique for solving SICS. We establish iteration complexity bound for the proposed algorithm. Numerical experiments are conducted to demonstrate the practical efficiency of our algorithm.

2 - Efficient Algorithms for the Group Lasso
Zhiwei (Tony) Qin, Columbia University, 313A, 500 West 120th Street, New York, NY, 10027-6699, United States of America, tonyqin@gmail.com, Donald Goldfarb, Katya Scheinberg

First we propose a general version of the block coordinate descent (BCD) algorithm to the Group Lasso with an efficient approach to perform subproblem optimization. As an alternative we propose an extension of ISTA/FISTA based on variable step-lengths as a simplified version of BCD. Both proposed algorithms show excellent performance over other state-of-the-art approaches to this problem. Additionally, we apply the algorithms to the Multiple Measurement Vector (MMV) recovery problem.

3 - Fast Alternate Linearization Methods for Robust Principal Component Analysis
Donald Goldfarb, Professor, Columbia University, 500 W. 120th Street, Mudd Building, Room 313, New York, NY, 10027, United States of America, goldfarb@columbia.edu

Robust principal component analysis (RPCA) problem can be solved as a convex optimization problem under fairly mild conditions. We present a fast alternating linearization method for doing this and an accelerated variant that obtains, in the latter case, an epsilon-optimal solution in O(1/sqrt(epsilon)) iterations. We apply our methods to solve applications of the RPCA model in surveillance video and video denoising that result in problems with up to 46 million variables.

4 - Fast First Order Method with Line Search
Katya Scheinberg, Research Sceintist, Columbia University, Mudd Bldg, 500 W 120th street, New York, NY, 10027, United States of America, ks79@columbia.edu, Donald Goldfarb

We show a theoretically justified approach that allows us to use the line search in conjunction with an accelerated gradient method.

■ MA41

C - Room 10A, Level 3

Optimization Algorithms and Error Analysis

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Angelia Nedich, University of Illinois at Urbana-Champaign, 104 S. Mathews Avenue, Urbana, United States of America

1 - Dual Averaging Methods for Regularized Stochastic Learning and Online Optimization
Lin Xiao, Researcher, Microsoft Research, 1 Microsoft Way, Redmond, WA, 98052, United States of America, Lin.Xiao@microsoft.com

We consider regularized stochastic learning and online optimization problems, where the objective function is the sum of two convex terms: one is the loss function of the learning task, and the other is a simple regularization term. We develop extensions of Nesterov's dual averaging methods that can exploit the regularization structure in an online setting. In the case of ℓ_1-regularization, our method is particularly effective in obtaining sparse online solutions.

2 - A Practical Relative Error Criterion for the Classic Augmented Lagrangian
Jonathan Eckstein, Rutgers, Rutcor, Room 155, 640 Bartholomew Road, Busch Campus, Piscataway, NJ 08854, USAjeckstei@rci.rutgers.edu, Paulo J.S. Silva

We describe an augmented Lagrangian method for nonlinear optimization that has a relative error criterion for the minimization of each subproblem, based only on readily available information: a simple function of the augmented Lagrangian gradient must fall within some fixed fraction of the violation of the KKT conditions. We give motivation, prove global convergence in the convex case, and present preliminary computational results. The algorithm involves a novel "error drift" sequence.

3 - Random Projection Algorithms for Convex Minimization Problems
Umit Tursun, University of Illinois at Urbana-Champaign, 117 Transportation Building, Urbana, United States of America, utursu2@illinois.edu, Angelia Nedich

We discuss iterative gradient-based methods with random projections for constrained convex minimization problems, where the constraint set is specified as the intersection of finitely many "simple" constraints. The proposed algorithms are applicable to the situation where the whole constraint set of the problem is not known in advance, but it is rather learned in time through observations. We present the algorithms' convergence properties and provide error bounds.

■ MA42

C - Room 10B, Level 3

Stochastic Programming - Models and Algorithms

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Eduardo Perez, Postdoctoral Research Associate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, eduardopr@neo.tamu.edu

1 - Algorithms for Solving Two-Person Zero-Sum Games
Jinho Lee, PhD Student, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, jinho7956@mail.utexas.edu, David Morton

A two-person zero-sum game with finitely many strategies can be solved via a linear program (LP). However, if the payoff matrix has exponentially many rows or columns, solving an LP is not most efficient approach. In this case, iterative methods such as fictitious play, weighted majority and randomized algorithms, can be used to approximately solve the game. Following Washburn (2001), we review the computational complexity and compare the empirical performance of these algorithms.

2 - Finite Horizon Preventive Maintenance Models with Random Age Reduction Factors
Inderjeet Singh, Research Assistant, The University of Texas at Austin, 1 University Station C2200, ETC 5.110, Austin, TX, 78712, United States of America, inderjeet@mail.utexas.edu, David Morton, Elmira Popova, Ernie Kee

In practice most preventive maintenance (PM) actions are imperfect and their exact quality cannot be predicted. However, uncertainty in PM quality can be estimated a priori and in some situations it is known after the PM has been performed. We develop two single equipment stochastic PM optimization models that use random age reduction factors to model PM quality. The operational failures are minimally repaired, and we minimize the expected total cost of the PMs and repairs over a finite horizon.

3 - Ellipsoidal Scenario Selection for the Sample Average Approximation
Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr, Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu

We propose a marriage between the modern convex optimization and sampling techniques for the large scale stochastic programming. The research outcome is a sampling scheme which is essentially a novel variance reduction method which directly samples the polyhedron. The research will lead to a distributed computational infrastructure and substantially reduced model scale.

4 - A Multi-Product Risk-Averse Newsvendor with Law-Invariant Coherent Measures of Risk
Sungyong Choi, Rutgers University, 1 Washington Street, Room #1072, Newark, NJ, 07102, United States of America, sungyongchoi@gmail.com, Andrzej Ruszczynski, Yao Zhao

We consider a risk-averse multi-product newsvendor with law-invariant coherent measures of risk. We first establish the convexity of the model, the symmetry of the solution and the monotonicity of the impact of risk aversion. Then, we obtain closed-form approximation which is easy to compute and much more accurate than the risk-neutral solution. Then we obtain the analytical and numerical insights for the interplay between risk aversion and demand dependence structure.

■ MA43

C - Room 1, Level 2- Mezzanine

Modeling in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Michael Carter, Professor, University of Toronto, Mechanical & Industrial Engg, 5 King's College Rd., Toronto, ON, M5S 3G8, Canada, mike.carter@utoronto.ca

1 - Ambulatory Clinic Scheduling at Princess Margaret Hospital
Brendan Eagen, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, brendan.eagen@utoronto.ca, Michael Carter, Timothy Chan

We investigate the scheduling of ambulatory clinics at Princess Margaret Hospital, the largest cancer care hospital in Canada. Our objective is to evenly distribute the demand for shared resources across the work week by re-assigning the hospital's 350 clinic sessions to time slots. Our problem closely resembles a collectively capacitated generalized assignment problem; where the clinic sessions are items to be assigned to knapsacks (time slots) subject to the capacities of our shared resources.

2 - Get Me to Burnt Church on Time - Blood Logistics Planning
John Blake, Professor, Dalhousie University, Halifax, NS, Canada, john.blake@dal.ca

As part of its program to improve the efficiency and effectiveness of blood operations, Canadian Blood Services has proposed a plan to modify the way in which blood products are distributed in Atlantic Canada. The proposed change is not without its detractors. In this paper we discuss the opportunity to use operational research to resolve an interesting and important (if thorny) practical problem.

3 - How Many Family Physicians are Needed? A System Dynamics Approach
Sonia Vanderby, University of Toronto, Mechanical & Industrial Engineering, 5 Kings College Rd, Toronto, ON, M5S 3G8, Canada, sonia@mie.utoronto.ca

This research model the family physician workforce necessary to meet the health needs of a population in four sectors: inpatient, ambulatory, continuing and community care. Developed using system dynamics, this model produces outcomes in terms of physician FTEs and headcounts. The model includes five components: population health status and demography, health service requirements, workforce characteristics and service delivery adjustments. Application to the province of Alberta is presented.

4 - Chemotherapy Appointment Scheduling at the BC Cancer Agency
Martin Puterman, Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Martin.Puterman@sauder.ubc.ca, Ruben Aristizabal, Vincent Chow, Pablo Santibanez, Kevin Huang

The Ambulatory Care Chemotherapy Unit at the BC Cancer Agency - Vancouver Centre delivers nearly 15,000 outpatient treatments per year. Clinical complexity, high resource utilization and scheduling restrictions led to multiple operational problems. We redesigned the appointment booking process and developed an optimization model to allocate appointments to nurses, balancing workload and complexity. We present the scheduling model and discuss our experience during implementation.

■ MA44

C - Room 2, Level 2- Mezzanine

Stochastic Models in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Turgay Ayer, PhD Candidate, University of Wisconsin-Madison, 1513 University Ave., 3233 ME Building, Madison, WI, 53706, United States of America, tayer@wisc.edu

1 - Models for the Spread of Infectious Diseases and Optimal Health Policies
Reza Yaesoubi, Post-Doctoral Research Fellow, Harvard Medical School, 641 Huntingtone Ave., Boston, MA, 02115, United States of America, reza.yaesoubi@gmail.com, Ted Cohen

We propose a new class of models for the spread of infectious diseases in large populations. This class of models, which generalizes the existing discrete-time Markov chain models of infectious disease spread, can be used by Markov Decision Process (MDP) and Partially Observable MPD to assist real-time selection of public health interventions given the epidemiological status of the disease. We generate the stationary optimal health policies for a stylized model of Influenza spread.

2 - Weakly Coupled MDP Models for Allocation Scheduling in Healthcare
Yasin Gocgun, PhD candidate, Industrial and Systems Engineering, University of Washington, Seattle, United States of America, gocgun@u.washington.edu, Archis Ghate

We study allocation scheduling problems where multiple renewable resources are dynamically allocated to heterogeneous classes of job service requests arriving randomly. We provide MDP models of these problems and show that they are weakly coupled. Hence we apply a Lagrangian relaxation technique for their approximate solution. An application to patient scheduling problems will be presented.

3 - Capacity Planning for Long Term Care in the Ottawa Region
Jonathan Patrick, Assistant Professor, University of Ottawa, 55 Laurier Avenue, Ottawa, ON, K1N 6N5, Canada, Patrick@telfer.uottawa.ca

Inadequate access to long term care (LTC) causes blocked beds in the hospitals as well as stress in the community due to long wait times. LTC scheduling is a complex problem due to the non-homogeneity of LTC beds, the presence of client choice and the competing demands of hospital and community. We present a MDP model that determines the required hospital access, a more complex ADP model of the entire scheduling process and a simulation model for testing policies and for capacity planning.

■ MA45

C - Room 6, Level 2- Mezzanine

Modeling, Quantifying and Reducing Health Disparities

Sponsor: Health Applications
Sponsored Session

Chair: Maria Mayorga, Assistant Professor, Clemson University, 110 Freeman Hall, Department of Industrial Engineering, Clemson, SC, United States of America, MAYORGA@clemson.edu

1 - A Methodology to Guide Risk Analysis in Health Care Delivery Systems
Laila Cure, University of South Florida, Department of Industrial & Management Sy, Tampa, FL, United States of America, lncure@mail.usf.edu, Jose Zayas-Castro, Peter Fabri

Healthcare systems require continuous monitoring of risk in the delivery of care to prevent adverse events. Risk analysis is a time consuming activity that depends on the background of analysts and data available. Patient safety data is often limited and biased. We propose a systematic methodology based on traditional safety science and risk analysis models to allocate available evidence of risk throughout the delivery system. This will facilitate risk analysis and allow for timely intervention.

2 - Making Combination Vaccines Affordable: Determining the Optimal Subsidy
Ruben Proano, Assistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, rpmeie@rit.edu, Wenbo Zhang

Reducing the number of shots needed to provide full protection to infectious diseases decreases the logistics and administrative costs associated with immunization campaigns. However, combination vaccines are prohibitively expensive for low income countries. This study determines the minimum subsidy that would incentive a manufacturer to introduce of a combination vaccine in a low income country at an affordable price, without losing its profitability.

3 - Characterizing the Impact of Risk Factors on Mortality for Breast Cancer Patients
Shengfan Zhang, North Carolina State University, 3008 Kings Ct Apt H, Raleigh, NC, 27606, United States of America, szhang5@ncsu.edu, Kathleen Diehl, Julie Ivy

We model and compare mortality for breast cancer patients using community-based Carolina Mammography Registry data. Mortality from breast cancer and other causes are calculated as a function of patient age, race, breast cancer risk factors (breast density and estrogen receptor status) and censoring information. Left censoring is incorporated using a multifaceted cancer growth model to quantify the lag between actual start time of breast cancer and diagnosis time (recorded cancer start date).

4 - Obesity Trends Among White Women in the US
Maria Mayorga, Assistant Professor, Clemson University, 110 Freeman Hall, Department of Industrial Engineering, Clemson, SC, United States of America, MAYORGA@clemson.edu, Kelly Hunt, Odette Reifsnider

We use a mixed-methods approach, incorporating both statistical methods and simulation to examine trends in weight-gain over time among white women of child-bearing age in the US from 1980 to 2008 using US Census and NHANES data. Results show that incidence rate has increased over time. We test different models for attributing increased risk over time. Results will be used to predict effects due to the intrauterine environment and to quantify disparities among ethnic/racial groups.

■ MA46

C - Room 7, Level 2- Mezzanine

Panel Discussion: INFORMS Journals

Cluster: Invited Panels on Professional Issues
Invited Session

Moderator: Terry Harrison, Professor, Penn State University, 459 Business Building, University Park, PA, United States of America, tharrison@psu.edu

1 - Panel discussion with INFORMS Editors
Panelists: Terry Harrison, Professor, Penn State University, 459 Business Building, University Park, PA, United States of America, tharrison@psu.edu, Michel Gendreau, CIRRELT, C.P. 6128, Succursale Centre-ville, Montreal QC, Canada, Michel.Gendreau@cirrelt.ca, Stephen Graves, Abraham Siegel Professor of Managment, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Ave E53-347, Cambridge MA 02139, United States of America, sgraves@MIT.edu, Jeff Camm, Professor, University of Cincinnati, QAOM Dept, Mail Location 0130, Cincinnati OH 45221, United States of America, jeff.camm@uc.edu, John Chinneck, Professor, Carleton University, Systems and Computer Engineering, 1125 Colonel By Drive, Ottawa On K1S 5B6, Canada, chinneck@sce.carleton.ca

This session is a panel discussion with the Editors-in-Chief from several of the INFORMS journals. Each Editor will present a short description of their journal, both in what they are look for in submissions and how they handle the editorial process. After these brief statements by the editors, we will take questions from the audience. The EICs who will participate are: Jeff Camm (Interfaces), John Chinneck (JOC), Steven Graves (MSOM), Michel Gendreau (Transportation Science).

■ MA47

C - Room 8, Level 2- Mezzanine

Panel Discussion: Opportunities for OR in Biology and Medicine

Cluster: Computational Biology and Bioinformatics
Invited Session

Moderator: Russell Schwartz, Associate Professor, Carnegie Mellon University, 4400 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, russells@andrew.cmu.edu

1 - Opportunities for Operations Research in Biology and Medicine
Panelists:Russell Schwartz, Associate Professor, Carnegie Mellon University, 4400 Fifth Avenue, Pittsburgh, PA, 15213, United States of America, russells@andrew.cmu.edu, Ming-Ying Leung,Professor, The University of Texas at El Paso, 500 W. University Avenue, El Paso TX 79968, United States of America, mleung@utep.edu, Allen Holder, Rose-Hulman Institute of Technology, 5500 Wabash, Terre Haute IN, United States of America, holder@rose-hulman.edu

This panel discussion will consider problems and challenges in applying operations research methods to biology and medicine. The discussion is intended to broadly define both operations research and biology/medicine and will include relevance of optimization and simulation methods to problems in applied medical work and basic biological research. This is intended to be an interactive discussion with the audience and to follow up on issues that arise in the preceding sessions of the cluster.

■ MA48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Syncopation Software - DPL Even Easier From Excel!
Chris Dalton, 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 modelling 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-simulations.com, 320 Forest Haven Drive, Winter Garden, FL, 34787, United States of America, Chapman@LINKS-simulations.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.

■ MA49

C -Room 10, Level 2- Mezzanine

Pricing of Information Goods and Services

Sponsor: Information Systems
Sponsored Session

Chair: Amit Mehra, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, India, Amit_Mehra@isb.edu

1 - Economics of Interaction Utility
Ashish Agarwal, Asistant Professor, University of Texas at Austin, B6500, CBA 5.234, Austin, United States of America, Ashish.Agarwal@mccombs.utexas.edu, Tridas Mukhopadhyay, Pei-yu Chen

Customers in markets such as software buy one or more products to meet their individual requirements. Vendors provide additional interaction utility to customers when they buy specific product combinations. We use a game theoretical setup to study the vendor incentives for interaction utility in a market for two such products. We find vendors can provide variable interaction utility even if they can make higher profits by providing uniform level of interaction utility across all product pairs.

2 - Online Services in Competitive Markets: A Study of Prisoner's Dilemmas and Bertrand Supertraps
Min-Seok Pang, PhD Student, University of Michigan, 701 Tappan St., R0400, Ann Arbor, MI, 48109, United States of America, mins.pang@gmail.com, Hila Etzion

Many firms are utilizing IT to provide online services that promote interactivity among customers. We study a pricing and bundling problem of two product vendors who consider offering services with network effects. They have three choices - selling a product only, selling a bundle of the product and a service, and selling the service separately. We show that the firms may be caught in a Prisoner's Dilemma situation or a Bertrand Supertrap; offering services may undermine their profitability.

3 - Dynamic Pricing of Enterprise Software with Value Uncertainty: Motivation for Selling SaaS
Mingdi Xin, Assistant Professor, University of British Columbia, 660-2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, mingdi.xin@sauder.ubc.ca

I study software vendors' motivation to offer the lease-based Software-as-a-Service (SaaS) model as an alternative to perpetual licensing, considering two well-known characteristics of enterprise software adoption: upfront implementation costs and clients' uncertainty about their valuation for the software prior to use. The insights gained from this model shed light on the prevalence of perpetual licensing in the software market and the variation in adoption of SaaS across software segments.

4 - Introducing New Software Products using Public Beta Launches
Amit Mehra, Assistant Professor, Indian School of Business, Gachibowli, Hyderabad, India, Amit_Mehra@isb.edu

Public beta launches help spread the word about a new software product and provides insights into customer preferences that helps build a more valuable final product. However, showcasing a bad product in public may kill the market potential as well. Hence firms must carefully manage their new product introduction using public betas. We discuss these issues and also compare public betas with other product introduction strategies like skimming and penetration pricing.

■ MA50

C -Room 11, Level 2- Mezzanine

Agent-based Decision Support in Auctions and Negotiations

Sponsor: Information Systems
Sponsored Session

Chair: Wolfgang Ketter, Assistant Professor, Erasmus University, Rotterdam School of Management, Department of Decision and Information Science, Rotterdam, Netherlands, wketter@rsm.nl

1 - Neural Networks Based Agent for Determining Starting Price in Multi-unit Sequential Dutch Auctions

Meditya Wasesa, Erasmus University, Rotterdam School of Management, Dept of Decision and Information Science, Rotterdam, 3062 PA, Netherlands, mwasesa@rsm.nl, Jan van Dalen, Eric van Heck, Wolfgang Ketter, Alok Gupta

We focus on providing neural networks based recommender agent for determining starting price values for Multi-unit Sequential Dutch Auctions (MSDA) auctioneers. First, our agent will predict the first bid and the subsequent bid values. Then, the agent will use the prediction results as basis to give dynamic starting price recommendations. Finally, by adjusting the agent's recommendation tolerance, the auctioneers can preview the choice's consequences to the revenue and transaction time.

2 - Competing Keyword Auctions

De Liu, Assistant Professor, University of Kentucky, 455Y Gatton B&E Building, Lexington, KY, United States of America, de.liu@uky.edu, Jianqing Chen, Andrew Whinston

This paper studies the optimal design of keyword auctions when there are two competing auctioneers. Advertisers differ both in price (valuation-per-click) and quality (expected click-through rates). Two auctioneers compete for advertisers by choosing either a price-only ranking rule or a quality-adjusted ranking rule. Under this framework, we examine advertisers'participation problem and two auctioneers' game.

3 - Maritime Customs Negotiation with Corrupt Agents

F. Jordan Srour, Lecturer, The American University of Beirut, Engineering Management Program, FEA, P.O. Box 11-0236, Beirut, 1107 2020, Lebanon, srourf@hotmail.com, Neil Yorke-Smith

The progress of containers through customs is often more an exercise in negotiation rather than a structured queuing process. Once customs processes involve negotiation, corruption becomes a factor. By exploiting agent-based simulation techniques for modeling customs practices, the cost of customs corruption and the value of various reform policies can be estimated.

4 - Behavioural Simulations in Spot Electricity Auctions

Augusto Ruperez Micola, Assistant Professor, Universitat Pompeu Fabra, Barcelona, Spain, augusto.ruperezmicola@gmail.com, Albert Banal-Estañol

We study the consistency of behavioural simulation methods used to model the operations of wholesale electricity auctions and compare results to standard economic theory predictions. The match is good under best-response and reinforcement learning but not under fictitious play. The simulations perform well under flat and upward-slopping supply bidding, and also for plausible demand elasticity assumptions. Learning is influenced by the number of bids and initial conditions.

■ MA51

C -Room 12, Level 2- Mezzanine

Military Vehicle Routing Problems I

Sponsor: Military Applications
Sponsored Session

Chair: Chase Murray, Assistant Professor, Auburn University, Dept of Industrial & Systems Engineering, Auburn, AL, United States of America, cmurray@auburn.edu

1 - Dynamic Decentralized Cooperative Vehicle Routing

Michael Hirsch, Senior Principal Engineer, Raytheon, 3323 Pelham Road, Orlando, FL, 32803, United States of America, Michael_J_Hirsch@raytheon.com, Hector Ortiz-Pena

We research the tracking of multiple ground targets in an urban environment. Tracking is performed by a set of low-level autonomous UAVs (LLAU). These LLAU dynamically solve a decentralized vehicle routing problem, in order to track the targets. A set of high-level autonomous UAVs (HLAU) provides the communication backbone for the LLAU to share information on the targets they perceive. The HLAU solve a decentralized vehicle routing problem, in order to maximize communication of the LLAU.

2 - Target Visitation Sequence as a Bilevel Programming Problem

Eduardo Pasiliao, Air Force Research Laboratory, 101 West Eglin Boulevard, Egllin AFB, United States of America, pasiliao@eglin.af.mil

We formulate a model to simulate the possible paths for an airborne agent through multiple target locations requiring one or more visitations. Although the fastest way to get from one point to another is to travel in a straight line, the fact that the agent has a minimum turn radius means that it almost never takes a straight line route from one target to another. For our studies, we assume that the targets are immobile and the agent turns with a fixed minimum radius in a two-dimensional frame. The problem is primarily to find an optimal target visitation sequence. However, in order to calculate the length of the travel path through a given visitation sequence, we need to manipulate the approach angles to the target locations. The approach angle to a given target determines the best path to get to the next target in the sequence.

3 - Simultaneous Sensor Selection and Routing of Unmanned Aerial Vehicles for Complex Mission Plans

Frank Mufalli, University at Buffalo (SUNY), 339b Bell Hall, Buffalo, NY, United States of America, fmufalli@buffalo.edu, Rajan Batta, Rakesh Nagi

Military reconnaissance missions often employ a set of unmanned aerial vehicles (UAVs) equipped with sensors to gather intelligence information from a set of known targets. This work presents both a column generation heuristic and metaheuristic to simultaneously assign sensors to UAVs and route them through a field of targets. A mathematical model is also presented that was solved directly using CPLEX. Results from a performance study indicate that the heuristics quickly find good solutions.

4 - Dynamic Rerouting of Unmanned Aerial Vehicles

Chase Murray, Assistant Professor, Auburn University, Dept of Industrial & Systems Engineering, Auburn, AL, United States of America, cmurray@auburn.edu, Mark H. Karwan

We have proposed a modeling framework for dynamically rerouting airborne vehicles in response to changes in battlespace conditions. Because these assets are in-flight when new mission plans are required, rapid solution approaches are necessary. An intelligent branch-and-bound procedure is proposed, where additional valid cuts are employed to strengthen the LP relaxation. Extensive numerical testing demonstrates the effectiveness of this approach.

■ MA52

C -Room 13, Level 2- Mezzanine

New Models in National Security

Cluster: Homeland Security and Defense
Invited Session

Chair: Alexander Gutfraind, Postdoctoral Fellow, Los Alamos National Laboratory, Theoretical Division, Mail Stop B284, Los Alamos, NM, 87545, United States of America, gfriend@lanl.gov

1 - Attack-Graph-Based Attacker-Defender Modeling for Computer Network Security

Vicki Bier, Professor, University of Wisconsin-Madison, Department of Industrial Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, bier@engr.wisc.edu, Mehmet Ertem

We propose a general class of attacker-defender models for security of computer networks from different attacker types. The objective is to maximize the security of the network under a limited budget. We use attack graphs to analyze attacker preferences, and consider both myopic and non-myopic attackers and defenders to capture tradeoffs between optimality of results and computational feasibility.

2 - Minimum Connected Cut Problem and its Application in Destabilization of Terrorist Networks

Arunabha (Arun) Sen, Professor, School of Computing, Informatics and Decision Systems Engineering, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, asen@asu.edu, Sujogya Banerjee, Shahrzad Shirazipourazad, Pavel Ghosh

In this presentation, we introduce the Minimum Connected Cut Problem (MCCP), a variant of the classical Minimum Cut Problem (MCP). The concept of minimum connected cut can be utilized for the purpose of destabilizing terrorist networks. We show that MCCP is an NP-complete problem, thereby establishing the fact that the computational complexity of the MCCP is significantly higher than that of the MCP.

3 - Cutting Transnational Terrorist Networks

Alexander Gutfraind, Postdoctoral Fellow, Los Alamos National Laboratory, Theoretical Division, Mail Stop B284, Los Alamos, NM, 87545, United States of America, gfriend@lanl.gov

To estimate the risk of terrorist attacks I introduce a model of transnational terrorist groups based on the theory of activity networks. The networks represent how terrorists select target countries while minimizing risk. The models shows that protecting the US against attacks will cause a large increase in risk to other countries. Hence, multi-national defense strategies need to be developed.

4 - Optimizing Transformation of the United States Nuclear Weapons Infrastructure

Carol Meyers, Mathematician, Lawrence Livermore National Laboratory, 7000 East Avenue, L-153, Livermore, CA, 94550, United States of America, meyers14@llnl.gov, Clifford Shang, William Hart, Cynthia Phillips

The US nuclear weapons complex has undergone substantial consolidation in the last 30 years, including the closure of over 40% of all nuclear production and testing sites, and a substantial consolidation in the square footage of remaining facilities. We discuss mixed integer programming models that we have developed to help optimize this transformation process, utilizing a variety of optimization tools including an innovative algebraic modeling language and parallel computing.

■ MA53

C -Room 14, Level 2- Mezzanine

Design and Operation of Sensor Networks

Sponsor: Telecommunications
Sponsored Session

Chair: Natarajan Gautam, Associate Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, gautam@tamu.edu

Co-Chair: Arupa Mohapatra, Student, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77843, United States of America, arupa@tamu.edu

1 - On Sensor Network Localization using SDP Relaxation

Yinyu Ye, Professor, Stanford University, Stanford University, Stanford, CA, 94305, United States of America, yinyu-ye@stanford.edu, Nicole Taheri, Davood Shamsi

Sensor network localization is determining the locations of sensors given some mutual distances. We analyze certain conditions that guarantee a correct solution to the SDP relaxation of the problem. We find an objective function for a triangulation graph that results in an exact solution. Also, we show a d-localizable graph with nodes in general position is strongly localizable. Lastly, we find a non-asymptotic bound on the connectivity range of nodes to ensure the network is d-localizable.

2 - Optimizing Resource Replication in Wireless Sensor Networks with Non-uniform Topologies

Jeffrey Kharoufeh, Associate Professor, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States of America, jkharouf@pitt.edu, Guvenc Degirmenci

We develop and analyze approximate queueing models to evaluate resource replication strategies for query-based wireless sensor networks whose nodes are distributed non-uniformly in the plane. We show how to select the resource replication level that minimizes the aggregate long-run average energy expenditure of the network, subject to a quality-of-service constraint.

3 - Combined Routing and Node Replacement in Underwater Sensor Networks for Seismic Monitoring

Arupa Mohapatra, Student, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77843, United States of America, arupa@tamu.edu, Richard Gibson, Natarajan Gautam

Underwater wireless sensor networks are gaining prominence in seismic monitoring of petroleum reservoirs. Since the battery energy available to the sensor nodes is very limited, the inactive nodes are to be replaced in time to ensure continuous monitoring. The fixed cost of a replacement attempt is very high, but the variable component of the cost is not negligible either. We combine efficient routing and node-replacement schemes to minimize the average node-replacement cost of the network.

4 - Modeling and Optimization of a Wireless Sensor Network Problem

Hui Lin, Texas A&M University, Industrial and Systems Eng, College Station, TX, United States of America, linhui@neo.tamu.edu, Halit Uster

We present an integrated modeling framework for wireless sensor networks incorporating topology control and routing decisions. The optimization model aims to promote energy efficiency so as to prolong network lifetime. We develop efficient solution procedures based on Benders decomposition and utilize data visualization to support our optimization efforts. We also present computational results on the performance of the solution methods for test problem instances.

■ MA54

C -Room 15, Level 2- Mezzanine

Sources for Knowledge and Incentives for Sharing (KLIC)

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Jane Davies, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, j.davies@jbs.cam.ac.uk

1 - Birth of Stars: Does Heritage Matters in Science?

Francisco Veloso, Catolica Lisbon and Carnegie Mellon, Palma de Cima, Lisbon, Portugal, fveloso@cmu.edu, Leonardo Reyes-Gonzalez

Prior work has quantified the impact that leading researchers have on an established system, their peers and the institutions they work for. This paper looks at the role eminent scientists play in developing a research system. In particular, we look at the impact that leading scholars have in faculty at the beginning of their careers, contrasting the relevance of these stars alongside the role of a research group, as well as how the two dimensions jointly influence the new faculty.

2 - Information Sharing and Relative Performance Evaluation

Liad Wagman, Assistant Professor, Illinois Institute of Technology, Stuart School of Business, 565 W Adams St., Suite 451, Chicago, IL, 60661, United States of America, lwagman@stuart.iit.edu, Eliezer Geisler

Firms compensate based on relative performance to drive competition and incentivize effort. Intuition suggests such practices would discourage sharing new information with colleagues, even when its diffusion can enhance productivity and profit. We study how tradeoffs in information diffusion impact the profit-maximizing design of employment contracts. We find that relative-performance based compensation can actually reduce the firm's cost of institutionalizing new information.

3 - Inventor Dispersion and Market Value

Kun Liu, Assistant Professor, Wayne State University, 5201 Cass Ave, Detroit, United States of America, ek9525@wayne.edu, Jifeng Yu

Little research has examined how the dispersion of inventions among many or a few inventors would affect the firm's value creation and appropriation. We suggest that the dispersion among inventors has an inverted-U relationship with the firm's market value measured as Tobin's Q.

4 - Knowledge Creation and Knowledge Transfer in New Product Development Projects

Wenli Xiao, Georgia Institute of Technology, College of Management, 800 West Peachtree Street, Atlanta, GA, 30308, United States of America, xiao.wenli@mgt.gatech.edu, Janice Carrillo, Cheryl Gaimon

Two models are introduced (continuous and discrete) that characterize linkages among three stages of knowledge creation for engineering activities in an NPD project. We recognize that by transferring knowledge from one stage to another, the manager enhances the creation of knowledge at the latter stage. For both models, we provide a deep understanding of the nature of knowledge creation and knowledge transfer by analyzing how various parameters drive different solutions.

■ MA55

C -Room 16, Level 2- Mezzanine

Models in Entrepreneurship

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Moren Levesque, Associate Professor, York University, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, mlevesque@schulich.yorku.ca

1 - Exploring Gender Differences in the Innovation Activity of Entrepreneurs

In Hyeock Lee, Western Kentucky University, 1906 College Heights Blvd., Bowling Green, KY, 42101, United States of America, ian.lee@wku.edu, Matthew Marvel

Although most scholars agree that entrepreneurship is a gender-based process, little research has explored the gender-innovation relationship in new firms, representing a gap in the literature. We address this gap, and explore three potential mediating factors - educational background, inter-firm partnerships, and the regional location of the new firm - between entrepreneur gender and innovation activity.

2 - Intentionality of Growth: How Strategic Intent Affects Growth Tactics
John N Angelis, Rochester Institute of Technology, 105 Lomb Memorial Drive, Rochester, United States of America, jangelis@saunders.rit.edu, Rajendran Sriramachandramurthy, Richard DeMartino, Joseph C Miller

After demonstrating an intent to grow, small and medium-size firms must operationalize their growth strategy. In a survey of 27 firms, we investigate the relationship between the firms' approach to strategic growth planning and the degree to which a firm innovates in markets served and product/service offerings. We also examine how perception of internal and external growth obstacles influences growth tactics.

3 - Venture Capital Investment: Initiating and Revising the Deal
Meyyappan Narayanan, PhD Candidate, University of Waterloo, 200 University Ave West, Waterloo, ON, N2L 3G1, Canada, mnarayanan@uwaterloo.ca, Brian Cozzarin

We model the venture capital investment deal process under information asymmetry about the entrepreneur's disutility of effort (that affects his/her effort level). We let the VC take on a belief on the entrepreneur's minimum effort level and conjecture that there is a "critical point" in that belief and a corresponding ownership share for the VC that maximizes the deal welfare. We also present a decision rule for the VC to adopt if the offer is rejected.

4 - Are Entrepreneurs Influenced by Risk Attitude, Regulatory Focus or Both-a time Allocation Experiment
Moren Levesque, Associate Professor, York University, 4700 Keele Street, Toronto, ON, M3J 1P3, Canada, mlevesque@schulich.yorku.ca, Christian Schade, Katrin Burmeister

We endeavor to understand the determinants of behaviors where the tradeoff between financial risk and financial return comes from how individuals choose to divide their working time between wage and self-employment. We derive normative propositions drawn from utility theory and challenge them with behavioral hypotheses based on regulatory focus theory. A sample of 28 entrepreneurs and 38 non-entrepreneurs enables us to test these propositions and hypotheses in a controlled experiment.

■ MA56

C - Room 1, Level 1

Simulation: Industrial Applications

Sponsor: Simulation Society
Sponsored Session

Chair: Soumyadip Ghosh, Research Staff Member, IBM TJ Watson Research Center, 1101 Kitchawan Rd, Yorktown Heights, NY, 10598, United States of America, ghoshs@us.ibm.com

Co-Chair: Peter Haas, IBM Almaden Research Center, 650 Harry Road, San Jose, CA, 95120-6099, United States of America, peterh@almaden.ibm.com

1 - MCDB-R: Risk Analysis in the Database
Peter Haas, IBM Almaden Research Center, 650 Harry Road, San Jose, CA, 95120-6099, United States of America, peterh@almaden.ibm.com, Christopher Jermaine, Subi Arumugam, Luis Perez, Fei Xu

Enterprises need to manage the risk arising from data uncertainty. Typically, complex stochastic models specify a probability distribution over possible data values, and hence over database query results. Thus risk assessment amounts to exploration of the tail of a query-result distribution. We extend the Monte Carlo Database System (MCDB) to efficiently obtain a set of samples from the tail of a query-result distribution by adapting recent "Gibbs cloning" ideas to a database setting.

2 - Case Studies of Simulation in Services
Anshul Sheopuri, Research Staff Member, IBM TJ Watson Research Center, 19 Skyline Drive, Hawthorne, United States of America, sheopuri@us.ibm.com

In this talk, I will provide an overview of some our engagements where simulation is a critical component. I will review three pieces of work: (1) Pricing of High Performance Computing resources, (2) demand shaping in an assemble-to-order system, and, (3) volume forecasting of a loan origination process. The talk will highlight the need of simulation in order to being analytics-to-market by incorporating business actions.

3 - Variance Reduction Methods for Performance Estimation of Heuristic Policies: An Application to a Combined Pricing and Production Problem
Sechan Oh, IBM Research, 650 Harry Road, San Jose, United States of America, seoh@us.ibm.com, Markus Ettl, Karthik Sourirajan

In the areas of production and pricing control, optimal policies are often intractable to characterize, and thus cannot be implemented in practice. In such cases, one can develop heuristic policies as alternatives. Monte-carlo simulation is the most common method for estimating the performance of those heuristic policies. In this talk, we present variance reduction methods for such simulation tests, and apply it to a combined pricing and production problem.

■ MA57

C - Room 2, Level 1

Managing Risk in Supply Chains

Cluster: Risk Management
Invited Session

Chair: Amitabh Sinha, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, amitabh@umich.edu

1 - Dynamic Risk Management of Commodities: Model and Analysis
Sripad Devalkar, PhD Candidate, University of Michigan, Ross School of Business, 701 Tappan Street, R5431, Ann Arbor, MI, 48108, United States of America, devalkar@umich.edu, Ravi Anupindi, Amitabh Sinha

We model the dynamic risk management problem for a commodity processor in a multi-period setting. We propose a time-consistent risk measure based on the conditional value at risk (CVaR) and obtain the optimal policy structure. We develop efficient heuristics to compute the operational and financial decisions. We show that a time-consistent risk measure provides better mean-risk tradeoff and reduces the chance of extreme losses over the horizon, compared to optimizing the CVaR of total profits.

2 - Operations Management with Risk Constraints
Rene Caldentey, New York University, Leonard N. Stern School of Business, New York, NY, United States of America, rcaldent@stern.nyu.edu, Martin Haugh

We propose a methodology for the optimal selection of dynamic operating and financial hedging strategies when the decision maker is risk sensitive. Risk aversion is imposed through constraints on the feasible policies. We identify circumstances in which operational and financial decisions can be effectively decoupled.

3 - Optimal Market-Making Strategies with Risk Aversion
David Simchi-Levi, Professor, MIT, 77 Massachusetts Ave. Rm. 1-171, Cambridge, MA, 02139, United States of America, dslevi@mit.edu, Miao Song

Market-makers have the obligation to trade fixed amounts of assets at quoted bid or ask prices, and their inventories are exposed to the potential loss when the market price moves in an undesirable direction. We formulate this inventory control problem using a dynamic programming model and analyze the structural properties of the optimal control policy, which lead to efficient algorithms to solve the problem.

4 - Direct and Indirect Incentives in Managing Supply Disruption
Sammi Tang, Assistant Professor, University of Miami, 5250 University Drive, Coral Gables, FL, 33146, United States of America, ytang@miami.edu, Diwakar Gupta, Haresh Gurnani

We consider a supply chain where a buyer facing a deterministic demand sources from a supplier whose production process is subject to disruption risk. The supplier can choose a better reliability technology by making a costly investment. We study the effectiveness of the indirect incentive provided by order inflation, and a direct incentive provided by a subsidy, in improving supply reliability.

■ MA58

C - Room 3, Level 1

Joint Session Quantitative Finance/ Bayesian Models: Bayesian Methods in Finance

Cluster: Quantitative Finance/ Bayesian Models
Invited Session

Chair: Carlos Carvalho, Assistant Professor, The University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712-0212, United States of America, carlos.carvalho@mccombs.utexas.edu

1 - Dynamic Stock Selection Strategies: A Structured Factor Model Framework

Hedibert Lopes, Associate Professor of Econometrics and Statistics, The University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, hlopes@chicagobooth.edu, Carlos Carvalho, Omar Aguilar

We propose a framework for dynamic portfolio selection inspired by asset pricing theory and financial index models. We introduce a class of highly structured dynamic factor models for extracting latent components responsible for the cross-sectional co-variation in a large set of financial securities. Our models incorporate stock specific information in the estimation and deliver economically interpretable factors when estimating large time-varying covariance matrix and selecting stocks.

2 - Nonlinear Filtering and Learning Dynamics

Nicholas Polson, Professor, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637-1610, United States of America, nicholas.polson@ChicagoBooth.edu, Lars Peter Hansen, Thomas J. Sargent

We develop and then apply two refinements of particle filtering methods that allow us to model the behavior of individual agents who learn in the presence of model uncertainty. One refinement extends the use of sufficient statistics conditioned on hidden states and a subset of parameters as a device to perform sequential parameter learning. This allows us to replenish particles and extend the number of time periods for which numerical results are available. The other refinement focuses on the accuracy of the particle filtering algorithm on the portions of the filtered distribution that are most pertinent to the decision maker. We illustrate these methods in an equilibrium model with investors who design robust decision rules by exponentially tilting probabilities implied by their statistical model.

3 - On the Long Run Variance of Stocks: Time Varying Predictive Systems

Robert McCulloch, University of Texas, IROM Department, Austin, TX, United States of America, robert.mcculloch1@gmail.com

In "Predictive Systems: Living with Imperfect Predictors", Pastor and Stambaugh (2008) develop a framework for inferring expected returns. The predictive system framework consists of a vector auto regression in the stock return, the latent expected return for the next period, and a set of variables thought to be able to predict returns. In this paper we extend the predictive systems framework to account for multivariate time varying volatility with nonlinear prior information.

4 - Complex Priors in Time-varying Covariance Matrices

Carlos Carvalho, Assistant Professor, The University of Texas at Austin, 1 University Station, B6500, Austin, TX, 78712-0212, United States of America, carlos.carvalho@mccombs.utexas.edu

We propose a strategy to impose relevant nonlinear prior information in elements of a time-varying covariance matrix. Different computational alternatives to obtain samples from the posterior distribution are considered.

■ MA59

H - Salon A, 4th Floor

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Forio

Michael Bean, Forio Business Simulations, 333 Bryant Street, San Francisco, CA, 94133, United States of America, mbean@forio.com

During the session, Michael Bean will demonstrate how to create web simulations and use free drag-and-drop tools to create data visualizations for exploring what-if scenarios. He will discuss commonly occurring web simulation design challenges and potential solutions, and show examples of web simulations that have been used by thousands of users. Michael will also provide a series of guidelines for creating simulations online.

2 - Conrady Applied Science - Probabilistic Structural Equations and Causal Inference with BayesiaLab 5.0

Lionel Jouffe, Conrady Applied Science, 312 Hamlet's End Way, Franklin, TN, 37067, United States of America, jouffe@bayesia.com

Probabilistic Structural Equation Models (PSEM) based on machine-learned Bayesian Networks provide an efficient alternative to traditional Structural Equation Models (SEM). With BayesiaLab 5.0, PSEMs can be created through a series of semi-automatic clustering steps, which allows analysts to perform driver analysis extremely quickly, reducing research time from "months to minutes". As an extension, an intervention function is available, which formally implements Pearl's Do-Calculus for policy analysis.

■ MA60

H - Salon B, 4th Floor

Decision Analysis for Terrorism and Natural Disasters

Sponsor: Decision Analysis
Sponsored Session

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

1 - Do East Versus West Coast Residents Respond Differently to a Catastrophic Biological Outbreak?

Heather Rosoff, Postdoctoral Research Associate, University of Southern California, CREATE, RTH 322, MC-2902, Los Angeles, CA, 90089-2902, United States of America, rosoff@usc.edu, Richard John, Fynnwin Prager

This project uses scenario simulation of a catastrophic biological outbreak to evaluate the dynamic nature of affect, risk perception and avoidance behavior over time. Our experiment manipulated the outbreak cause (terror vs. accidental vs. unknown) and location (near vs. distant to origin), and explored coast as a moderating variable.

2 - Using MAU to Structure Domestic Intelligence Policy

Richard John, Associate Professor, University of Southern California, Department of Psychology & CREATE, SGM 621, MC-1061, Los Angeles, CA, 90089-1061, United States of America, richardj@usc.edu, Robin Dillon-Merrill, Genevieve Lester

The first step in a formal evaluation model is the construction of a value structure typically in the form of a hierarchy (i.e., a value tree). Working with consultants from defense and homeland security, we constructed a value tree to evaluate several domestic intelligence alternatives. We then used the value tree to elicit scores and weights from stakeholder groups to better understand disagreements regarding the effectiveness and intrusiveness of different domestic intelligence policies.

3 - Perceived Risk, Fear and Avoidance Behavior for Terrorism and Natural Disasters

William J Burns, Research Scientist, Decision Research, 511 Hillock Place, Encinitas, CA, 92024, william_burns@sbcglobal.net, Paul Slovic

Respondents nationwide evaluated (read and listened to a audio news report) online a description of a dirty bomb attack as well as a major earthquake occurring in the financial district of Los Angeles. The dirty bomb attack inspired considerably more fear, perceptions of risk and intentions to delay purchasing products or working near the downtown area of Los Angeles. Intentions to delay varied across product classes.

4 - How Near-Miss Events Influence Decisions: Evidence From Natural & Man-Made Disasters

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

In the aftermath of disasters, people often wonder why individuals, governments, and first responder organizations failed to react quickly and efficiently. We examine the role that near-miss experiences play in this problem. We explain why some types of near-misses increase an individual's propensity for risk, leading to complacency and inaction, whereas other near-misses have the opposite effect. We conclude with ideas about how to better communicate risks to the public.

■ MA63

H - Room 404, 4th Floor

Sequential Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Dharma Kwon, Assistant Professor, University of Illinois at Urbana-Champaign, Department of Business Administration, Champaign, IL, 61820, United States of America, dhkwon@illinois.edu

1 - Sale of a Deteriorating Asset via Sequential Search

Steven Lippman, Professor, UCLA Anderson Grad. School of Mgmt., 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, slippman@anderson.ucla.edu

We consider the sale of an asset via sequential search over a finite time horizon and analyze the problem in both the posted price and reservation price regimes. The distinguishing feature of this search model is the fact that the asset deteriorates with the passage of time. Under mild conditions, we show that the seller's optimal posted price and the seller's optimal reservation price) per remaining unit of the asset decreases as time passes.

2 - Sequential Changepoint Detection: State-of-the Art and Open Problems

Alexander G. Tartakovsky, Professor, University of Southern California, 3620 S. Vermont Ave, KAP 108, Los Angeles, CA, 90089-2532, United States of America, tartakov@usc.edu

Changepoint problems deal with detecting a change in a process. The gist of the sequential changepoint problem is to design a detection procedure that minimizes the detection delay of a real change subject to a bound on the false alarm rate. We overview state-of-the-art and recent advances, and discuss open problems. We consider a variety of optimality criteria such as Bayesian, generalized Bayesian, minimax, etc. Not only classical iid models but also general non-iid models are addressed.

3 - Learning about Consumer Tastes for a Horizontally Differentiated Product Category

Canan Ulu, University of Texas at Austin, IROM, B6500, Austin, TX, 78712, United States of America, canan.ulu@mccombs.utexas.edu, Dorothee Honhon, Aydin Alptekinoglu

We model this problem as a discrete time dynamic program where each period the firm chooses an assortment based on the prior distribution over consumer tastes. The consumers then choose a product that maximizes their own utility and the firm observes sales. We order assortments based on their information content and show that the optimal assortment cannot have lower information content than the myopically optimal assortment.

4 - Sequential Replacement Decisions Under Incomplete Information

Dharma Kwon, Assistant Professor, University of Illinois at Urbana-Champaign, Department of Business Administration, Champaign, IL, 61820, United States of America, dhkwon@illinois.edu

Business entities such as venture capitalists often have to make sequential investment and exit decisions for a series of projects without knowing the individual project's quality. We use a Bayesian framework to study sequential decisions to terminate and replace projects.

■ MA68

H - Room 415, 4th Floor

Virtual Worlds and Their Potential Impact on Business

Sponsor: eBusiness
Sponsored Session

Chair: Molly Wasko, Florida State University, College of Business, Tallahassee, FL 32306 United States of America, mwasko@uab.edu

1 - Leading Virtual World Teams

Molly Wasko, Florida State University, College of Business, Tallahassee FL 32306, United States of America, mwasko@uab.edu, Samuel Goh

Every day, millions of globally-dispersed participants connect and collaborate in virtual worlds, which presents an intriguing opportunity to examine leadership in virtual world teams. VWTs face the disruptive effects of geographical, cultural, and technology-mediated discontinuities found in virtual teams, combined with the challenges of face-to-face teams in terms of synchronous coordination. This begs the question: how do leaders influence member outcomes within VWTs?

2 - Bridging the Virtual and the Real: The Technology of Tomorrow is Arriving

Jeremiah Spence, Doctoral Researcher, University of Texas at Austin, 1108 Lavaca St. 110-494, Austin, TX, 78701, United States of America, jspence5@mail.utexas.edu, Laurian Stocioviciu, Nadie Machado-Spence

Virtual worlds, online games & interactive interfaces are becoming highly sophisticated, and a bridging is taking place between the virtual and the real that will transform the experience of interacting with others and information. This presentation will map out the convergence of interactive and immersive technologies, and the market implications of the radical changes in the information consumer experience that will result from these innovations.

3 - Comparing the Quality of Customer Service in 3D Immersive Environment to Traditional Web Service

Dan Ke, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States of America, dan.ke@business.uconn.edu, Sulin Ba, Jan Stallaert, John Zhang

According to media richness theory, lack of face-to-face interaction makes web service communication inefficient. 3D virtual worlds provide a new platform that offers customer service, where users can communicate "face to face" via their representative avatars. We propose a conceptual model of service quality to compare the quality of customer service and users' satisfaction in 3D virtual worlds to that of web-based services. We design an experiment in Second Life to test our conceptual model.

■ MA69

H - Salon F, 6th Floor

Current O.R. Based Planning Tools Used by US Railroads, and Opportunities for Further Application of O.R.

Sponsor: Railrway Applications
Sponsored Session

Chair: Ron Griffith, Director Service Design, BNSF Railway, 2600 Lou Menk Dr, 1st Floor - OOB, Fort Worth, TX, 76131, United States of America, Ron.Griffith@BNSF.com

1 - MIP Based Approach to Solve Train Routing Problem

Krishna Jha, Director, Innovative Scheduling, Gainesville, FL, United States of America, Krishna@innovativescheduling.com, Ravindra Ahuja, Suat Bog, Florin Rusu

Innovative Train Scheduling Optimizer (ITSO) is an integrated optimization software to generate train schedules considering railcar, crew, and locomotive costs. We have developed a decomposition problem to solve this large and complex optimization problem. We present the MIP based approach to solve the Train Routing Problem, a critical component in the decomposition based approach. We also compare results of MIP approach with that of heuristics for real-life instances.

2 - PHMSA Route Analyzer: An Algorithm Based Routing Tool for TIH/PIH Traffic

Viraj Karnik, Norfolk Southern, 1200 Peachtree St, Atlanta, GA, United States of America, viraj.karnik@nscorp.com, Ingrid Schafrick, Clark Cheng

PHMSA and FRA issued a rule (HM-232E) to make it safer and more secure to transport hazardous material by rail. This requires rail carriers to compile annual data on certain shipments of explosive, TIH, and radioactive materials; use the data to analyze safety and security risks along rail routes; assess alternative routing options; and make routing decisions based on those assessments. PHMSA Route Analyzer provides NS a platform (tool) to adhere to the requirements laid out by the regulation.

3 - Application of OR Models in Service Design

Dharma Acharya, AVP - Operations Research, CSX, 500 Water St. J250, Jacksonville, FL, 32202, United States of America, Dharma_Acharya@CSX.com, Cary Helton

In this presentation, we will describe the current application of OR models in designing and maintaining railroad operating plan at CSX. We will also present additional opportunity areas where more OR models can be useful in creating and maintaining the railroad operating plan for changing traffic demand.

■ MA70

H - Salon G, 6th Floor

Optimization in Sabre AirCentre Enterprise Operations Solutions

Sponsor: Aviation Applications
Sponsored Session

Chair: Chunhua Gao, Sabre Airline Solutions, 3150 Sabre Drive, Southlake, TX, 76092, United States of America, chunhua.gao@sabre.com

1 - Optimization Methods in Next Generation Crew Rostering Optimizer
Ramakrishna Thiruveedhi, Sabre Airline Solutions, 3150 Sabre Drive, Southlake, TX, 76092, United States of America, Ramakrishna.Thiruveedhi@sabre.com, Chunhua Gao, Peng Duan, Tina Shaw

Sabre AirCentre Enterprise Operations Solutions is a new, enterprise-wide, next generation operations solution working across all areas of operations - flight, crew, maintenance and airport - from planning to tracking to recovery. Crew Rostering Optimizer is an important component in crew management solutions. We present an optimization framework designed to solve airline crew rostering problem with quality of life attributes fairly distributed and many airline desired controls incorporated.

2 - Airport Staff Roster Optimization
Ke Ding, Sabre Airline Solutions, 555 Loushanguan Road, Suite 1608, Shanghai, 200051, China, Ke.Ding@sabre.com, Mandar Sathe, Xuehua Lu

Airport staff rostering problem is to construct dated, repeating or rotating, and fair or packed rosters from tasks in a given period with the objective to maximize task coverage with given employees, or minimize the number of employees to cover given tasks while subjecting to task, shift, roster, and solution level constraints for multiple employee types. We will present our multi-stage optimization approach to solving this complex problem and some solution results on real word scenarios.

3 - Pruning Techniques in Crew Recovery Optimizer
Chunhua Gao, Sabre Airline Solutions, 3150 Sabre Drive, Southlake, TX, 76092, United States of America, chunhua.gao@sabre.com, Dong Liang, Tina Shaw

Sabre is developing an optimizer to recover the broken crew roster lines during irregular operations. As the number of broken crews increases, the crew recovery problem becomes harder to solve. In this presentation, we will discuss several pruning techniques to speed up the optimizer, including: i) pruning candidate crews; ii) restricting assignment swaps; and iii) decomposing problems. Our experiments show that these techniques can balance the requirements on run time and solution quality.

4 - Sabre Reaccommodation Manager
Sureshan Karichery, Sr. Operations Research Analyst, Sabre Holdings, Navigator Level 2/3, ITPB, Whitefield, Bangalore, KA, 560066, India, Sureshan.Karichery@sabre.com, Michael Clarke, Ashwin Naik

The Sabre Reaccommodation Manager provides a framework that addresses how airlines can efficiently rebook affected passengers in the event of schedule disruptions. The model incorporates various rules and aspects of the passenger re-accommodation procedures and contractual obligations. The underlying optimization model is a multi-commodity network flow problem over a time-space network. We present some computational results from a recent implementation at one of the largest US airline.

■ MA71

H - Salon H, 6th Floor

DEA Algorithms

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Appa Gautam, London School of Economics, g.appa@lse.ac.uk

1 - Stochastic DEA by Genetic Algorithm in Uncertain Environments
Shunsuke Yamada, Osaka University, Japan, shunsuke.yamada@ist.osaka-u.ac.jp, Hiroshi Morita

Data envelopment analysis is a method for measuring the efficiency of decision making units. When there are stochastic variations in data, the efficiency evaluations such as efficiency score, reference units, are also stochastic. It has been proposed the genetic algorithm in uncertain environments (GAUCE) to solve a combinatorial optimization problem under uncertainty. We discuss the stochastic evaluation of efficiency under uncertainty by applying the framework of GAUCE.

2 - Using Penalty Function to Influence Weight Selection in Data Envelopment Analysis
Warren Sutton, Research Analyst, CNA, 4825 Mark Center Dr., Alexandria, VA, 22311, United States of America, suttonw@cna.org, Stanko Dimitrov

One of the greatest strengths of DEA is the lack of presupposed weights on the inputs and outputs. However, this strength also can be a weakness in situations where none of the evaluation criteria should be ignored. This study examines how to alter weight selection using a penalty function to allow for user preferences. The effectiveness of the methodology is demonstrated with an application to the Navy detailing.

3 - A Fast Algorithm for DEA Problems with a New Method for Finding Positive Multipliers
Appa Gautam, London School of Economics, g.appa@lse.ac.uk, Nikolaos Argyris, Srinivasan Parthasarathy

We introduce a computationally efficient algorithm for solving DEA models. For an n DMU problem it solves n LPs consisting only of the DMU being investigated and a sub-set of the extreme efficient units (generators) on the efficient frontier which generate the PPS. We provide a comparison with the current best procedure in Dula (2010). A by-product of our work is a new closed-form method for finding positive weights for the generators which relates to the work of Cooper et al (2007).

4 - A New MILP Model for Finding the Most Efficient DMU
Mehdi Toloo, Azad University of Central Tehran branch, m_toloo@yahoo.com, Zahra Molaee

Data envelopment analysis (DEA) with considering the best condition for each decision making unit (DMU) assesses the relative efficiency for it and partitioned DMUs into two sets: efficient and inefficient. Practically, in traditional DEA models more than one efficient DMU are recognized and these models can not rank efficient DMUs. Some studies have been done aimed at ranking efficient DMUs. Recently, some authors have addressed the problem of finding most efficient DMU. Amin & Toloo [Amin, Gholam R., & Toloo, M. (2007). Finding the most efficient DMUs in DEA: An improved integrated model. Computers & Industrial Engineering, 52(2), 71-77.] proposed an integrated model for finding the most CCR-efficient DMUs. Amin [Amin, Gholam R., (2009). Comments on finding the most efficient DMUs in DEA: An improved integrated mode, Computers & Industrial Engineering, 56 (4), 1701-1702.] showed the problem of using Amin & Toloo's integrated DEA model and proposed a new improved DEA model for determining a single efficient unit. It is mathematically proved that his model identifies only a single efficient DMU. Nevertheless, his model is a Mixed Integer Nonlinear Programming (MINLP) which is complex to be solved. In this paper, it is shown that these two models have some extra restrictions which could have an effect on their optimal solutions. Then a new Mixed Integer Linear Programming (MILP) integrated DEA model is introduced for determining the best efficient DMU. A numerical example is used to show the usefulness of this model.

■ MA72

H - Salon J, 6th Floor

Traffic Signal Systems: Monitoring, Modeling and Optimization

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Henry Liu, University of Minnesota, Minneapolis, MN, United States of America, henryliu@umn.edu

1 - The Models and Algorithm for Investigating the Impacts of Signal Timing on Vehicle Emissions
Jing-Quan Li, Assistant Research Engineer, University of California - Berkeley, Berkeley, CA, United States of America, jingquan@path.berkeley.edu, Ning Zou, Guoyuan Wu

This paper investigates the impacts of signal timing on emissions at a pre-timed signalized intersection. We propose a two-stage approach: the first stage consists of optimization models that examine the trade-off between delays and stops; and the second stage is to estimate emissions using microscopic emission estimation models.

2 - Approximating Queue Size Dynamics Along Signalized Arterials using Event-Based Traffic Data
Saif Eddin Jabari, Graduate Research Assistant, University of Minnesota, 500 Pillsbury Dr. S.E., Minneapolis, MN, 55455, United States of America, jabar005@umn.edu, Henry Liu

Traditional queuing theoretic approaches to modeling queue sizes involve mathematical forms of transition probabilities that are preventative from an estimation standpoint. Therefore we propose a Brownian approximation scheme for actuated signalized intersections. The drift of the approximating process is shown to coincide with a deterministic dynamical system with complementarity constraints, to which a unique solution exists.

3 - A Data-driven Approach to Offset Optimization for Signalized Arterials
Henry Liu, University of Minnesota, Minneapolis, MN, United States of America, henryliu@umn.edu, Heng Hu

Since high-resolution traffic signal data can be readily available nowadays, in this paper, we present a data-driven approach to arterial offset optimization which can account for traffic flow variations. Since queues formed at the side-streets and residual queues for the major approaches are critical to the determination of signal offset, they are being considered in the optimization model explicitly.

4 - Vehicle Actuated Signal Performance Under General Traffic at an Isolated Intersection
Bruce Wang, Texas A&M University, College Station, TX, United States of America, bwang@civil.tamu.edu, Kai Yin

We study green extension of a two-phased vehicle actuated signal at an isolated intersection between two one-way streets. The green phase is extended by a preset time interval, referred to as critical gap. The green phase switches if there is no arrival during the critical gap. We develop an exact model to study the intersection performance with traffic following Poisson processes. We further extend the model to approximate the case of general traffic.

■ MA73

H - Salon K, 6th Floor

Consolidation and Network Design I: Location Problems

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Xiaopeng Li, University of Illinois at Urbana-Champaign, B156 Newmark Civil Engineering Laborator, 205 N. Mathews Ave, Urbana, IL, 61821, United States of America, li28@illinois.edu

1 - Location of Consolidation Facilities for a Distribution Network with Lead Time Constraints
Ronald G. Askin, Professor and Director, Arizona State University, School of Computing, Informatics, and Decision Systems Engineering, Tempe, AZ, 85287-8809, United States of America, Ron.Askin@asu.edu, Ilaria Baffo

We consider the problem of designing and operating a multi-product distribution network with multiple production facilities and many retail outlets. Potential locations for consolidation facilities that combine shipments for cost reduction and meeting replenishment lead time restrictions are considered. The problem is formulated with one and two stage consolidation opportunities. Computationally efficient heuristic solution approaches are developed and evaluated.

2 - A New Mixed Integer Program and Look-Ahead Algorithm for the Block Relocation Problem
Matthew Petering, University of Wisconsin-Milwaukee, P.O. Box 784, Milwaukee, WI, 53201, United States of America, mattpete@uwm.edu, Mazen Hussein

The block relocation problem (BRP) considers the optimal handling and retrieval of items stored in LIFO stacks. We introduce a new mathematical formulation of the BRP and describe a new look-ahead algorithm that achieves better objective values and CPU runtimes than the other algorithms from the literature.

3 - The Discrete Minimum-Cost Group Assembly Problem
Taesung Hwang, UIUC, B156 NCEL, 205 N. Mathews Ave., Urbana, IL, United States of America, hwang7@illinois.edu, Fan Peng, Yanfeng Ouyang

In a given area, N arbitrarily located objects need to be assembled such that for each object there should be at least one other object within a predetermined distance D. The formulated problem minimizes the sum of total travel distances of all the objects. The talk will briefly discuss how the model can be applied to a wide range of engineering contexts.

4 - The Effects of Operational Disruptions on Biorefinery Location Design
Xiaopeng Li, University of Illinois at Urbana-Champaign, B156 Newmark Civil Engineering Laborator, 205 N. Mathews Ave, Urbana, IL, 61821, United States of America, li28@illinois.edu, Yanfeng Ouyang, Fan Peng, Yun Bai

We apply discrete and continuous reliable facility location models to the design of reliable bio-ethanol supply chains for the State of Illinois. The impacts of site-independent and dependent disruptions are analyzed. It is found that refinery disruptions affect both optimal refinery deployment and the supply chain cost.

■ MA74

H - Room 602, 6th Floor

Innovations in Freight Systems Modeling

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Salvador Hernandez, Assistant Professor, University of Texas at El Paso, 500 W. University Ave., El Paso, TX, 79968-0516, United States of America, shernandez43@utep.edu

1 - Systems of Systems Framework for Understanding Freight Transportation Networks
Rodrigo Mesa Arango, rmesaa@gmail.com, Satish Ukkusuri

Freight transportation is a system formed by heterogeneous component systems that interact with each other by moving commodities across regions. Each component system is operated and managed independently, they adapt dynamically to environment changes. Their interactions set networks at different levels of hierarchy across trans-domain categories that display emergent behavior of the whole. The above mentioned traits allow define freight transportation as a system-of-systems. Several works have been done in modeling freight transportation networks capturing from different perspectives the complex interactions within and between actors. This paper presents a system-of-systems framework that will match system-of-systems traits with the previous work done in freight transportation modeling. We specially remark the use of network theory to understand evolutionary behavior in freight transportation networks.

2 - Optimal Fueling Strategies for Locomotive Fleets in Railroad Networks
Seyed Mohammad Nourbakhsh, PhD Student, UIUC, B-156 Newmark Civil Engineering Lab, MC-250, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, nourbak1@illinois.edu, Yanfeng Ouyang

This research presents a mathematical model that integrates not only fuel station location decisions but also locomotive fueling schedule decisions considering stochastic fuel consumption rate. The proposed model helps railroads decide which fuel stations to contract, and how each locomotive should purchase fuel along its predetermined shipment path, such that no locomotive runs out of fuel while the summation of fuel purchasing costs, shipment delay costs, and contracting charges is minimized.

3 - A Centralized Time-dependent Multiple Carrier Collaboration Problem for Less-than-Truckload Carriers
Salvador Hernandez, Assistant Professor, University of Texas at El Paso, 500 W. University Ave., El Paso, TX, 79968-0516, United States of America, shernandez43@utep.edu, Srinivas Peeta

We address a time-dependent centralized multiple carrier collaboration problem (TD-MCCP) in the context of the small- to medium-sized less-than-truckload (LTL) industry from a planning perspective. It represents a collaborative strategy in which a central entity (such as a 3PL firm) seeks to minimize the total system costs of an LTL carrier collaborative consisting of multiple collaborating carriers, by identifying collaborative opportunities over a shared network under three rate-setting behavioral strategies and a leasing alternative.

Monday, 11:00am - 12:30pm

■ MB01

C - Ballroom D1, Level 4

Non-dispatchable Producers and Electricity Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Antonio J. Conejo, Professor, University Castilla-La Mancha, Campus Universitario s/n, Ciudad Real, 13071, Spain, Antonio.Conejo@uclm.es

1 - Wind Impact on Locational Marginal Prices
Juan M. Morales, University of Castilla-La Mancha, Campus Universitario s/n, E. T. S. I. Industriales, Ciudad Real, 13071, Spain, JuanMiguel.Morales@uclm.es, Juan Pérez-Ruiz, Antonio J. Conejo

We describe a sampling-based approach to simulate the impact of an increasing wind power production on the LMPs of a competitive electricity market. The proposed analysis is useful to evaluate the random behavior of LMPs as a function of the statistical characterization of wind farms. Wind productions are treated as spatially correlated negative loads and the collateral effect of strategic offering is disregarded. A case study is used to draw some general conclusions of interest.

2 - Wind and Energy Markets: A Case Study of Texas
Ross Baldick, University of Texas, Austin, TX, United States of America, baldick@ece.utexas.edu

Many jurisdictions worldwide are greatly increasing the amount of wind production, with the expectation that increasing renewables will cost-effectively reduce greenhouse emissions. This presentation discusses the interaction of increasing wind, transmission constraints, renewable credits, wind and demand correlation, intermittency, carbon prices, and electricity market prices using the particular example of the Electric Reliability Council of Texas (ERCOT) market.

3 - Modeling Approaches for Combined Wind Power and Transmission System Optimization Problems
Daniel Burke, PhD Research Student, Electricity Research Centre, University College Dublin, Dublin, Ireland, daniel.burke@ucd.ie, Mark O'Malley

As a variable, uncertain, geographically interdependent electric power source, it's challenging to integrate wind energy within traditional combined generation/transmission expansion planning models without high dimensionality and complexity. While historical time series enumeration methods are well established, alternative approaches based on scenario reduction or multivariate component analysis may have equal promise in certain applications where sequential sample dependency is not critical.

4 - Wind Power Scenario Generation by Regression Clustering
Geoffrey Pritchard, University of Auckland, Dept of Statistics, Private Bag 92019, Auckland, New Zealand, geoff@stat.auckland.ac.nz

Probability distributions in stochastic programming must be represented discretely for computational reasons. We will consider ways of doing this when the distribution is conditional on covariates (predictors) whose value is known at the outset. The intended application is to stochastic optimization problems requiring probabilistic wind power forecasts.

■ MB02

C - Ballroom D2, Level 4

Real Options Theory and Energy Applications

Cluster: Energy: Modeling the Interface Between Markets and Operations
Invited Session

Chair: Stein-Erik Fleten, Professor, NTNU Norway, Department of Industrial Economics and Technology Management, Trondheim, Norway, Stein-Erik.Fleten@iot.ntnu.no

1 - Optimal Capacity Sizing and Investment Timing Under Risk Aversion and Uncertainty
Michail Chronopoulos, University College London, United Kingdom, m.chronopoulos@ucl.ac.uk, Afzal Siddiqui, Bert De Reyck

In this paper, we examine the problem a firm faces when contemplating investment in a project with a continuously scalable capacity size. We first analyze the optimal investment timing and sizing in the risk-neutral framework assuming no operational flexibility, and then extend this approach by allowing for risk aversion, through a CRRA utility function, and operational flexibility, through suspension and resumption options.

2 - Commercial Fleet Renewal - A Real Options Approach
Stefan Spinler, Professor, WHU-Otto Beisheim School of Management, Burgplatz 2, Koblenz, 56179, Germany, stefan.spinler@whu.edu, Andrei Neboian, Paul Kleindorfer

We evaluate commercial fleet renewal strategies with electric vehicles (EVs) using real options. We use a discrete-time real options model, with two underlying stochastic processes on battery and fuel prices, to solve for annual fleet replenishment strategies (using a mix of diesel vehicles and EVs), taking into account technology learning via experience curves. We derive optimal replacement strategies which maximize total project value given a specified demand scenario for fleet services.

3 - The Value of Storage for Intermittent Generators in a Deregulated Electricity Market
Yangfang(Helen) Zhou, PhD candidate, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, yfzhou05@gmail.com, Alan Scheller-Wolf, Stephen Smith, Nicola Secomandi

We study the value of storage for intermittent generators, such as wind turbines, in a deregulated electricity market. We develop and analyze a Markov decision process that optimizes the management of storage in the face of uncertain wind availability and electricity price, which we model as stochastic processes. We discuss the structure of the optimal storage policy. We also apply our model to wind and market data and discuss the managerial insights that follow from this application.

4 - Switching From Oil to Natural Gas in Active Offshore Petroleum Fields: Real Option Analysis
Stein-Erik Fleten, Professor, NTNU Norway, Department of Industrial Economics and Technology Management, Trondheim, Norway, Stein-Erik.Fleten@iot.ntnu.no, ÿystein Dahl Hem, Alexander Svendsen, Vidar Gunnerud

We value the option to switch from oil production to natural gas. A two-factor price model is implemented for both the oil price and the gas price, and the option valuation is based on the Least-Squares Monte Carlo algorithm. The most important factors affecting the real option value is the initial oil and gas price, but also price volatility has an impact. The option to switch has significantly higher value than a NPV approach. The NPV undervaluation may lead to fewer resources being developed.

■ MB03

C - Ballroom D3, Level 4

Forestry II: Harvest and Transportation Planning

Sponsor: Energy, Natural Resources and the Environment//Forestry Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Avenue, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Optimal CPLEX Parameter Settings for Solving Harvest Scheduling Models with Adjacency Constraints
Marc McDill, Penn State School of Forest Resources, University Park, PA, United States of America, mmcdill@psu.edu, Phillip Manning

Optimal parameter settings to improve the efficiency of solving harvest scheduling models with adjacency constraints were examined using Ilog's CplexÆ 11.2 optimizer tuning tool. A total of 640 randomly generated hypothetical forests were created with either 50 or 100 stands and four age-class distributions. Mean solution times were shorter using the optimal parameters compared to the default parameters. The results provide a simple approach to decreasing the solution time.

2 - A Cutting Plane Method for Solving Harvest Scheduling Models with Area Restrictions
Nora Konnyu, School of Forest Resources, University of Washington, Seattle, WA, United States of America, nk6@uw.edu, Svetlana Kushch

Integer programming is used as an exact optimization method in spatial forest planning with maximum harvest size restrictions. The most efficient models require costly enumeration techniques prior to optimization. We present a branch-and-cut algorithm for the Path Formulation that bypasses enumeration by creating adjacency constraints only if harvest opening size violations occur during optimization. The algorithm performs best when maximum harvest size is large relative to average stand size.

3 - Branching Techniques for Constrained Forest Harvesting
Alastair McNaughton, University of Aukland, Auckland, New Zealand, a.mcnaughton@auckland.ac.nz, David Ryan

Large scale optimization of forest harvesting subject to environmental constraints often involves some form of branch and bound. The manner in which the branching decisions are formulated and prioritized usually impacts decisively the rate of convergence of the solution algorithm. The talk will be referenced to the area-restricted clear-fell problem.

4 - Making Spatially Explicit Forest Management Decisions That Consider Stochastic Fire Disturbances
Yu Wei, Dept Forest, Rangeland and Watershed Stewardship, Colorado State University, Fort Collins, CO, United States of America, wei@warnercnr.colostate.edu, Michael Bevers, Dzung Nguyen

This research employs multi-stage full recourse stochastic programming models to explore the challenges and advantages of building spatial forest optimization models that explicitly consider the influences of potential future natural disturbances. Our exploratory test models simultaneously consider timber harvest and forest core area objectives. We use stand-replacing forest fire as an example to represent natural disturbances.

5 - Design of Insurance Contracts using Stochastic Programming in Forestry Planning
Andres Weintraub, Department of Industrial Engineering, University of Chile, Santiago, Chile, aweintra@dii.uchile.cl, Mordecai Henig, Jose Mosquera

This work addresses a tactical planning problem faced by a forestry firm,deciding quantities of timber to harvest and roads to build. The problem is modeled and solved given several timbers' price scenarios assuming that the decision maker has a risk averse utility function. Additionally, we design two reasonable insurance contracts that benefit both the firm and the insurer and show that only one of them is efficient. The results are illustrated.

■ MB04

C - Ballroom D4, Level 4

Economic Modeling and Analysis of Highly Renewable Energy Systems

Cluster: Clean Energy
Invited Session

Chair: Alan Lamont, Engineer, Lawrence Livermore National Laboratory, 7000 East Ave., Livermore, ca, 94550, United States of America, lamont1@mail.llnl.gov

1 - An Optimization and Monte Carlo Planning Approach for High Penetrations of Intermittent Renewables

Elaine Hart, Stanford University, Yang & Yamazaki Environ. & Energy Bldg, 473 Via Ortega, MC 4020, Stanford, CA, 94305, United States of America, elaine.hart@gmail.com, Mark Z. Jacobson

A new model is has been developed that determines generator portfolio planning strategies for systems with high penetrations of intermittent generation, including wind, CSP, and PV's. The model formulates the renewable portfolio planning problem as a linear program, then uses a Monte Carlo dispatch simulation to determine the levels of conventional dispatchable generation required to meet a reliability constraint over a two-year period. Results are presented from a study of the California ISO.

2 - Optimizing Aggregation Scenarios for Integrating Renewable Energy into the U.S. Electric Grid

Bethany A. Corcoran, PhD Student, Stanford University, Yang & Yamazaki Environ. & Energy Bldg., 473 Via Ortega, Room 390C, Stanford, CA, 94305, United States of America, bethany.corcoran@gmail.com, Mark Z. Jacobson

This study is an analysis of 2006 and 2007 electric load, wind speed and solar irradiance, and existing hydroelectric, geothermal, and other power plant data to determine if aggregating various FERC regions reduces variability and/or coincidence of peak events, which could reduce the amount of carbon-based generators in a high renewables system. Multiple scenarios of varying RPS values are considered, and the corresponding transmission costs are compared against the cost/savings of generators.

3 - Assessing the Economic Value of Large Scale Electricity Storage

Alan Lamont, Engineer, Lawrence Livermore National Laboratory, 7000 East Ave., Livermore, ca, 94550, United States of America, lamont1@mail.llnl.gov

Large scale electricity storage will be a necessary component of electric system with a high proportion of intermittent resources. This research presents an analytic framework to assess marginal values of charging and discharging capacities, and energy storage capacity. It takes into account their efficiencies and operating costs, and the impact that large scale charging and discharging has on the system prices. A practical illustration is given for a system similar to the California system.

■ MB05

C - Ballroom D5, Level 4

Mechanism Design

Cluster: Auctions and Game Theory
Invited Session

Chair: Christoph Mueller, University of Minnesota, 4-101 Hanson Hall, 1925 Fourth Street South, Minneapolis, MN, 55455, United States of America, christmu@econ.umn.edu

1 - Robust Virtual Implementation Under Common Strong Belief in Rationality

Christoph Mueller, University of Minnesota, 4-101 Hanson Hall, 1925 Fourth Street South, Minneapolis, MN, 55455, United States of America, christmu@econ.umn.edu

We show that unlike static mechanisms, dynamic mechanisms can strategically distinguish payoff types by their observable choices and robustly virtually implement social choice functions even in cases the preference interdependence exceeds a critical threshold. In private consumption environments with generic valuations, dynamic mechanisms can strategically distinguish all payoff types and as a consequence robustly virtually implement all ex-post incentive compatible social choice functions.

2 - Incentive Compatible Market Design with an Application to Matching with Wages

M. Bumin Yenmez, Microsoft Research, One Memorial Drive, Cambridge, MA, 02142, United States of America, byenmez@stanford.edu

This paper studies markets for heterogeneous goods using mechanism-design theory. For each combination of desirable properties, I derive an assignment process with these properties in the form of a corresponding direct-revelation game, or I show that it does not exist. The key properties are individual rationality, incentive compatibility, budget balance, and efficiency. The main results characterize mechanisms that are ex post incentive compatible in combination with other properties.

3 - Mean Field Approximation of Large Games

Aaron Bodoh-Creed, Assistant Professor, Cornell University, 462 Uris Hall, Cornell University, Ithaca, NY, 14853, United States of America, acreed@cornell.edu

We compare the equilibria of a game with a large finite number of participants to the equilibria of a game with a continuum of participants. We show that equilibrium strategies of the two models converge as the number of participants in the large finite game goes to infinity. We apply our results to show that the uniform price auction asymptotically aggregates information and is efficient when agents have complementary preferences with a common value component for multiple units.

4 - Grid Distributions to Study Single Object Auctions

Luciano De Castro, Northwestern University, 2001 Sheridan Ave, Evanston, IL, 60201, United States of America, decastro.luciano@gmail.com

Existence of pure strategy equilibrium in auctions usually requires that types are affiliated, but this is restrictive. We offer a new method to deal with statistical dependence, using density functions that are constant in squares (grid distributions). The set of grid distributions is dense in the set of all distributions and also very convenient for numerical simulations. We develop an algorithm for solving the SMPSE existence problem. We also show that grid distributions always have a PSE.

■ MB06

C - Ballroom E, Level 4

Tutorial: Risk Applications in Commercial Nuclear Power

Cluster: Tutorials
Invited Session

Chair: Ernie Kee, Risk Analyst, South Texas Project Nuclear Operating Company, P.O. Box 289, Wadsworth, TX, 77483, United States of America, keeej@STPEGS.COM

1 - Risk Applications in Commercial Nuclear Power

Ernie Kee, Risk Analyst, South Texas Project Nuclear Operating Company, P.O. Box 289, Wadsworth, TX, 77483, United States of America, keeej@STPEGS.COM

Broad categories of risk evaluated in commercial nuclear power production, nuclear safety and production losses, are summarized. Risk applications in nuclear safety and production losses categories are described. Preventive maintenance scheduling using risk metrics is detailed. Direct application and presentation of risk information to operations and maintenance planning personnel is described. Reliability and cost data analysis methods in use at a commercial nuclear power plant are summarized.

■ MB07

C - Ballroom F & G, Level 4

Tutorial: Constructing Multiattribute Utility Functions for Decision Analysis

Cluster: Tutorials
Invited Session

Chair: Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61801, United States of America, aliabbas@uiuc.edu

1 - Constructing Multiattribute Utility Functions For Decision Analysis
Ali Abbas, Associate Professor, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave, Urbana, IL, 61801, United States of America, aliabbas@uiuc.edu

A fundamental step in decision analysis is the accurate representation of the decision maker's preferences. When the decision situation is deterministic, each alternative leads to a single prospect (consequence). A prospect may be characterized by one or more attributes, such as health state and wealth. A value function that ranks the prospects is sufficient to rank order the decision alternatives in deterministic decision problems. When uncertainty is present, each alternative may result in a number of possible prospects, each characterized by a number of attributes. A von Neumann-Morgenstern utility function, defined over the domain of the attributes, is then required for each prospect we face. The best decision alternative is the one with the highest expected utility. This chapter surveys a variety of methods for constructing multiattribute utility functions. These methods include (i) using a deterministic value function and a one dimensional utility function over value; (ii) using a general expansion theorem for multiattribute utility functions; (iii) using an independence assumption and a utility diagram to simplify the assessment of the conditional utility functions; (iv) using an attribute dominance condition to reduce the number of assessments; (v) using a utility copula to incorporate dependence using single attribute assessments; (vi) deriving the functional form by asserting the number of preference switches that may occur for lotteries defined on a subset of the attributes, and (vii) characterizing preferences using functional equations to derive the functional form.

■ MB08

C - Room 11A, Level 4

Achieving Sustainability Through Facility Location Optimization

Sponsor: Location Analysis
Sponsored Session

Chair: Tarek Abdallah, Research Assistant, Masdar Institute of Science and Technology, Abu Dhabi, UAE, Abu Dhabi, United Arab Emirates, tabdallah@masdar.ac.ae

1 - Locating Stores to Improve the Triple Bottom Line
Zachary Gillerlain, University of Cincinnati, Dept of QAOM, Cincinnati, United States of America, gillerzc@mail.uc.edu, Michael Magazine, Michael Fry

We examine the implications of adding the cost of carbon to supply chain design. We consider inventory risk pooling, transportation costs, and facility costs in a single product environment. We find the profit-maximizing optimal number of stores for the firm as well as the optimal number of stores for social welfare. We then derive a policy that motivates the firm to act according to the social optimum.

2 - An Optimization-Simulation Tool for Supply Chain Designs and Management for Biocrude Production
Gokce Palak, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, gp192@msstate.edu, Sandra Eksioglu

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 (WWT) facilities. Biocrude can be further refined and converted to biodiesel. The optimization model identifies locations for facilities and the assignment of WWT plants to refineries, so that the total supply chain related costs are minimized. The simulation model captures the seasonality and randomness of biomass supply.

3 - Investigating the Option of Installing PVs on Facilities' Rooftops in a Green Supply Chain
Tarek Abdallah, Research Assistant, Masdar Institute of Science and Technology, Abu Dhabi, UAE, Abu Dhabi, United Arab Emirates, tabdallah@masdar.ac.ae, Jasper Rigter, Ali Diabat

An innovative idea to achieve energy positive buildings is installing rooftop photovoltaic (PV) cells that supply clean energy. This option is dependent on its economic attractiveness and the facility location with respect to policies (subsidies, feed in tariff...), and the amount of solar radiation available. We calculate the cost of installing rooftop solar PVs and integrate this decision in a green supply chain model that also takes into account emissions trading and green procurement.

■ MB09

C - Room 11B, Level 4

Structural Estimation in Operations Management

Sponsor: Manufacturing and Service Operations Management
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

Co-Chair: Gabriel Weintraub, Columbia Business School, Decision, Risk, and Operations, New York, NY, United States of America

1 - Matching Supply and Demand in the US Auto Industry: An Empirical Study
Antonio Moreno, The Wharton School, 3730 Walnut St, Philadelphia, United States of America, amore@wharton.upenn.edu, Christian Terwiesch

The automotive industry has undergone significant changes over the last months. We empirically analyze how differences in operational and supply chain practices are related to the ability of car manufacturers and dealers to match supply with demand.

2 - Structural Estimation of Callers' Delay Sensitivity in Call Centers
Baris Ata, Northwestern University, Evanston, IL, United States of America, b-ata@kellogg.northwestern.edu, S Emadi, Z Aksin Karaesmen, Che-Lin Su

We consider study a call center serving forward looking customers and estimate their delay sensitivity by structural estimation methods using individual choice data.

3 - Physician Practice Patterns and the Growth in Kidney Failure Incidence
Anicham Kumarasamy, PhD Candidate, Stanford University, Graduate School of Business, Stanford, CA, United States of America, anichamk@stanford.edu, Stefanos Zenios, Peter Reiss

The prevalence and incidence of kidney failure treated by dialysis and transplantation in the United States have increased dramatically since 1988. The increase is only partially explained by health factors such as the increasing rates of diabetes and hypertension. We examine how changes in physician behavior may also explain the increase.

4 - Structural Estimation of Large Scale Procurement Combinatorial Auctions
Marcelo Olivares, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 417, New York, NY, 10027, United States of America, molivares@columbia.edu, Sang-Won Kim, Gabriel Weintraub

Combinatorial auctions can increase efficiency and reduce procurement costs in multi-unit procurement auctions when units exhibit cost synergies. However, efficiency can be reduced when bidders are allowed to combine units which do not have synergies. We use structural estimation to learn about the cost structure of bidders using bid data. Our methodology uses a simplified bidding strategy to model how bidders set markups and simulation-based-estimation to recover costs.

■ MB10

C - Room 12A, Level 4

Issues in Sourcing and Procurement

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu

1 - Is Outsourcing a Win-win Game? The Effect of Competition, Contractual Form, and Merger

Lauren Xiaoyuan Lu, Design Outsourcing in a Differentiated Product Market: The Role of Bargaining and Scope Economies, University of North Carolina at Chapel Hill, Kenan-Flagler Business School, Campus Box 3490, McColl Building, Chapel Hill, NC, 27599, United States of America, Lauren_Lu@unc.edu, Annabelle Feng

Manufacturing firms constantly face the outsourcing decision in a competitive environment. Two theories have been suggested to explain the motivations of outsourcing. First, outsourcing is a win-win game. Second, outsourcing is able to soften competition. This paper challenges these two well-accepted theories by providing general examples to illustrate that (1) Outsourcing may be a win-lose game even when suppliers possess more operational efficiency; (2) Outsourcing may intensify competition.

2 - Revenue Sharing and Information Leakage in a Supply Chain

Raj Rajagopalan, Univ of Southern California, Marshall School of Business, Los Angeles, United States of America, raj@marshall.usc.edu, Guangwen Kong, Hao Zhang

Sharing information vertically 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 one, reducing the incentive of the informed one to share information. We explore if a revenue sharing contract can reduce the incentive of upstream suppliers to leak information and study existence of non-leakage equilibrium.

3 - Global Dual Sourcing: Tailored Base Surge Allocation to Near and Offshore Production

Gad Allon, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu, Jan Van Mieghem

We analyze a tailored base-surge (TBS) sourcing policy that replenishes at a constant rate from the offshore source and produces at the near shore plant only when inventory is below a target. We present performance bounds on the optimal cost and prove that economic optimization brings the system in heavy traffic. We determine the allocation of random demand into base and surge capacity, estimate corresponding working capital requirements, and identify and value the key drivers of dual sourcing.

4 - Sourcing Intermediaries

Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu, Elena Belavina

We demonstrate that sourcing intermediaries relieve a central trade off that buying firms face- the need for flexibility in their sourcing choices to accommodate changes in the economic landscape and the benefits of building inflexible committed relationships with a limited number of partners.

■ MB11

C - Room 12B, Level 4

Consumer Driven Operations Management Models

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Muge Yayla-Kullu, Asst. Prof., RPI, Lally School of Mgmt., 110 8th St., Troy, NY, 12180, United States of America, Yaylah@rpi.edu

1 - Optimal Investment and Option Value in Phase-III Development of New Drug in Pharmaceutical Industry

Zhili Tian, PhD Candidate, Washington University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, tianzh@WUSTL.EDU, Panos Kouvelis

Firms investigate the quality of a new drug as a function of safety and efficacy through clinical trials in Phase III. We model the quality by a probability distribution with unknown parameters and the patient enrollment process by a controlled Markov process. We solve the problem as a stochastic optimal control with Bayesian update of quality. We derive managerial insights into when to abandon, accelerate, and conduct interim analyses and what drugs to abandon or accelerate through real cases.

2 - The Product Line Design Problem in a Decentralized Supply Chain

Renato De Matta, Associate Professor, University of Iowa, 108 PBB, Iowa City, IA, 52241, United States of America, renato-dematta@uiowa.edu, Timothy Lowe, Lifang Wu

We analyze two cases of a vertically differentiated product line design problem. In case 1, the manufacturer develops one or multiple product line designs long before discussion with the retailer. The retailer may elect to not carry a product if the product does not meet her target profit. In case 2, the manufacturer's design lead time is short enough that the target profit is available to the manufacturer prior to any design decisions. Computational results are presented.

3 - Supply Chains with Store Brands and Random Demands

Xiang Fang, University of Wisconsin Milwaukee, 3202 N. Maryland Ave., Milwaukee, United States of America, fangx@uwm.edu, Srinagesh Gavirneni, Vithala Rao

We analyze a supply chain in which a retailer accepts (with an appropriate contractual agreements) a national brand for resale and then determines whether to introduce a store brand. We identify the conditions under which the the national brand manufacturer can (or cannot) prevent the retailer from introducing its store brand. We also propose and evaluate contracts that are contingent on the retailer's store brand introduction decision which can (cannot) coordinate this supply chain.

4 - Product Line Design Under Customer Valuation Uncertainty

Muge Yayla-Kullu, Asst. Prof., RPI, Lally School of Mgmt., 110 8th St., Troy, NY, 12180, United States of America, YAYLAH@rpi.edu, Jayashankar Swaminathan

We study the effects of customer valuation uncertainty on the vertically differentiated product line decisions of a monopolist with limited resources. In the first period, the firm decides its capacity allocation for each product based on the available resources and expectations on the customers' valuations. In the second period, customers' valuation distribution is realized and the firm makes its production and pricing decisions subject to the capacity allocation decision of the first period.

■ MB12

C - Room 13A, Level 4

Supply Chain and Inventory Management

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Retsef Levi, Associate Professor of Management, Massachusetts Institute of Technology, Sloan School of Business, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, retsef@mit.edu

1 - Price of Price-only Contracts in Competitive Supply Chains When Pricing is Endogenous

Georgia Perakis, William F. Pounds Professor of Operations Research and Operations Management, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA, United States of America, georgiap@mit.edu, Justin Teo, Sun Wei

We consider a two-tier supply chain in which there is a supplier who proposes a price-only contract to several retailers competing in the market through selling differentiated (complements or substitutes) products to consumers. We determine how i) vertical competition and horizontal competition as well as ii) endogenous pricing decisions from the retailers, affect prices, order quantities, chain-wide profits and consumers due to lack of coordination.

2 - Single-Item Lot-Sizing Problems with Online Demand Selection

Retsef Levi, Associate Professor of Management, Massachusetts Institute of Technology, Sloan School of Business, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, retsef@mit.edu, Adam Elmachtoub

In many settings that use the single-item lot-sizing model, there is typically a choice of whether or not to satisfy each demand. Satisfying demands leads to production costs while rejecting demands incurs lost sales costs. In practice, the decision to accept or reject a demand must be made in an online manner. In this work, we provide competitive online approximation algorithms to several variants of the single-item lot-sizing problem with online demand selection.

3 - Capacity Planning Under Dynamic Evolution of Asymmetric Demand Forecasts

Ozalp Ozer, Associate Professor, School of Management, The University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, oozer@utdallas.edu, Sechan Oh

We model the evolution of forecasts generated by multiple forecasters with asymmetric demand information and generalized the MMFE framework. Using this framework, we study a supplier's problem of eliciting credible forecast information from a manufacturer when both parties obtain asymmetric demand information over time. In the presence of dynamically evolving demand forecasts, the supplier has to determine how to design a mechanism to elicit private information and when to offer this mechanism.

■ MB13

C - Room 13B, Level 4

Strategic Problems in Green Supply Chain Management

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Elif Akcali, Associate Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, akcali@ise.ufl.edu

1 - A Systems Dynamics Model for Analyzing Sustainable Business Policies in a Closed Loop Supply Chain

Sudip Bhattacharjee, University of Connecticut, Storrs, CT, United States of America, Sudip.Bhattacharjee@business.uconn.edu, Jose Cruz

Increased concern for the environment has led to the design of supply chains that are both economically and ecologically feasible. This paper takes a system dynamics approach to explore the factors that impact the sales of new versus remanufactured products, and suggests policy implications for closed-loop supply chains return, remanufacturing and recycling processes.

2 - Sustainability and Modularity in New Product Introduction

John Khawam, Postdoc, WHU-Otto Beisheim School of Management, Burgplatz 2, Koblenz, 56179, Germany, john.khawam@gmail.com, Stefan Spinler

We study a situation where a manufacturer can introduce new products with varying levels of modularity. The amount and nature of modularity affects both the profitability and the sustainability of the new product introduction. We explore the various factors involved in determining modularity.

3 - Optimal Seeding for Remanufacturing

Ibrahim Karakayali, Post-doctoral Research Fellow, McGill University, Desautels Faculty of Management, 1001 Sherbrooke St. West, Montreal, QC, H3A1G5, Canada, ibrahim.karakayali@mcgill.ca, Elif Akcali, Sila Cetinkaya

Determining the level of seed inventory in order to satisfy the demand of a remanufacturable item is an important problem. To address this problem, we develop stochastic dynamic models to characterize the optimal seeding, inventory and production policies for a multiple-product system with reusable random returns.

4 - A Closed-loop Logistics Network Design Problem with Integrated Forward and Reverse Channel Decisions

Gopalakrishnan Easwaran, Assistant Professor, St. Mary's University, One Camino Santa Maria, MS 34, San Antonio, TX, 78228, United States of America, geaswaran@stmarytx.edu, Halit Uster

We consider a multi-product closed-loop supply chain network design problem consisting of hybrid manufacturing/remanufacturing facilities and finite-capacity hybrid distribution/collection centers that serve a set of retailer locations. We present a Benders Decomposition approach that incorporates simultaneous use of strengthened Benders cuts obtained using two different subproblem formulations. We present the computational results illustrating the efficiency of the approach.

■ MB14

C - Room 14, Level 4

Panel Discussion: Excellence and Diversity in Academia

Sponsor: Women in OR/MS
Sponsored Session

Moderator: Esma Gel, Associate Professor, Arizona State University, Industrial Engineering, SCIDSE, Tempe, AZ, 85281, United States of America, Esma.Gel@asu.edu

Moderator: Susan Martonosi, Assistant Professor, Harvey Mudd College, Department of Mathematics, 301 Platt Boulevard, Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu

1 - Panel Discussion: Excellence and Diversity in Academia

Panelists: Susan Martonosi, Assistant Professor, Harvey Mudd College, Department of Mathematics, 301 Platt Boulevard, Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu, Cynthia Barnhart, Associate Dean for Academic Affairs, School of Engineering, Massachusetts Institute of Technology, Room 1-206, 77 Massachusetts Avenue, Cambridge MA 02139, United States of America, cbarnhar@mit.edu, Vicki Bier, Professor, University of Wisconsin-Madison, Department of Industrial Engineering, 1513 University Avenue, Madison WI 53706, United States of America, bier@engr.wisc.edu, Candace A. Yano, Professor, University of California, Haas School of Business, IEOR Department, Berkeley CA 94720, United States of America, yano@ieor.berkeley.edu, Esma Gel, Associate Professor, Arizona State University, Industrial Engineering, SCIDSE, Tempe AZ 85281, United States of America, Esma.Gel@asu.edu

The panel will focus on several different issues in fostering a tradition of excellence and diversity in academic institutions. Brief presentations by each speaker will be followed by a Q&A session.

■ MB15

C - Room 15, Level 4

Panel Discussion: Meet the Editors - How to Publish Behavioral Research

Sponsor: Behavioral Operations Management
Sponsored Session

Moderator: Enno Siemsen, University of Minnesota, 3-150 Carlson School of Management, 321 - 19th Ave S, Minneapolis, MN, 55455, United States of America, siems017@umn.edu

1 - Meet the Editors - How to Publish Behavioral Research

Panelists: Enno Siemsen, University of Minnesota, 3-150 Carlson School of Management, 321 - 19th Ave S, Minneapolis, MN, 55455, United States of America, siems017@umn.edu, Karen Donohue, Associate Professor, University of Minnesota, Carlson School of Management, Minneapolis MN, United States of America, donoh008@umn.edu, Teck Ho, Professor, Haas School of Business, University of California, Berkeley, United States of America, hoteck@haas.berkeley.edu, Stephen Graves, Abraham Siegel Professor of Managment, Massachusetts Institute of Technology, Sloan School of Management, 77 Massachusetts Ave E53-347, Cambridge MA 02139, United States of America, sgraves@MIT.edu

Behavioral operations has emerged into the mainstream. Leading journals in operations management have established a department for research in behavioral operations management, or have promoted the topic by publishing special issues. Many schools have included seminars on behavioral operations into their doctoral curriculum. The Behavioral Operations Management Section at INFORMS has invited three editors of leading journals to talk about their expectations for good behavioral research, and to provide an opportunity for authors to ask questions.

■ MB16

C - Room 16A, Level 4

Semiconductor Industry

Contributed Session

Chair: Mengying Fu, Arizona State University, University Dr and Mill Avenue, Tempe, AZ, 85287, United States of America, Mengying.Fu@asu.edu

1 - Analysis of Capacity Planning Strategies for the AMHS in the Semiconductor/LCD Industry

Jaewoo Chung, Assistant Professor, Kyungpook National University-Daegu, S. Korea, 1370 Sankyuk Dong, Bukgu, Daegu, Korea, Republic of, chung@knu.ac.kr, Seolhui Son

The automated material handling system (AMHS) used in the semiconductor/LCD industry is an important component of the fabrication facility that costs more than three billion dollars. This research addresses the analysis of the capacity planning strategies for the AMHS under different ramp-up scenarios. An analytical model consisting of cash flow, cost breakdown, and measurement is used for assessing the hypothetical alternatives of the fabrication facilities planning.

2 - Multi-layer Overlay Control in Lithography Processes

Yibo Jiao, Graduate Research Assistant, The University of Texas at Austin, 1 University Station, C2200, ETC 5.124, Austin, TX, 78712, United States of America, jybxahu@mail.utexas.edu, Dragan Djurdjanovic

The multi-layer overlay lithography process is a multistage manufacturing process which variations in the previously deposited reference layers will affect the overlay errors in the subsequently deposited layers. In this paper, we present a systematic method which models such flow of overlay errors in lithography processes to minimize the accumulated multi-layer overlay errors. A number of simulations are also presented to demonstrate the newly introduced approach.

3 - A Conceptual Scheduling Framework in Semiconductor Manufacturing Systems

Sangoh Shim, Hanbat National University, Deokmyoek Dong, Yuseong Gu, Daejeon, Korea, Republic of, mizar0110@gmail.com

To enhance capabilities of manufacturing and respond lots of demands as soon as possible, there are several issues arising recently, which are transportation of wafers from a manufacturing line to another line, controlling production progress of urgent orders, balancing work-in-process among workstations and processing wafers with the limited waiting time. We introduce a concept new scheduling system which deals with the above issues and suggest its design.

4 - An Interval-based Metamodeling Approach to Simulate Material Handling in Semiconductor Wafer Fabs

Ola Batarseh, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, 32816, United States of America, ola_batarseh@yahoo.com, Yan Wang, Dima Nazzal

We propose an efficient simulation-based approach to estimate the performance of automated materials handling systems in semiconductor fabs. Our methodology is based on imprecise probabilities, in which the model parameters are represented as intervals to incorporate unknown dependency relationships as total uncertainties. Using a virtual fab as a test bed, the metamodel of the AMHS is implemented in JSim, a java-based simulation environment to investigate the validity of the proposed approach.

5 - Machine Qualification Management in A Semiconductor Assembly and Test Facility

Mengying Fu, Arizona State University, University Dr and Mill Avenue, Tempe, AZ, 85287, United States of America, Mengying.Fu@asu.edu, Ronald Askin, John Fowler, Muhong Zhang, Moeed Haghnevis

For cost reasons, not all machines in a semiconductor assembly and test facility have been qualified to process all products produced in the facility. A model has been developed and implemented that exams the feasibility of the current product-machine qualification matrix and recommends a new qualification matrix if current one infeasible. A mathematical program that minimizes machine qualification labor cost, and the impact of qualification matrix on the scheduling process will be discussed.

■ MB17

C - Room 16B, Level 4

OR/MS in Practice: Transportation Applications

Cluster: Practice of OR/MS

Invited Session

Chair: Ranganath Nuggehalli, Principal Scientist, UPS, 2311 York Road, Timonium, MD, 21093, United States of America, RNuggehalli@ups.com

1 - Workforce Management in Periodic Routing: Lessons Learned on a UPS Package Car

Karen Smilowitz, Northwestern University, 2145 Sheridan Road, Evanston, IL, 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 discuss how workforce management impacts periodic routing decisions. We review the treatment of workforce management in routing models from the academic literature and commercial software.

2 - Vehicle Routing Under Uncertainty: The Case of Partial Customer Location Data

Si Chen, Assistant Professor, Murray State University, Murray, KY, 42071, United States of America, si.chen@murraystate.edu, Richard Wong, Hongsheng Zhong

Phase 1 routes multiple vehicles with route duration constraints where customer location information is known only for a subset of customers. In phase 2, all customer locations are gradually revealed but adjusting a customer's phase 1 vehicle assignment now incurs a penalty. This problem arises in several logistics contexts including small package delivery. We present models and computational results evaluating operating/optimization strategies under varying amounts of partial information.

■ MB18

C - Room 17A, Level 4

Python for Optimization

Sponsor: CPMS, The Practice Section

Sponsored Session

Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - MPL for Python - Introducing New Scripting and Library Interfaces for the MPL Modeling Language

Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

MPL has been distributed with a standard GUI interface for development and object-oriented 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 "MPL for Python" we are introducing a new scripting and component library interfaces for MPL, that takes full advantage of the many powerful features of Python.

2 - The IBM ILOG CPLEX Optimizer Python API

Philip Starhill, CPLEX Research Engineer, IBM, 926 Incline Way, Suite 100, Incline Village, NV, 89451, United States of America, pstarhill@us.ibm.com

The IBM ILOG CPLEX Optimization Studio includes numerous ways to access the CPLEX Optimizer, including a complete API for the Python programming language. Thanks to the flexibility of the Python interpreter, this interface allows interactive access to advanced features of CPLEX in addition to providing a new API suitable for full-fledged application development. This presentation will provide an overview of the CPLEX Python API and present examples of its use.

3 - Keep the Model Hot - A Scenario Solver for GAMS

Michael Bussieck, GAMS Development Corp., 1217 Potomac St. NW, Washington, DC, 20007, United States of America, mbussieck@gams.com

If you have to solve hundreds of instances of the same basic model, model generation time eats up a significant part of the overall solution time. We are addressing this with a so-called scenario solver, which allows you to change bounds, matrix, and nonlinear expression based data while keeping the model hot in the solution engine. The APIs to GAMS component libraries together with convenient data structures in Python resulted in a prototype extending the build-in scenario solver.

4 - Constructing a Simulator of Light-induced Excitations of Molecules using Continuous Steepest Descent

David Mokrauer, Research Assistant, North Carolina State University Mathematics Department, 2311 Stinson Drive, Raleigh, NC, 27695-8205, United States of America, mokrauerd@gmail.com, Alexei Bykhovski, C. T. Kelley

The process of transition between two stable conformations of a molecule can be caused by the introduction of energy. We have constructed a simulator to approximate this reaction, and the simulator can handle a large number of degrees of freedom. The parallel software for this task included a continuation method, a high-dimensional sparse grid interpolation, computational chemistry software, and an optimizer. We developed python modules that perform these several tasks efficiently.

■ MB19

C - Room 17B, Level 4

Behavioral Issues in Revenue Management and Pricing

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Wedad Elmaghraby, welmaghr@rhsmith.umd.edu

1 - Salesforce Incentives in Revenue Management

Ayse Kocabiyikoglu, Bilkent University, Faculty of Business Administration, Bilkent, Ankara, 06800, Turkey, aysekoca@bilkent.edu.tr, Ioana Popescu

We investigate a revenue management setting where capacity allocation decisions are delegated to an agent, incentivized on salary plus commission. We compare the agent's allocation decision with the firm optimum, and suggest how the firm can design salesforce incentives to better match objectives. We study the effect of agent's preferences, contract parameters and market forces on the agent's decision.

2 - An Analysis of BPP Formulation in Bilateral Price Negotiations

Nur Ayvaz, Columbia University, W. 120th Street, CEPSR Building 530, New York, NY, 10027, United States of America, na2191@columbia.edu, Soulaymane Kachani, Costis Maglaras

We study the revenue management problem for a monopolist that operates in a setting where the buyers strategically post their prices (BPP) that the seller has to accept or reject. The goal is to maximize the seller's revenues in a variety of informational settings. Our motivating application is the real-estate developer's revenue maximization problem formulti-unit residential projects. We analyze the analogy between the BPP problem and the capacity allocation problem of airlines. The model gives rise to various opportunities such as involving contracting schemes in a real-estate market, and results and insights are applicable in many other settings.

3 - Some Applications of Customer Centric Revenue Management

Darius Walczak, PROS, 3100 Main Street, Suite 900, Houston, United States of America, dwalczak@prosrm.com, Kyle Schoener

The customer centric revenue management system ("CCRM") recommends the best offers to customers based on their characteristics such as past preferences and properties of the current request. CCRM can be integrated into a website, a call center where agents interact with customers, or it can be used as a guidance tool for sales staff to tailor an offer that is often linked to an incentive structure. We will discuss our experience with CCRM in two environments: hotels and contract-based services.

4 - Pricing Information and B2B Pricing

Wedad Elmaghraby, welmaghr@rhsmith.umd.edu, Shu Zhang, Wolfgang Jank, Itir Karaesmen

Sales people have significant responsibility in pricing decisions in many B2B transactions. We study how sales people adjust price quotes for different products and different customers over time based on information on prices, costs, customer purchase history, and product characteristics.

■ MB20

C - Room 18A, Level 4

Consumer Learning and Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Costis Maglaras, Professor, Columbia Business School, New York, NY, United States of America, c.maglaras@gsb.columbia.edu

1 - Allocating Time-Varying Capacity to Strategic Customers via Pricing

Ilan Lobel, Stern School of Business, New York University, New York, United States of America, ilobel@stern.nyu.edu, Christian Borgs, Jennifer Chayes, Ozan Candogan, Hamid Nazerzadeh

We consider the problem of selecting revenue-maximizing prices in a setting where the seller's capacity varies over time and each consumer is present during an arbitrary window and is fully strategic about her time of purchase. We show structural properties of the optimal prices and use those properties to construct a polynomial-time algorithm that solves this optimal pricing problem. We also discuss the application of this model to the problem of pricing cloud-computing services.

2 - Social Influence and Evolution of Market Share

Simla Ceyhan, Stanford University, Terman Engineering Building Room 492, Stanford, Ca, 94305, United States of America, simlac@stanford.edu, Mohammad Mousavi, Amin Saberi

We propose a model for the evolution of market share in presence of social influence. Using techniques from stochastic approximation theory, we show that market shares converge to an equilibrium. In a special case, when the choice model is a multinomial logit model, we show that inequality in the market increases with social influence and with strong enough social influence,monopoly occurs.

3 - Monopoly Pricing in a Social Network

Bar Ifrach, Columbia University, New York, NY, United States of America, BIfrach14@gsb.columbia.edu, Marco Scarsini, Costis Maglaras

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 sequential decisions of the customers that decided whether to buy 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.

■ MB21

C - Room 18B, Level 4

Smart Electricity Distribution

Sponsor: Service Science
Sponsored Session

Chair: Pawel Kalczynski, Professor, Cal State Fullerton, P.O. Box 6848, Fullerton, CA, 92834, United States of America, pkalczynski@fullerton.edu

1 - Connecting People to Electricity: Single Level and Multi-level Grid Network Design

Ayse Selin Kocaman, PhD Student, Columbia University, 500 West 120th Street, 918 S. W. Mudd Hall, New York, NY, 10027, United States of America, ask2170@columbia.edu, Vijay Modi, Tim Huh, Alex Zvoleff

We present methodologies to estimate the cost of energy infrastructure planning in rural areas. Our first heuristic provides a quick solution for the partial electrification problem where the grid can only connect pre-specified number of households. We provide another heuristic to design power distribution system which includes the placement of transformers between medium and low voltage lines. Proposed methods are applied to both simulated and real data obtained from satellite images of Africa.

2 - A Dynamic Model to Measure Risk in Electricity Markets

Reinaldo C. Garcia, Associate Professor, University of Brasilia, Faculty of Technology, Engenharia de Produção, Brasìlia, 70910-900, Brazil, rcgarcia@unb.br, Javier Contreras, Virginia Gonzàlez

Electric companies make use of price prediction techniques to hedge against volatility. They can manage risk trading in spot and contract markets. Their objective is to decide how much to allocate in each market minimizing risk and maximizing profits. This work implements a dynamic model where the volatility is not constant along the time horizon. The model is tested with US electricity data and the results are compared with previous models.

3 - Aggregation Choices in Zonal Pricing in Electricity Markets

Mette Björndal, Professor, NHH, Helleveien 30, Bergen, 5045, Norway, mette.bjorndal@nhh.no, Endre Björndal

Locational marginal prices constitute a well known benchmark for managing transmission capacity constraints in electricity markets. We study aggregation choices when simplifying nodal prices into zonal or area prices. We discuss two different aggregation concepts, which we call economic and physical aggregation, and their relation to optimal nodal prices. As an illustration we consider the approximations and simplifications of the present Nord Pool spot price algorithm.

4 - Optimal Dispatch of Thermal Generators
Pawel Kalczynski, Professor, Cal State Fullerton, P.O. Box 6848, Fullerton, CA, 92834, United States of America, pkalczynski@fullerton.edu, Dawit Zerom

A new discrete model for the optimal control of thermal generators is proposed to simulate the dispatch of any thermal generator operating in any deregulated electricity market using any price forecast. The model yields itself to powerful discrete optimization techniques and enables comparing price forecasts and bidding models using historical data. The results of this research may lead to better dispatch and bidding decisions and to an increase in profitability of thermal generators.

■ MB22

C - Room 18C, Level 4

Disruptive Event Management

Sponsor: Service Science
Sponsored Session

Chair: Evangelos Kaisar, Assistant Professor, Florida Atlantic University, 777 Glades Rd. Bldg. #36, Boca Raton, FL, 33431, United States of America, ekaisar@fau.edu

1 - A Bi-criteria Measure to Assess Supply Chain Network Performance for Critical Needs
Qiang Qiang, Penn State University - Great Valley School of Graduate Professional Studies, 30 E. Swedesford Rd, Malvern, PA, 19355, United States of America, qzq10@psu.edu

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.

2 - High-Resolution Logistics in Disaster Response: Modeling and Solution Algorithms
Abbas Afshar, University of Maryland, 1173 Glenn Martin Hall, College Park, md, 20742, United States of America, afshar@umd.edu, Ali Haghani

A mathematical model is proposed to describe several logistical aspects of responding to large-scale natural disasters. The model integrates multicommodity network flows and multimodal vehicle routing with multi-echelon facility location problem compatible with FEMA's supply chain structure. Also, an array of fast and efficient heuristic algorithms is proposed that makes the real-time implementation of the model possible.

3 - Catastrophic Event Planning and Response for Urban Areas Utilizing Dynamic Traffic Assignment and Departure Time
Evangelos Kaisar, Assistant Professor, Florida Atlantic University, 777 Glades Rd. Bldg. #36, Boca Raton, FL, 33431, United States of America, ekaisar@fau.edu, Wiiliam Degnan

Catastrophic event emergency planning has emerged as one of the most important operations management areas. Much of the successes of a response plan rely on the ability to maintain an operating transportation infrastructure. Traffic Assignment (DTA) techniques and a non-linear departure time slot allocation mathematical model ensuring infected populations receive treatment and/or vaccinations efficiently.

4 - Stock Optimization in Emergency Resupply Networks Under Stuttering Poisson Demand
Jie Chen, Ph.D., Cornell University, Rhodes 257, Ithaca, NY, 14850, United States of America, jc562@cornell.edu, Peter Jackson, John Muckstadt

We model a network of field service locations (FSL) that manage parts according to an (s-1,s) policy. FSLs get replenishments from a RSL. Excess FSL demand is routed to an emergency stocking location (ESL). Excess ESL demand is backordered. ESL to FSL leadtimes are assumed to be negligible compared to RSL-ESL resupply times. We show how to compute stock levels at FSLs and the ESL across all part types so as to minimize backorder and emergency resupply costs subject to a budget constraint.

■ MB23

C - Room 18D, Level 4

Exploring Information to Enable Smart Services

Sponsor: Service Science
Sponsored Session

Chair: Anca Ivan, IBM Research Almaden, 650 Harry Road, San Jose, United States of America, ancaivan@us.ibm.com

1 - Early Detection Methods Based on Medical Records for Improving Patient Outcomes and Enabling Targeted Care
Jakka Sairamesh, CEO and President, 360Fresh, Inc, 3600 West Bayshore Road, Suite 102, Palo Alto, CA, 94303, ramesh@360fresh.com

We will present a novel early-warning method that predicts patients at risk of readmissions based on clinical rules, natural language processing techniques and predictive algorithms applied to risk factor embedded in electronic medical records. We will also discuss the effectiveness of the methods for targeted and improved Health care services.

2 - Analytics as a Service - A Paradigm for Enabling Universal Analytics
Ying Chen, Analytics as a Service, IBM Almaden Research Center, 650 Harry Road, San Jose, CA, 95120, United States of America, yingchen@us.ibm.com, Jeffrey Kreulen

Although analytics is critical to today's enterprises, how to enable analytics universally in the business remains a challenge. Analytics as a Service (AaaS) tackles this problem by providing a web-based analytics service framework. It consists of composable analytics components and workflows that are orchestrated via a dynamic workbench to enable formation of new applications, integration into existing processes and applications, and customization.

3 - Sequence Effects in Service Bundles: Implications for Scheduling Optimization
Michael Dixon, PhD Candidate, Cornell University, G-80 Statler Hall, Ithaca, NY, 14853, United States of America, mjd295@cornell.edu, Gary Thompson, Rohit Verma

Past research has shown that the relative attractiveness of events and their sequence within a service encounter affect customers' repurchase behavior. In this paper we investigate the complexity of scheduling and assigning events to service bundles for maximizing repurchase by customers. The model formulation and scheduling approach is illustrated for a large performing art venue that organizes over 300 events every year.

■ MB24

C - Room 19A, Level 4

Joint Session SPPSN/HAS: Models in Public Health

Sponsor: Public Programs, Service and Needs/ Healthcare Applications
Sponsored Session

Chair: Jacqueline Griffin, PhD Student, Georgia Institute of Technology, Atlanta, GA, 30309, United States of America, jackie.griffin@gatech.edu

Co-Chair: Hannah Smalley, United States of America

1 - Investigating the Influences of Batch Appointments at a Medicaid Pediatric Dental Clinic
Husniyah Abdus-Salaam, North Carolina A&T State University, 1601 East Market St., 400 McNair Hall, Greensboro, NC, 27411, United States of America, husniyah@gmail.com, Lauren Davis

Families with multiple children present a new challenge in scheduling when appointments are requested for all of their children within the same time frame. We consider these patients to be batch appointments in which each patient within the batch is dependent amongst each other. To further understand the impact of these dependent demand arrivals, we develop a statistical model to identify the key indicators of whether or not a patient will meet their scheduled appointment.

2 - Impact of Mass Gatherings and Holiday Traveling on the Course of an Influenza Pandemic
Pengyi Shi, PhD Student, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, pengyishi@gatech.edu, Pinar Keskinocak, Julie Swann, Bruce Lee

During the 2009 H1N1 influenza pandemic, the concerns of potential negative impacts of mass gatherings and holiday traveling were raised. We develop a simulation model to evaluate the impact of such temporary social mixing changes. Our results indicate that mass gatherings or traveling occurred close to the epidemic peak can worsen or alter the course of an influenza pandemic. Decision makers may consider travel restrictions, postponing or canceling public gatherings under certain circumstances.

3 - The Promise and Value of Remote Monitoring Devices
Ashlea Bennett, Assistant Professor, University of Arkansas at Fayetteville, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, ashlea@uark.edu, Mike Hewitt

The costs of caring for people with chronic illnesses are rising as chronic disease diagnoses increase. Remote monitoring devices (RMDs) have the potential to change the care environment, alleviating anticipated resource shortages and reducing the occurrences of serious, costly complications. We develop a model that estimates the value of providing RMDs to target populations and is flexible to accommodating various disease categories, use options, and benefit characteristics of the devices.

4 - Costs and Benefits of HIV and Hepatitis C Co-epidemic Control Programs in Injection Drug Users
Lauren Cipriano, Department of Management Science and Engineering, Stanford University, Stanford, United States of America, cipriano@stanford.edu, Greg Zaric, Doug Owens, Margaret Brandeau

Injection drug users (IDUs) continue to experience epidemic rates of new HIV and hepatitis C infections. Using a dynamic compartmental model of HIV and hepatitis C in the IDU and non-IDU populations, we compared the number of new infections and the cost effectiveness of various screening protocols and frequencies targeting IDUs in opioid replacement therapy. We find that frequent screening for acute HIV infection, but not hepatitis C, prevents many infections and is likely cost-effective.

■ MB25

C - Room 19B, Level 4

Threats to Life and Limb

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Arnold Barnett, Professor, Massachusetts Institute of Technology, E53-379 MIT, Cambridge, MA, 02478, United States of America, abarnett@mit.edu

1 - Legalizing Marijuana in California: Death and Taxes?
Jonathan Caulkins, professor, Heinz College/Carnegie-Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, caulkins@andrew.cmu.edu

This November Californians will vote on a proposition that would legalize marijuana. RAND developed a model to project effects on consuption and tax revenues. The model wonderfully illustrates structural vs. parametric sensitivity analysis and has various implications, including for rates of murder by Mexican drug trafficking organizations.

2 - Race Effects in Redemption Patterns
Alfred Blumstein, University Professor, Carnegie Mellon University, Heinz College, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ab0q@andrew.cmu.edu, Kiminori Nakamura

One concern about criminal-background checking is the disparate impact on racial minorities. We examine by race the hazard or recidivism risk as a function of time clean. We contrast differences in arrest prevalence, early hazard, and later hazard, and explore factors contributing to observed differences.

3 - Urban Homicide: Yesterday's Crisis?
Arnold Barnett, Professor, Massachusetts Institute of Technology, E53-379 MIT, Cambridge, MA, 02478, United States of America, abarnett@mit.edu

US homicide rates are now only about half their levels in the early 1980's and early 1990's, which suggests that lifetime victimization probabilities for murder have themselves dropped substantially. But patterns are not always what they seem to be. We analyze murder-risk in the 50 largest US cities based on data for the years 1988-2008, assessing general trends as well as deviations from those trends.

4 - Estimating Influenza Infection Rates in Small Communities
Richard Larson, Professor, Massachusetts Institute of Technology, E40-233, Cambridge, MA, 02139, United States of America, rclarson@mit.edu, Anna Teytelman

The novel H1N1 virus was identified in April 2009, eventually infecting millions of people. Morbidity information was not initially well reported, so accurate epidemiological data were not immediately available for modeling. We introduce a probabilistic model for unchecked influenza spread within small communities and use it to estimate the basic reproductive number R0, the infection growth factor. We present our results for La Gloria, Mexico, the village that was the point of origin of H1N1.

■ MB26

C - Room 4A, Level 3

Logical Analysis of Data

Sponsor: Data Mining
Sponsored Session

Chair: Myong Jeong, Rutgers University, 640 Bartholomew Road, Piscataway, United States of America, mjeong@rci.rutgers.edu

Co-Chair: Chun-An Chou, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, United States of America, joechou@rci.rutgers.edu

1 - Meta-heuristic Procedures for Generating Optimal LAD Patterns
Hong Seo Ryoo, Associate Professor, Korea University, 1, 5-Ga, Anam-Dong, Seongbuk-Gu, Seoul, 136-713, Korea, Republic of, hsryoo@korea.ac.kr, Premnath Ayyalasomayajula, Cui Guo

In analyzing data, feature selection and pattern generation stages of LAD give rise to combinatorial optimization problems, and how they are handled greatly affect the quality of a decision function to be formed. In this paper, we develop meta-heuristic procedures for generating LAD patterns when the number of features for data under analysis is large. With numerical experiments on benchmark datasets, we demonstrate the utility of the proposed procedures.

2 - Efficient Optimization Approaches for Pattern Generation in Logical Analysis of Data
Chun-An Chou, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, United States of America, joechou@rci.rutgers.edu, W. Art Chaovalitwongse, Tiberius O. Bonates

We propose a column generation based approach for pattern generation in Logical Analysis of Data. In the master problem, we consider two objectives of maximizing separation margin and minimizing the number of patterns, respectively. To generate improving patterns, we propose a greedy optimization procedure, combined with a mixed-integer linear programming (MILP) model, in the subproblem. The performance is tested on widely used data sets and compared to existing classification algorithms.

3 - Robust Classification by Orthogonalization
Endre Boros, Professor, Rutgers University, RUTCOR, 640 Bartholomew Road, Piscataway, NJ, United States of America, boros@rutcor.rutgers.edu, Julien Darlay

We present a work in progress on developing robust classifiers by selecting strong patterns which cover in an orthogonal way positive and negative observations.

4 - Logical Analysis of Data (LAD) Model to Predict Rate of Decline of Kidney Function
Munevver Mine Subasi, Assistant Professor, Florida Institute of Technology, 150 W. University Blvd, Melbourne, FL, 32901, United States of America, msubasi@fit.edu, Ersoy Subasi, Peter L. Hammer, Weijia Zhang, Michael Lipkowitz, Victor Anbalagan, John Roboz

We use SELDI-TOF mass spectrometry to assay the serum proteome in the African American Study of Kidney Disease and Hypertension Cohort study which examines traditional and non-traditional risk factors for progression of renal disease. We analyze the data with Logical Analysis of Data to develop combinatorial biomarkers that predict the progression rate. Eventual identification of the protein peaks may lead to a better understanding of progression of CKD and/or new therapeutic modalities.

■ MB27

C - Room 4B, Level 3

New Perspectives on Organization Science

Sponsor: Organization Science
Sponsored Session

Chair: Joseph Broschak, Associate Professor, Management/Organizations, University of Arizona, McClelland Hall 405, Tucson, AZ, United States of America, broschak@email.arizona.edu

1 - Organizational Learning: From Experience to Knowledge
Linda Argote, Professor, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, argote@cmu.edu, Ella Miron Spektor

Organizational learning has been an important topic for the journal, Organization Science, and for the field. We provide a theoretical framework for analyzing organizational learning. We also discuss current and emerging research themes on knowledge creation, retention and transfer. Promising future research directions are identified. We hope that our perspective will stimulate future work on organizational learning.

2 - Transactive Memory Systems: Current Issues and Future Research Directions

Kyle Lewis, Professor, University of Texas at Austin, Austin, TX, United States of America, Kyle.Lewis@mccombs.utexas.edu, Benjamin Herndon

In this essay we outline current issues in transactive memory system (TMS) research and describe directions for future research. Current issues include how researchers define and conceptualize TMS, the distinction between the theoretical composition of a TMS and measuring a TMS, and the role of task type in TMS theory. Directions for expanding TMS research to multi-activity tasks and to the organizational level are explored.

3 - Simulation is Not Only a Model

Richard Burton, Professor, Duke University, One Towerview Dr, Durham, NC, 27708-0120, United States of America, rmb2@duke.edu

Organizational simulation is a method to investigate organizational questions. Yet, the simulation models and the organizational question are frequently considered separately. But they are tightly linked or closely matched. Simulation is a good method for what-might-be questions. For integrated triangulation studies, it is particularly useful. We examine the match of organizational question and model and the implications for research.

■ MB28

C - Room 4C, Level 3

Bayesian Modeling in Reliability and Risk

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Refik Soyer, George Washington University, 2201 G St., NW, Funger Hall, Suite 415, Washington, DC, 20052, United States of America, soyer@gwu.edu

1 - Predictability of Operation Processes in Finite Horizon

Ehsan Soofi, Professor, University of Wisconsin-Milwaukee, Sheldon B. Lubar School of Business, P.O.Box 742, Milwaukee, WI, 53201, United States of America, esoofi@uwm.edu, S.N.U.A. Kirmani, Nader Ebrahimi

We use the conditional entropy to study the predictability of stochastic processes in the finite horizon. The conditional entropies of stationary processes decrease as the processes evolve, implying that, on average, their pasts become more informative about prediction of their outcomes. Some important operation processes such as martingales, models for maintenance policies, non-homogeneous Poisson, and mixed Poisson processes are non-stationary.

2 - A Bayesian Model to Determine Lifetime Distributions for Maintenance Optimization

Thomas Mazzuchi, Professor, The George Washington University, Eng. Mgt. and Syst. Eng., 1776 G Street, NW, Suite 101, Washington, DC, 20052, United States of America, mazzu@gwu.edu, Johan Rene van Dorp

We shall present a model for eliciting life time distribution via a histogram technique reminiscent of the method studied by Van Noortwijk et al (1992). The elicited discrete distribution is used to estimate the parameters of a Dirichlet Process (DP). This DP is next updated using the failure time and maintenance data in a Bayesian fashion. The resulting life time distribution follows as the posterior estimate of the process.

3 - A Bayesian Expert Judgement Based Maritime Accident Probability Model

Johan Rene van Dorp, Professor, The George Washington University, Eng. Mgt. and Syst. Eng., 1776 G Street, NW, Suite 101, Washington, DC, 20052, United States of America, dorpjr@gwu.edu, Jason Merrick

In this presentation we shall briefly review a maritime risk assessment methodology which integrates simulation of Maritime Transportation Systems (MTS) with incident/accident data collection, expert judgment elicitation and a consequence model. We shall describe the Bayesian expert judgement model in more detail. An application of this model shall be presented in the context of a two-year oil transportation risk study conducted from 2006-2008 in the Puget Sound and surrounding waters.

4 - Markov Modulated Bayesian Reliability Models

Refik Soyer, George Washington University, 2201 G St., NW, Funger Hall, Suite 415, Washington, DC, 20052, United States of America, soyer@gwu.edu

In this talk, we discuss use of Markov modulated processes in reliability modeling. In so doing we consider Bayesian models in software reliability analysis and discuss computational issues. We present MCMC methods for posterior analysis and model selection.

■ MB29

C - Room 5A, Level 3

Financial Informatics and Statistics

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Agus Sudjianto, Ph.D. Senior Vice President, Risk Management Quality & Productivity Executive. Bank of America, agus.sudjianto@bankofamerica.com

1 - Financial Visual Analytics

William Ribarsky, Chair, Computer Science Department, College of Computing and Informatics, University of North Carolina at Charlott, Charlotte, NC, United States of America, ribarsky@uncc.edu

The field of visual analytics, which is founded on the deep integration of interactive visualization and analytics, has been shown to provide an effective approach to problems of scale in data and complexity in reasoning. In this presentation, I will discuss financial problems of this type that we are attacking with visual analytics. I will concentrate on work in fraud analysis and emerging risk analysis. I will discuss the overall process, the systems that have been developed, and give results.

2 - Estimation of Network Granger Causality

George Michailidis, University of Michigan, Ann Arbor, 439 West Hall, Ann Arbor, MI, 48109, United States of America, gmichail@umich.edu

We examine the problem of estimating temporal mechanisms for networks using time-course data. We introduce the concept of Network Granger Causality, propose a novel penalty for simultaneous estimation of model parameters and the order of the underlying vector autoregressive model and discuss its asymptotic properties. The methodology is illustrated on a number of simulated and real data sets. Extensions that take into consideration the underlying network structure are also considered.

3 - Hierarchical Variable Selection for Interpretable Clustering of Credit Card Portfolio Data

Harsh Singhal, Bank of America, 201 N Tryon St, Charlotte, NC, United States of America, harsh.singhal@bankofamerica.com, Nengfeng Zhou

We will present a technique for hierarchical variable selection for regression models. We will demonstrate its usefulness through an application to clustering various segments in a credit card portfolio for loss modeling. Such a clustering provides a means to achieving a good trade-off between statistical efficiency and interpretability.

■ MB30

C - Room 5B, Level 3

Bayesian Inference and Model Selection

Cluster: Bayesian Models
Invited Session

Chair: Robert McCulloch, University of Texas, IROM Department, \Austin, TX, United States of America, robert.mcculloch1@gmail.com

1 - Nonparametric Function Estimation Subject to Monotonicity, Convexity and Other Shape Constraints

Tom Shively, Professor of Statistics, University of Texas, McCombs School of Business, Austin, TX, United States of America, Tom.Shively@mccombs.utexas.edu

We develop a Bayesian method for the nonparametric estimation of functions subject to shape constraints in models with log-concave likelihood functions. The shape constraints we consider include monotonicity, convexity and functions with a single minimum. Simulation results indicate the function estimates have good small sample properties. An example applies the methodology to the estimation of a function constrained to have a single minimum in a model for electricity consumption.

2 - Bayesian Benchmarking for Longitudinal Data

James Scott, Assistant Professor of Statistics, University of Texas, McCombs School of Business, Austin, United States of America, James.Scott@mccombs.utexas.edu

We develop Bayesian models for benchmarking historical performance. Our goal is to compare publicly traded companies against their peers using a standard accounting measure known as Return on Assets (ROA). Our data set has 645,456 records from 53,038 companies in 93 different countries across 43 years, and exhibits many features that complicate the analysis, such as skewness, heavy tails, conditional heteroskedasticity, and massive multiplicity.

3 - Fully Bayes Model Selection with a Generalized g-prior
Edward George, Professor of Statistics, University of Pennsylvania, Wharton, 3730 Walnut St, 400 JMHH, Philadelphia, PA, 19104, United States of America, edgeorge@wharton.upenn.edu

For the normal linear model variable selection problem, we propose selection criteria based on a fully Bayes formulation with a generalization of Zellner's g-prior. A special case of the prior formulation is seen to yield tractable closed forms for marginal densities and Bayes factors which reveal new model characteristics of potential interest. Our results allow for p > n and extend to the multivariate regression setup. (This is joint work with Yuzo Maruyama at the University of Tokyo).

4 - Simulation-based Regularized Logistic Regression
Nicholas Polson, Professor, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637-1610, United States of America, nicholas.polson@ChicagoBooth.edu, Robert B. Gramacy

We develop simulation-based methods for regularized logistic regression by exploiting normal mixtures in two ways: using z-distributions to represent the logistic likelihood, and mixtures of stable distributions to implement regularization penalties including the lasso. By carefully choosing the z-distribution parameterization, and choosing how regularization is applied, we obtain subtly different MCMC sampling schemes with varying efficiency depending on the data type (binary v. binomial, say) and the desired estimator (maximum likelihood, maximum a posteriori, posterior mean, etc.). Advantages of this umbrella approach include flexibility, computational efficiency, application in p n settings, uncertainty estimates, sensitivity analysis, variable selection, and an ability to assess the optimal degree of regularization in a fully Bayesian setup.

■ MB31

C - Room 5C, Level 3

Operations Research at Jeppesen (The 2010 INFORMS Prize Winner)

Cluster: Practice of OR/MS
Invited Session

Chair: Stefan E. Karisch, Jeppesen, 55 Inverness Drive East, Englewood, CO, 80112, United States of America, stefan.karisch@jeppesen.com

1 - Operations Research at Jeppesen (The 2010 INFORMS Prize Winner)
Stefan E. Karisch, Jeppesen, 55 Inverness Drive East, Englewood, CO, 80112, United States of America, stefan.karisch@jeppesen.com

In 1997, Jeppesen saw its service deteriorate when a growing line of over 100,000 aviation charts overwhelmed its production system. The company responded by establishing a small O.R. group to analyze its production problems. In just two short years, Jeppesen was able to eliminate late delivery of product orders, reducing costs by nearly $3 million annually. Since then, the expanding OR department has consistently applied a wide variety of OR techniques throughout the enterprise to improve operations and to support decision-making related to resource utilization, inventory optimization, capital investments, market strategy, product development and pricing. Today, more than 75 professionals with an OR background are helping Jeppesen apply analytics to make better decisions, build better products, and offer better services.

■ MB32

C - Room 6A, Level 3

Advances in Approximate Dynamic Programming and Reinforcement Learning - II

Sponsor: Computing Society
Sponsored Session

Chair: Panos Parpas, Massachusetts Institute of Technology, 400 Main Street, Cambridge, 02139, United States of America

1 - A Rollout Framework for Dynamic Programming Approximations
Justin Goodson, Saint Louis University, John Cook School of Business, Davis-Shaughnessy Hall, 3674 Lindell Ave, St. Louis, MO, 63108, United States of America, goodson@slu.edu, Barrett Thomas, Jeffrey Ohlmann

Traditional rollout policies employ heuristic optimization to approximate value functions in dynamic programs, but can be difficult to obtain for problems with large action spaces. We introduce two new types of rollout policies and show how they can be used in combination to significantly reduce this computational burden. We demonstrate the potential of our method by obtaining high-quality, dynamic solutions for the multi-vehicle routing problem with stochastic demand and duration limits.

2 - Convergence Analysis of Kernel-based On-policy Approximate Policy Iteration Algorithms
Jun Ma, PhD Candidate, Princeton University, 11 Lawrence Drive Apt 203, Princeton, NJ, 08540, United States of America, junma@Princeton.EDU

Using kernel smoothing techniques, we propose three different online, on-policy approximate policy iteration algorithms applied to infinite horizon problems with continuous and vector-valued states and actions but without special problem structure such as linear, additive noise and computable expectation. We provide a formal convergence analysis of the algorithms under a variety of technical assumptions.

3 - Optimal Control of Multiscale Markov Processes: Dimensionality Reduction and Algorithms
Panos Parpas, MIT, 400 Main Street, Cambridge, United States of America, pparpas@mit.edu, Mort Webster

Many areas where quantitative methods of decision making under uncertainty are applied are subject to dynamics that evolve over multiple spatial and temporal scales. The traditional methods of decision making under uncertainty cannot be directly applied in the multiscale setting. We adopt the framework of Singularly Perturbed Markov Processes and propose a general algorithmic framework based on a Multiscale Monte Carlo (MMC) method to control and simulate multiscale stochastic processes.

■ MB33

C - Room 6B, Level 3

Optimization Applications in Retail

Sponsor: Computing Society
Sponsored Session

Chair: Lisa Miller, Target Corp., 33 South Sixth Street, CC-2220, Minneapolis, MN, 55402, United States of America, LisaA.Miller@target.com

1 - Optimization in Retail Pricing: Common Themes and Variations
Gul Ege, R&D Director, SAS Institute Inc, SAS Circle, Cary, NC, 27513, United States of America, Gul.Ege@sas.com

Determination of optimal prices and promotions in retail contains a variety of goals, constraints, and pricing strategies at different points in a product's life cycle. We will present an overview of these problems, that SAS Revenue Optimization suite addresses. We will also outline the underlying themes that are common to these decisions and the differences between them to warrant different analytical implementations to the optimization problems.

2 - Improving Online Advertising Performance Through Data Mining and Optimization
Robert Cooley, CTO, OptiMine Software, 1043 Grand Ave, #144, Saint Paul, MN, 55105, United States of America, rob.cooley@optiminesoftware.com

Online advertising has characteristics that are similar to both indirect and direct marketing. The unique nature of online advertising and the available data sources lead to a need for unique applications for managing and optimizing the advertising spend. This talk will present results and observations from applying a combination of multivariate predictive modeling and global constraint based optimization to paid search advertising for online retail and lead aggregation.

3 - Regular Price Optimization in Retail Pricing
Raj Solanki, Senior Manager, SAS Institute, 100 SAS Campus Dr, Cary, NC, 27513, United States of America, Raj.Solanki@sas.com, Saurabh Gupta

Regular price is the price that is offered by retailers to customers on an everyday basis in the absence of a promotion or clearance. Depending on the pricing strategy used for a product, regular price can be the price accounting for a significant part of the revenue and margin derived from the product over its life cycle. We will present aspects of the business problem considered in arriving at optimal values of regular prices.

4 - Space Optimization at Target
Lisa Miller, Target Corp., 33 South Sixth Street, CC-2220, Minneapolis, MN, 55402, United States of America, LisaA.Miller@target.com

With over 1,700 store of varying shapes and sizes in diverse markets, Target faces a constant challenge to put the right products in the rights stores in the right quantities. Target is currently addressing space optimization at two levels: how much space and which location should each category receive in each store; and which items should be sold in each store and where should they be located on the shelf.

■ MB34

C - Room 7, Level 3

Dynamic Programming Applications in Health Care

Sponsor: Computing Society
Sponsored Session

Chair: Martin L. Puterman, Professor, Sauder School of Business, UBC, 2053 Main Mall, Vancouver, BC, Canada

1 - Optimization of Screening and Treatment Decision for Prostate Cancer

Jingyu Zhang, North Carolina State University, 375 Daniels Hall, 111 Lampe Dr, North Carolina State University, Raleigh, NC, 27695, United States of America, jzhang2@ncsu.edu, Nilay Shah, Brant Inman, Brian T. Denton

We report on a partially observable Markov decision process model for prostate cancer screening decisions. Our model considers the effect of multiple treatment options. We discuss some of the theoretical properties of the optimal policy and describe a novel approximation method suited to problems with a continuous message process. We present numerical results to evaluate the performance of our algorithm, and discuss our findings based on data for a large regional population.

2 - Optimal Learning Strategies for Glycemic Control in Type 2 Diabetes

Ilya Ryzhov, Operations Research and Financial Engineering, Princeton University, Princeton, NJ, 08540, United States of America, iryzhov@princeton.edu, Warren Powell, Kate Hsih

In severe cases of type 2 diabetes, there is uncertainty regarding risk factors and preferred treatment regimens. We model clinical treatment decisions for diabetes patients as a Markov decision process with unknown transition probabilities representing the possible effects of common diabetes drugs. We use models and techniques from optimal learning to improve our beliefs about the treatment effects while optimizing the patient's health condition with regard to glycemic control.

3 - Optimal Search in Minimally Invasive Surgery

Steven Shechter, University of British Columbia, 3027 West Mall, Vancouver, BC, Canada, steven.shechter@sauder.ubc.ca, Farhad Ghassemi, Christopher Nguan, Martin Puterman

Motivated by minimally invasive surgery, we consider a minimum cost search for a target, whose precise location is uncertain. The searcher takes one of two actions on a grid cell: 1) cut into the cell, which is quick but bears the risk of damaging the target; or 2) explore the cell, which is time consuming but safely resolves uncertainty regarding whether the target is in that cell. We present analytical and computational results on various formulations and solution approaches to this problem.

4 - Applying Approximate Dynamic Programming in Controlled Ovarian Hyperstimulation

Lei Zhao, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, 100084, China, lzhao@tsinghua.edu.cn, Warren Powell, Miao He

We study the dynamic dosage decisions in controlled ovarian hyperstimulation (COH) treatment to trade-off the pregnancy probability and the risk of ovarian hyperstimulation syndrome (OHSS). We design and experiment on approximate dynamic programming (ADP) algorithms to solve the resulting stochastic dynamic program.

■ MB35

C - Room 8A, Level 3

Stochastic Networks and Applications

Sponsor: Applied Probability
Sponsored Session

Chair: Devavrat Shah, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D670, Cambridge, MA, United States of America, devavrat@mit.edu

1 - Simultaneously Learning and Optimizing using Controlled Variance Pricing

Bert Zwart, CWI, Science Park 123, Amsterdam, Netherlands, Bert.Zwart@cwi.nl

We propose a pricing policy which enhances the certainty equivalent pricing policy with a taboo interval around the average previously chosen prices. The taboo interval shrinks at an appropriate rate as the amount of data gathered gets large. We show that this procedure is consistent, giving bounds on how fast this learning occurs and on how much is lost due to price experimentation.

2 - A Network of Time-varying Many-server Fluid Queues with Customer Abandonment

Yunan Liu, IEOR Department, Columbia University, 500 West 120th Street, New York, NY, 10027, United States of America, yl2342@columbia.edu, Ward Whitt

We introduce and analyze a fluid queue network that servers as an approximation for the non-Markovian open network of many-server queues with customer abandonment, proportional routing and time-varying model elements. We establish the existence of a unique vector of net arrival rate functions at each queue and the associated time-varying performance. In doing so, we provide the basis for an efficient algorithm.

3 - Interplay Between Complexity and Queueing in Stochastic Networks

Devavrat Shah, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D670, Cambridge, MA, United States of America, devavrat@mit.edu, David Tse, John Tsitsiklis

In this work, we shall discuss lower bound induced on average queue-size in a generic stochastic processing network when the policy for scheduling resources in such a network is computationally restricted. This relation between complexity and queueing behavior will be explained by means of an example from wireless networks. Joint work with David Tse and John Tsitsiklis.

4 - On Guaranteeing End-to-end Performance Over Wireless Networks

Sanjay Shakkottai, Associate Professor, The University of Texas at Austin, 10703 Keystone Bend, Austin, TX, 78712, United States of America, shakkott@mail.utexas.edu, VJ Venkataramanan, Xiaojun Lin, Lei Ying

In this talk, we present recent results on end-to-end buffer usage performance (tail probabilities in the large-buffer large-deviations regime) in multi-hop wireless networks. We show that for networks with time-varying channels and combinatorial interference constraints, a modification of back-pressure scheduling performs close to optimal (optimality with respect to rate function).

■ MB36

C - Room 8B, Level 3

Teaching OR Through Active Learning I

Sponsor: INFORM-ED
Sponsored Session

Chair: Kevin Hutson, Associate Professor, Furman University, 3300 Poinsett Hwy., Greenville, SC, 29613, United States of America, kevin.hutson@furman.edu

1 - Teaching Introductory Statistics with the Workshop Method

Richard Forrester, Associate Professor of Mathematics, Dickinson College, College and Louther Streets, Carlisle, PA, 17013, United States of America, forrestr@dickinson.edu

Statistics is considered to be a foundation skill according to the Computing Society Curricular Recommendations. In this talk we discuss the success and difficulties associated with teaching introductory statistics using a workshop approach at a small liberal arts college.

2 - Teaching OR Through Puzzles and Paradoxes

Douglas Shier, Professor, Clemson University, Mathematical Sciences Department, Clemson, SC, 29634, United States of America, shierd@clemson.edu

In addition to using real-world applications to teach OR, it can be useful to engage students by presenting puzzles and paradoxes that can be solved using OR techniques. On the one hand this reinforces the formulation of problems using symbolization, tables or graphical representation. On the other hand, this approach shows the power and breadth of such techniques as recursion, dynamic programming and network flows.

3 - Discovering Linear Optimization with Simplex

Glenn Hurlbert, Arizona State University, School of Math & Stat Sciences, Tempe, AZ, United States of America, hurlbert@asu.edu

I teach Linear Optimization with various blends of Moore Method, Discovery, and Lecture, depending on the semester. Eventually, my notes became the Springer text, Linear Optimization: the Simplex Workbook, which is flexible enough to be used in your favorite environment. In this talk I will describe how I use it, motivated by how effective the subject can be at engaging students with applied modeling, heuristic arguments, concrete theory, and mathematical connections.

■ MB37

C - Room 8C, Level 3

Games in Queueing Networks

Sponsor: Applied Probability
Sponsored Session

Chair: Rahul Jain, Assistant Professor, University of Southern California, EE & ISE Departments, Los Angeles, 90089, United States of America, rahul.jain@usc.edu

Co-Chair: Parijat Dube, IBM TJ Watson Research Center, Yorktown Heights, NY, United States of America, pdube@us.ibm.com

1 - Endogenous Networks for Content Distribution
Kostas Bimpikis, MIT, United States of America, kostasb@mit.edu, Mihalis Markakis

We study a model of network formation motivated by content distribution among self-interested peers. Each peer decides whether to obtain the file directly from the seed or connect to another peer so as to minimize her delay. The download rate is non-increasing with the number of peers that chose the same source. We describe equilibrium topologies and compare them with the optimal configuration. Finally, we establish a Braess type paradox, where increasing bandwidth increases aggregate delay.

2 - Dynamics in Congestion Games
Jinwoo Shin, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, United States of America, jinwoos@mit.edu, Devavrat Shah

Game theoretic modeling and equilibrium analysis of congestion games have provided insights in various network problems. In this paper, we study how long it takes to reach equilibrium, when the system does operate in the presence of dynamics, e.g. nodes join or leave. In this pursuit, we first provide a novel probabilistic model to capture realistic behaviors of agents. Second, we evaluate the time to converge to equilibrium under this behavior model and the presence of dynamics.

3 - Peer-to-peer Procotol Designs Based on Social Norms
Mihaela van der Schaar, Associate Professor, UCLA, 54-147A Engineering IV Building, 420 Westwood Plaza, Los Angeles, CA, 90095, United States of America, mihaela@ee.ucla.edu, Jaeok Park

Inspired by the success of social norms, we propose a general analytical framework for designing a new class of protocols where we shape the behavior of peers by introducing norms of behavior in P2P networks. We show that if peers are foresighted and consider the impact of their current actions on their future rewards, cooperation among peers can be self-enforced, with the existence of network errors, network dynamics, and malicious attacks.

4 - Games Among Telecommunication Network Providers
Bruno Tuffin, INRIA Rennes Bretagne Atlantique, Campus Universitaire de Beaulieu, Rennes, 35042, France, bruno.tuffin@irisa.fr, Patrick Maillé

We analyze multi-level games among telecommunication providers. At the lowest level, customers choose their provider depending on price and congestion level while at a higher level, knowing what would be the customer equilibrium, providers compete on prices. Providers may compete for the same set of customers, or operate on zones partly common, typical of providers implementing different wireless technologies. We additionally describe a third level of game, on technology investments.

5 - Strategic Arrivals in Queueing Networks
Rahul Jain, Assistant Professor, University of Southern California, EE & ISE Departments, Los Angeles, 90089, United States of America, rahul.jain@usc.edu, Harsha Honnappa

We consider a queueing network that starts operation at a particular time. Arrivals can arrive at any time, and there only a finite population of arriving users. We study the arrival process when the users choose their arrivals to minimize the waiting cost as well as the cost due to time to completion. We study this in the fluid limit and characterize the arrival process as well as price of anarchy due to selfish decisions by arriving users.

■ MB38

C - Room 9A, Level 3

Global Optimization for Energy Systems

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Xiang Li, Postdoctoral Associate, Massachusetts Institute of Technology, 77 Massachusetts Ave., Building 66-363, Cambridge, MA, 02139, United States of America, xiangli@MIT.EDU

1 - Investment Decisions in the Natural Gas Supply Chain Under Competitive Operations
Marte Fodstad, NTNU / SINTEF, Alfred Getz veg 3, Trondheim, Norway, marte.fodstad@iot.ntnu.no, Yohan Shim, Steve Gabriel, Asgeir Tomasgard

We present a bilevel model analyzing investment decisions in the natural gas supply chain. The upper level planner decides on where and when to invest in fields and pipelines. The lower level problem describes the equilibrium of several producers making production and sales decisions while competing for capacity in the transportation network. Gas prices and demand are stochastic. An algorithm using Benders decomposition and scenario decomposition is used to solve the problem.

2 - A MINLP for Plug-in Hybrid Electric Vehicle Design & Allocation to Minimize Life Cycle Cost and GHGs
Jeremy Michalek, Associate Professor, Carnegie Mellon University, Scaife Hall 324, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, jmichalek@cmu.edu, Ching-Shin Shiau

We pose a nonconvex MINLP to determine vehicle design & allocation to minimize life cycle cost, GHG emissions, and oil consumption. We find that (1) small to mid-size battery packs minimize cost and GHGs; (2) at today's energy prices battery cost must be below $465/kWh for PHEVs to be cost effective; (3) carbon taxes have a negligible effect on PHEV economics; and (4) battery swing hits upper bounds for all three objectives - implying that subsidies should be tied to range rather than capacity.

3 - Decomposition Strategy for the Stochastic Pooling Problem
Xiang Li, Postdoctoral Associate, Massachusetts Institute of Technology, 77 Massachusetts Ave., Building 66-363, Cambridge, MA, 02139, United States of America, xiangli@MIT.EDU, Asgeir Tomasgard, Paul Barton

This paper presents a rigorous, duality-based decomposition method for the stochastic pooling problem, which arises in the design and operation of various industrial networks such as natural gas production networks. The proposed decomposition algorithm terminates finitely with an e-optimal solution or an indication of infeasibility of the problem. The case study results demonstrate the dramatic computational advantages of the decomposition method, particularly for large-scale problems.

■ MB39

C - Room 9B, Level 3

Geometric Aspects of Mixed Integer Nonlinear Programming Theory

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Juan Pablo Vielma, IBM Research and University of Pittsburgh, P.O. Box 218, Yorktown Heights, NY, United States of America, jvielma@pitt.edu

1 - Eigenvalue Techniques for Nonconvex Optimization Problems
Daniel Bienstock, Columbia University, 500 West 120th St., New York, NY, 10027, United States of America, dano@columbia.edu

We describe continuing work on exploiting eigenspace structure in the solution of optimization problems with convex objective and nonconvex constraint. Our approach relies on the S-Lemma and trust-region methods, together with combinatorial estimations of large ellipsoids that do not intersect the feasible region. We will focus on branching and reformulation techniques.

2 - Explicit Convex and Concave Envelopes via Polyhedral Subdivisions

Mohit Tawarmalani, Associate Professor, Purdue University, 100 S.Grant Street, West Lafayette, IN, 47907-2076, United States of America, mtawarma@purdue.edu, Jean-Philippe Richard, Chuanhui Xiong

We derive explicit convex and concave envelopes of several nonlinear functions over subsets of a hyper-rectangle by identifying appropriate polyhedral subdivisions. In particular, we develop concave envelopes of concave-extendable supermodular functions and convex envelopes of symmetric functions of binary variables and disjunctive convex functions. Many existing characterizations of envelopes are special cases of our constructions. We discuss applications in factorable nonlinear programming.

3 - On the Chvatal-Gomory Closure of a Compact Convex Set

Daniel Dadush, Georgia Tech, Atlanta, GA, United States of America, dndadush@gatech.edu, Santanu Dey, Juan Pablo Vielma

In this paper, we prove that the Chvatal-Gomory closure of any compact convex set is a rational polytope. Thus, we generalize a result of Schrijver which shows that the Chvatal-Gomory closure of a rational polyhedron is a rational polyhedron.

4 - On Maximal S-free Convex Sets

Diego Moran, Georgia Institute of Technology, 350101 Georgia Tech Station, Apt C601, Atlanta, GA, 30332-140, United States of America, dmoran@gatech.edu, Santanu Dey

Let S be a subset of integers in Rn contained in an arbitrary convex set. An S-free convex set is a convex set not containing any points of S in its interior. A maximal S-free convex set is an S-free convex set not properly contained in any other S-free convex set. In this talk, we show that maximal S-free convex sets are polyhedra and discuss some properties of these sets.

■ MB40

C - Room 9C, Level 3

Solving Nonconvex Optimization Problems with Couenne, an Open-Source Branch-and-cut Solver

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: Pietro Belotti, Clemson University, Clemson, SC, 29634, United States of America, pbelott@clemson.edu

1 - Rounding-based Heuristics for Nonconvex MINLPs

Giacomo Nannicini, nannicin@andrew.cmu.edu, Pietro Belotti

We propose two primal heuristics for possibly nonconvex MINLPs, based on the idea of rounding the solution to a continuous NLP subject to linear constraints. We design a heuristic that tries to find a first feasible solution, and an improvement heuristic which starts at a feasible solution and tries to compute one with a better objective function value within a neighborhood of the starting point. Computational results show the effectiveness in practice of these simple ideas.

2 - Symmetry Breaking in Couenne

Jim Ostrowski, University of Waterloo, Waterloo, Ontario, Canada,jostrows@engmail.uwaterloo.ca, Pietro Belotti, Leo Liberti

In this talk we will discuss the recent addition of symmetry breaking methods to the MINLP solver Couenne. We will describe how Couenne computes the symmetry group of nonlinear programming problems and how Couenne uses orbital branching to exploit symmetry. Computational results using symmetric instances in the MINLPlib library will (hopefully) be provided.

3 - Lower and Upper Bounding Techniques in Couenne

Pietro Belotti, Clemson University, Clemson, SC, 29634, United States of America, pbelott@clemson.edu

We discuss the recent advances in the cutting planes separators and in the heuristics available in Couenne, an Open-Source solver for Global Optimization that has been developed under the COIN-OR framework. In particular, we present a linearization technique for multilinear sets and present preliminary computational results that prove its usefulness in the context of bilinear and polynomial nonconvex optimization.

4 - Solving Linear Relaxations of Quadratically Constrained Quadratic Programs

Andrea Qualizza, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, qualizza@cmu.edu, Pietro Belotti, Francois Margot

We discuss Linear Programming relaxations of Non-Convex Quadratically Constrained Quadratic Programs. We use a cutting plane method to approximate the well known PSD+RLT relaxations in the lifted space containing the Yij=xi*xj variables. We study linear inequalities arising from the outer-approximation of the cone of PSD matrices and sparsification of these inequalities derived from principal minors. Computational results based on instances from the literature will be presented.

■ MB41

C - Room 10A, Level 3

Optimization Modeling and Methodologies for Clustering

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Jiming Peng, University of Illinois at Urbana-Champaign, 117 Transportation Building MC-238, Urbana-Champaign, United States of America, pengj@illinois.edu

1 - Brain Connectivity Networks Based on Functional MRI Data Analysis

Dmitriy Korenkevych, PhD Student, University of Florida, University of Florida, 303 Weil Hall, Stadium Road, Gainesville, FL, 32611, United States of America, dmitriy@ufl.edu, Frank Skidmore, Panos Pardalos

We construct functional connectivity brain networks based on neural activity, measured by functional magnetic resonance imaging. We compare economical properties of resulting networks, such as global network efficiency, nodal network efficiency, etc, for healthy subjects and Parkinson patients.

2 - Solving Densest-k-Subgraph Problem via 1-mean Clustering and Spectral Method

Peng Jiang, PhD Student, University of Illinois at Urbana Champaign, 201 North Goodwin Avenue, Urbana, IL, 61801, United States of America, pjiang2@illinois.edu, Jiming Peng, Michael Heath, Rui Yang

The densest-k-subgraph problem can be represented as a special class of binary quadratic programming problem. Such problem arises frequently in various applications and has been proven to be NP-hard. Reformulate the underlying BQP as a single clustering problem. Apply a 2-approximation algorithm to solve the reformulated clustering problem. Obtain a feasible solution of the original BQP. Two spectral methods are also proposed. Numerical results are reported.

3 - Optimal Allocation of Resources in Adaptive Survey Designs

Melania Calinescu, VU University Amsterdam, De Boelelaan 1105, Amsterdam, 1081 HV, Netherlands, melania@few.vu.nl, Sandjai Bhulai, Barry Schouten

Survey nonresponse occurs when members of a sample cannot or will not participate in the survey. It remains a problem despite the development of statistical methods that aim to reduce nonresponse. Instead, we address the problem of resource allocation in survey designs in which the focus is on the quality of the survey results given that there will be nonresponse. Therefore, we propose a novel method in which the optimal allocation of survey resources can be determined.

■ MB42

C - Room 10B, Level 3

New Models and Methods in Stochastic Optimization

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Tito Homem-de-Mello, University of Illinois at Chicago, Chicago, IL, United States of America, thmello@uic.edu

1 - Optimization with Uncertainly Weighted Multivariate Linear Stochastic Dominance Constraints

Jian Hu, PhD Candidate, Northwestern University, 2145 Sheridan Road, Tech C151, Evanston, IL, 60208, United States of America, jianhu@northwestern.edu, Sanjay Mehrotra, Tito Homem-de-Mello

We propose optimization problems with uncertainly weighted Multivariate Linear Stochastic Dominance (MLSD) constraints. In the literature MLSD is introduced in the context of robustness to compare the weighted component-wise sums of two random vectors over a certain weight region. It is a nature extension that this region is given a measure to evaluate the importance of weights to decision makers. The expected-value weighted MLSD arises in this consideration. The SAA method is applied.

2 - Moment Robust Stochastic Optimization Models and Their Tractability

Sanjay Mehrotra, Professor, Northwestern University, 2145 Sheridan Road Room C210, Evanston, IL, 60208, United States of America, mehrotra@iems.northwestern.edu, He Zhang

We propose a two-stage distributionally stochastic optimization modeling framework that incorporates error distribution information in moment parameter estimations. We show that the models are two-stage stochastic conic programs when uncertainly is present in the cost parameters. We also present situations leading to tractable two-stage convex optimization models. Motivating computational examples will be presented.

3 - Distributionally Robust Optimization and its Tractable Approximations

Melvyn Sim, NUS Business School, Singapore, Singapore, melvynsim@nus.edu.sg, Joel Goh

We present a modular framework to obtain an approximate solution to the problem that is distributionally robust, and more flexible than the standard technique of using linear rules. Our framework begins by firstly affinely-extending the set of primitive uncertainties to generate new linear decision rules of larger dimensions, and are therefore more flexible. Next, we develop new piecewise-linear decision rules which allow a more flexible re-formulation of the original problem.

4 - Robust Simulation of Environmental Policies

Jeff Hong, Hong Kong University of Science and Technology, Dept of Industrial Engineering and Logis, Hong Kong - PRC, hongl@ust.hk, Jing Cao, Zhaolin Hu

Integrated assessment models that combine geophysics and economics features are often used to evaluate environmental policies. In these models, there are often profound uncertainties whose joint distribution is typically difficult to specify or calibrate. We propose a robust approach to evaluating these policies. We test our algorithm on a famous environmental economic model, known as the DICE model, and obtain some insightful and interesting results.

■ MB43

C - Room 1, Level 2- Mezzanine

Joint Session HAS/ SPPSN: OR and Public Health Care

Sponsor: Health Applications/ Public Programs, Service and Needs
Sponsored Session

Chair: Ruben Proano, Assistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, rpmeie@rit.edu

1 - A Predictive Model for Outcomes Associated with Smoking Cessation Interventions

Maria Mayorga, Assistant Professor, Clemson University, 110 Freeman Hall, Department of Industrial Engineering, Clemson, SC, United States of America, MAYORGA@clemson.edu, Odette Reifsnider

We develop a discrete-event simulation model to predict health and economic outcomes, and conduct a comparative effectiveness study of smoking cessation interventions (e.g. Buproprion, Vareniclene). We assess patients' adherence to these treatments in addition to smoking-attributable illnesses (e.g. lung cancer, stroke). Evaluation of the costs of an intervention, the impact of co-morbidity on costs, and the outcomes achieved provides a framework to guide clinical and patient decision-makers.

2 - The Altruistic Monopsonist Vaccine Formulary Pricing and Purchasing Problem

Matthew Robbins, Dr., AFIT/ENS, WPAFB, Dayton, OH, United States of America, matthew.robbins@afit.edu, Sheldon Jacobson

The monopsonistic market power of the federal government uniquely positions it to significantly influence the pediatric vaccine market. The Altruistic Monopsonist Vaccine Formulary Pricing and Purchasing Problem (AMVF3P) is introduced, which seeks pediatric vaccine prices and purchase quantities that ensure a birth cohort is immunized according to a given childhood immunization schedule at an overall minimum system cost, while also ensuring that manufacturers each attain a specified profit.

3 - Optimal Scheduling of Dialysis Procedures

Ruben Proano, Assistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, rpmeie@rit.edu

Scheduling dialysis procedures for inpatients is a complex process that requires determining when a patient should receive treatment, while considering a limited number of dialysis units, isolation requirements, and other more critical medical procedures already scheduled for the patient. This study describes an optimization model that minimizes tardiness associated with scheduling dialysis procedures in a hospital in Upstate NY.

■ MB44

C - Room 2, Level 2- Mezzanine

Pierskalla Finalists I

Sponsor: Health Applications
Sponsored Session

Chair: Yasar Ozcan, Virginia Commonwealth University, Richmond, VA, 23284, United States of America, ozcan@vcu.edu

1 - Follow the Money: Monitoring Cost in Health Care Claims Data for Post-marketing Drug Safety Surveillance

Yihan Guan, PhD Candidate, Stanford University, Huang Engineering Center 212F, Stanford, CA, 94305, United States of America, yihan@stanford.edu, Margret Bjarnadottir

We present a novel method for post-marketing drug surveillance. Our method compares post-treatment costs of populations using alternative drugs based on risk-adjusted sequential analysis. The results of monitoring cost in claims data from 2.4 million individuals indicate that our method outperforms traditional methods by raising the alarm considerably earlier. Our model also achieves a balance between the risk of high false positive rate and the risk of delaying the discovery of true signals.

2 - Optimal Strain Selection for the Annual Influenza Vaccine

Osman Ozaltin, University of Pittsburgh, Pittsburgh, PA, United States of America, oyo1@pitt.edu, Oleg A. Prokopyev, Andrew J. Schaefer, Mark S. Roberts

Seasonal influenza is a major public health concern and the first line of defense is the flu shot. We formulate a multistage stochastic mixed-integer programming model to determine the best flu shot composition, along with the timing of its manufacturing. We propose a branch-and-price algorithm, which can solve very large instances efficiently. We address various policy questions about the optimal allocation of scarce flu prevention resources.

3 - Optimizing Statin Treatment Decisions for Diabetes Patients in the Presence of Uncertain Future Adherence

Jennifer Mason, North Carolina State University, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, jemason2@ncsu.edu, Darin England, Brian T. Denton, Steven Smith, Murat Kurt, Nilay Shah

Patients often take less medication than prescribed by their doctor. Poor adherence can reduce the effectiveness of medical treatment. Active surveillance of pharmacy claims can be used as a proxy for a patient's adherence level. We discuss an MDP model for the optimal timing of interventions for patients with suboptimal adherence. We present structural results of the model and provide numerical results. We also include sensitivity on the quality of interventions.

4 - Pharma Rebates, Pharmacy Benefit Managers and Employer Outcomes

Ozden Gur Ali, Koc University, Sariyer, Istanbul, Turkey, oali@ku.edu.tr, Murali Mantrala

We build a simulation model of a market with one generic and two branded drugs where a pharmacy benefit manager (PBM) is contracted by a corporate employer to lower its costs. The brands' rebates, the PBM's assignment of drugs to formulary tiers, and the resulting employer outcomes under varying contracts and marketing mix scenarios are analyzed, and Pareto optimal contracts with highest health benefit for a given employer budget, are determined for insights and managerial implications.

5 - Analytics of Post-marketing Drug Surveillance Systems

Margret Bjarnadottir, Acting Assistant Professor of Operations, Information, and Technology, Stanford University, 518 Memorial Way, Stanford, CA, 94305, United States of America, margret@stanford.edu, Stefanos Zenios

Recently it has been shown that post-marketing drug surveillance systems can be built based on claims data. However, not much progress has been made in investigating the system's operational properties. In this paper we lay the analytical foundation for a drug-surveillance system using a Brownian motion approximation, and derive optimal linear decision bounds that minimize the time until detection while controlling the rate of false alarms and discuss some analytical properties of the system.

■ MB45

C - Room 6, Level 2- Mezzanine

Quantitative Models for Improving Health Care Delivery Efficiency

Sponsor: Health Applications
Sponsored Session

Chair: 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

1 - Driving Clinical Quality Improvement Through Mental Health Recovery Control Charts

Linda Laganga, Mental Health Center of Denver, 4141 East Dickenson Place, Denver, CO, 80222, United States of America, Linda.Laganga@mhcd.org, Christopher(CJ) McKinney, Antonio Olmos

We measure mental health recovery outcomes and use these measures to drive clinical quality improvement. These measures are used in regression models and control charts to depict consumers' progress in recovery and identify outliers. Investigation of unexpected outcomes and patterns provides feedback to continuously improve the service delivery system and promote fidelity to best-practice models. This ultimately leads to efficient resource use to maximize successful recovery outcomes.

2 - A Model Assisting the Patient-Centered Medical Home to Deliver Cost-Effective Care

Ping H. Huang, Research Scientist, Regenstrief Center for Healthcare Engineering, Purdue University, 203 Martin Jischke Drive, West Lafayette, IN, 47907, United States of America, huang74@purdue.edu

The Patient-Centered Medical Home is expected to improve the healthcare outcome while restraining the cost. Since most expenditures are generated outside of the primary care setting, our goal is to help the primary care physician to understand its patient panel's characteristics as well as patterns of resource consumption. We provide a portfolio of strategies to assist the PCMH to select and implement optimal strategies to improve the panel's cost-effective utilization of healthcare resources.

3 - Would Allowing Privately Funded Care Reduce Public Waiting Times? Empirical Evidence From CJRR Data

Qu Qian, PhD Student, The University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, alex.qian@sauder.ubc.ca, Hong Chen, Anming Zhang

This paper develops theoretical models and then empirically tests the effect of allowing funding to private care on public waiting times using joint replacement surgery data of nine Canadian provinces. Two policies that induce funding to private care are found to reduce average waiting times. Lagging effects of arrival rates on waiting times are detected. This paper provides an empirical analysis of the health care waiting time problem under a unique institutional setting.

4 - Optimal Resource Allocation for Publically Funded Traumatic Brain Injury (TBI) Patients

Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, United States of America, nkong@purdue.edu, Zhen Zhu, Lanshan Han, Andrew L. Liu, Kristin Hendrix, Nancy Swigonski, Steve Downs

Without appropriate care, TBI patients may suffer from recurring aggravation in their disabilities during their rehabilitation. The literature suggests that there are optimal times and settings in rehabilitation for TBI-specific rehabilitation. However, the duration that a patient spends at each rehabilitation facility is often limited by insurance coverage. In this paper, we develop a constrained Markov decision process model to study how to optimally allocate limited resources.

■ MB46

C - Room 7, Level 2- Mezzanine

Undergraduate Research Showcase II

Cluster: Undergraduate Operations Research Prize
Invited Session

Chair: David Czerwinski, San Jose State University, One Washington Square, San Jose, CA, United States of America, david.czerwinski@sjsu.edu

1 - Using Simulation to Assess Public Health Emergency Distribution Networks: The Emergency Supply Chain Operations Evaluator (ESCOE)

Christine Barnett, Cornell University, Ithaca, NY, United States of America, clb264@gmail.com, Kenneth Chu, Kathleen King, John Muckstadt

Prophylaxing or vaccinating a population rapidly is key to minimizing mortality and morbidity during a public health emergency such as smallpox, anthrax, or influenza. In many cases, doing so requires moving medical supplies efficiently from federal stockpiles to state controlled warehouses and then on to local dispensing clinics. Many network topologies and operating policies have been proposed for this supply chain. We present a simulation model for measuring the efficacy of alternative plans.

2 - A Novel Column Generation Approach for the Airline Ground Crew Rostering Problem

David (Shu Wo) Lai, Chinese University of Hong Kong, Hong Kong - PRC, laishuwo@gmail.com

This paper addresses a Ground Crew Rostering Problem motivated by an international airline. The problem is formulated as a mixed integer programming model. A column generation heuristic is proposed. Performance on large instances is further improved by a novel decomposition method in which large instance is reformulated into a number of smaller instances. Additional constraints are introduced in advance to guarantee feasibility. Extensive computational result on randomly generated datasets shows that the proposed approach outperforms the standard column generation approach significantly. Large instances up to 6 months and 10 shifts are solved efficiently to near optimality.

3 - Computational Feasibility of Increasing the Visibility of Vertices in Covert Networks

Yaniv Ovadia, United States of America, y4a5n6i7b8@gmail.com, Susan Martonosi

Disrupting terrorist and other covert networks requires identifying and capturing key leaders. Previous research by Martonosi and Altner defines a load metric on vertices of a covert network representing the amount of communication in which a vertex is expected to participate. They suggest that the visibility of a target vertex can be increased by removing other, more accessible members of the network. We first prove that the general problem of identifying the optimally load maximizing vertex set removal is NP-complete. We then consider the feasibility of more quickly computing the load maximizing single vertex removal by designing an efficient algorithm for recomputing Gomory-Hu trees.

4 - Combinatorial Algorithms for Minimizing the Weighted Sum of Completion Times on a Single Machine

James Davis, Rutgers University, Newark, NJ, United States of America, jamesmariodavis@gmail.com, Vijay Kothari, Rajiv Ghandi

In this paper we study the problem of minimizing the weighted sum of completion times of jobs with release dates on a single machine. We develop two algorithms that rely on a linear program formulation first studied extensively by Schulz. For the first algorithm, we work in the offline setting and develop a primal-dual algorithm with an approximation guarantee of 2.42. This algorithm provides the current best upper bound on the integrality gap of Schulz's LP formulation. For the second algorithm, we consider the online setting where we gain knowledge of a job on its release date and produce a schedule as the machine processes jobs. We develop an online dual fitting algorithm with an approximation guarantee of 3. This is the first online algorithm to use Schulz's LP as a lower bound.

■ MB47

C - Room 8, Level 2- Mezzanine

Complexity and its Measure in Manufacturing/Enterprise Systems for Variety

Cluster: Complex Systems
Invited Session

Chair: Jeonghan Ko, University of Nebraska-Lincoln, W349 NH, Lincoln, United States of America, jko2@unl.edu

Co-Chair: Xiaowei Zhu, University of Michigan, 2350 Hayward Street, RM 2250, Ann Arbor, MI, 48109, United States of America, xwzhu@umich.edu

1 - Variety Induced Complexity in Mixed-model Assembly Systems and its Impact on Throughput Models

Hui Wang, PhD, Industrial and Operations Engineering, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, johnwang@umich.edu, S. Jack Hu

We propose a complexity measure to 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. We also develop throughout analysis models 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.

2 - Concurrent Product-process Design for Variety and Complexity in Mixed-model Assembly Systems
Xiaowei Zhu, University of Michigan, 2350 Hayward Street, RM 2250, Ann Arbor, MI, 48109, United States of America, xwzhu@umich.edu, He Wang, S. Jack Hu, Zhongqin Lin, Guanlong Chen

Product variety has increased dramatically as manufacturers compete for market shares. High variety introduces complexity in manufacturing. A concurrent approach is proposed for product and process design in mixed-model assembly systems. Relative complexity is introduced to measure the complexity. Using the measure a model is developed to find the best set of product variants to be offered while trading-off market share and complexity. Numerical examples are provided to demonstrate the approach.

3 - Multi-product Manufacturing Line Considering Product-change Dependent Inter-task Times
Jeonghan Ko, University of Nebraska-Lincoln, W349 NH, Lincoln, NE, United States of America, jko2@unl.edu, Ehsan Nazarian

We present complexity of multi-product manufacturing line designs incorporating product-change dependent inter-task times. We evaluate feasible configuration scenarios for a multi-product manufacturing line considering precedence rules, cycle time limits and product types. This approach can reduce complexity involved in adjusting manufacturing line after initial design.

4 - A Systemic Approach for Enterprise Design
Arash Golnam, EPFL (Swiss Federal Institute of Technology), EPFL-IC-LAMS, Station 14, CH-1015, Lausanne, 1015, Switzerland, arash.golnam@epfl.ch, Ron Sanchez, Alain Wegmann

Adopting a systemic view of an enterprise and its environment, we propose a model-based approach for designing viable enterprises. In our approach, we apply Systemic Enterprise Architecture Method (SEAM) to visualize and graphically represent various aspects of an enterprise throughout the design steps. SEAM is based on General Systems Theory principles and embodies insights from Cybernetics as well as conceptualizations from Competence-based Management Theory.

■ MB48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Gurobi Optimization - The Gurobi QP Optimizer
Ed Rothberg, Gurobi Optimization, 3733-1 Westheimer Road, Houston, TX, 77027, United States of America, rothberg@gurobi.com

The new Gurobi Optimizer 4.0 includes QP simplex, QP barrier, and MIQP optimizers. The barrier and MIQP optimizers are parallel, and make efficient use of multiple cores. This tutorial will discuss some of the algorithmic issues associated with handling quadratic objectives in a math programming solver. We'll also look at a few QP formulation issues, and consider some of the tradeoffs associated with introducing quadratic terms into your models.

2 - AIMMSÆ (Paragon) - Robust Optimization in Action
Peter Nieuwesteeg, Senior AIMMS Specialist, AIMMS (Paragon Decision Technology), 5400 Carillon Point, Kirkland, WA, 98033, United States of America, p.nieuwesteeg@aimms.com, Ming Fang

There are different approaches to handle uncertainty in your model. We will show robust optimization as one of them. We start with a short introduction in AIMMS, where we show how you can use it to build, solve and visualize your optimization problems. After that, we will demonstrate robust optimization as a way of handling uncertainty, without the need to rewrite your AIMMS application. We will show how easy, yet powerful, this is and what it can do to improve your model results.

■ MB49

C -Room 10, Level 2- Mezzanine

Contract Design and Global Sourcing of IT Services

Sponsor: Information Systems
Sponsored Session

Chair: Anjana Susarla, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, anjanas@andrew.cmu.edu

1 - Role of Information Work, Incentives and Contracts in Determining Quality in Global Sourcing
Ravi Aron, Asst. Professor, Johns Hopkins University, 100 N. Charles St, Room 1115, Baltimore, MD, 21201, United States of America, raviaron@jhu.edu, Praveen Pathak

We investigate how the nature of information work, contractual clauses and the extent of monitoring across boundaries of the firm interact over time to produce to quality outcomes in the offshore production of services.

2 - Asset Transfer and Contract Design: A Study of Information Technology Outsourcing Contracts
Kiron Ravindran, University of California, Irvine, 2345 S Bentley Ave #202, Los Angeles, CA, 90064, United States of America, kravindr@uci.edu, Vijay Gurbaxani

Asset Transfer amplifies the innate challenges in Information Technology Outsourcing by placing both parties in a situation of bilateral dependence. We build a theoretical framework to predict how contracts mitigate the related risks. Analyzing a unique survey data of large contracts, we show that asset transfer significantly affects contract structure. Specifically, we show how several clauses complement each other in protecting both parties against the risks associated with asset transfer.

3 - Relational Contracts, Reputation Capital and Self-Enforcement in Global Sourcing
Anjana Susarla, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, anjanas@andrew.cmu.edu, Lan Shi

We examine the interplay between formal and relational contracts in sourcing IT services. We find that the structure of a formal contract impacts parties reneging temptation, and thus the relational contract that is feasible. We also quantify various measures of reputation building in a bilateral context.

■ MB50

C -Room 11, Level 2- Mezzanine

Security, Incentives and Customization in Information Systems Design

Sponsor: Information Systems
Sponsored Session

Chair: Jan Stallaert, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States of America, Jan.Stallaert@business.uconn.edu

1 - On the Prevention of Fraud and Privacy Exposure in Business Information Flow
Xue Bai, University of Connecticut, 2100 Hillside Rd., Storrs, CT, 06269, United States of America, xue.bai@business.uconn.edu, Manuel Nunez, Dmitry Zhdanov, Ram Gopal

We develop a mathematical model for designing secure business processes where information security and staffing serve as constraints. Our model enables organizations to design and adequately staff the business processes to minimize security threats when significant staffing constraints exist. Our model is applicable to any digital transformation that involves confidential data sequences that carry vulnerability as is often the case in many settings.

2 - Optimal Software Localization Design
Dawei Zhang, PhD Student, University of Calgary, 2500 University Drive NW, Calgary, AB, T2N 1N4, Canada, dzhang@ucalgary.ca, Barrie R Nault, Jianqing Chen

Software localization is the process of modifying software to accommodate features (e.g., different languages) for a new market other than its origin. This paper studies the optimal localization level and pricing for a new market in the presence of network effects. We explore how the relationship between the localization level and prices depends on localization cost, size of target market, proportion of bilingual customers and magnitude of the network effects.

3 - Digital Health Communities -The Effect of Their Motivation Mechanisms

Lei Wang, University of Connecticut, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, lei.wang@business.uconn.edu, Sulin Ba

Health-related websites are starting to play a role in people's daily lives by monitoring food intake and creating challenges to motivate them to change their life styles. These websites provide different motivation mechanisms. However, little research has been done on the real effect of them. This research analyzes data collected from a digital health community to understand what mechanisms can help motivate people. The results can benefit both the IS research community and the health websites.

4 - Auctioned Advertisements using Behavioral Targeting

Jan Stallaert, University of Connecticut, 2100 Hillside Road, Storrs, CT, 06269, United States of America, Jan.Stallaert@business.uconn.edu, Jianqing Chen

We consider a model where ads are presented to users depending on their likelihood of click-through. We assume advertisers are differentiated with respect to the ads they provide as well as their valuation per click-through. We analyze when behavioral targeting is superior to traditional advertising both from the publisher's and the advertisers' perspectives.

■ MB51

C -Room 12, Level 2- Mezzanine

Military Vehicle Routing Problems II

Sponsor: Military Applications
Sponsored Session

Chair: Chase Murray, Assistant Professor, Auburn University, Dept of Industrial & Systems Engineering, Auburn, AL, United States of America, cmurray@auburn.edu

1 - UAV Routing and Search in a Highly Dynamic Environment

Noah Bednowitz, PhD Candidate, University at Buffalo, North Campus, 339 Bell Hall, Buffalo, NY, 14260, United States of America, NHB@buffalo.edu

We consider a system of Unmanned Aerial Vehicles (UAVs) assigned to search for targets in a constrained region. UAVs are routed along a path that maximizes the immediate search gain while positioning them for future gains. Solution algorithms based on a dynamic programming approximation are developed.

2 - Searching for a Mobile Entity on a Network: An Empirical Study

Wanyan Yu, University at Buffalo, 435 Bell Hall, Buffalo, United States of America, wanyanyu@buffalo.edu, Rajan Batta

We consider the problem of searching for an entity which has limited mobility on a network. The objective is to minimize the expected search time. A search game model is built and a simulation approach is used to evaluate the search time under different strategies for the searcher and the mobile entity. The impact of factors such as the search radius, the size of the network and the structure of the network are investigated.

3 - Phase Transition Problems in Complex Networks

David Jeffcoat, Principal Engineer, Air Force Research Lab, 101 W. Eglin Blvd, Eglin AFB, FL, 32542, United States of America, david.jeffcoat@eglin.af.mil

We present new performance measures for complex networks under uncertainty with consideration of related phase transition problems. Particular attention will be given to developing appropriate quantitative measures of collateral losses in complex networks. The overarching questions we are investigating are: How do the structural properties and performance characteristics of a complex network change, and when do phase transitions take place as random disruptions/failures occur?

4 - Calculating Flight Time for UAVs in the Presence of Obstacles and Incorporating Flight Dynamics

David Myers, University at Buffalo - SUNY, 339B Bell Hall, Buffalo, NY, 14260, United States of America, djmyers2@buffalo.edu, Mark H. Karwan, Rajan Batta

Efficient routing is needed for the continued growth of the use of UAVs in all domains. Removal of the assumptions of having an obstacle free operational field and straight line flight paths allows is done. A network generation procedure is used and pseudonodes are added in order to include flight dynamics. A selective Dijkstra's algorithm is written and implemented. Complex mission plans can have the needed data computed quickly enough for use in a dynamic domain.

■ MB52

C -Room 13, Level 2- Mezzanine

Reports from the Daniel Rose Technion-Yale Initiative in Homeland Security and Counterterror Operations Research

Cluster: Homeland Security and Defense
Invited Session

Chair: Edward Kaplan, William N and Marie A Beach Professor of Management Sciences, Yale University, School of Management, P.O. Box 208200, New Haven, CT, 06520, United States of America, edward.kaplan@yale.edu

1 - Managing a Secret Project

Edieal Pinker, Associate Professor of Computers and Information Systems and Operations Management, University of Rochester, Simon School of Business Administration, Rochester, NY, 14627, United States of America, ed.pinker@simon.rochester.edu, Vera Tilson, Joseph Szmerekovsky

We consider a project manager with an adversary. The project manager seeks to limit the adversary's opportunity to react to the project, and therefore wants to manage the project in a way that keeps the adversary "in the dark" as long as possible while completing the project on time. We formulate a secret project management problem where a combination of deception, scheduling, and crashing is used to minimize the time between when the adversary discovers the project and project completion.

2 - A Stochastic Competitive R&D Race Where Winner Takes All

Boaz Golany, Dean and Samuel Gorney Professor of Engineering, Technion-Israel Institute of Technology, Technion-Israel Institute of Technology, Haifa, 32000, Israel, golany@ie.technion.ac.il, Uriel Rothblum, Inbal Mund

The paper considers firms competing over developing a product. Each firm decides whether to launch and how much to invest in the required R&D project; these decisions are known to all firms. We prove the existence of a unique Nash Equilibrium, identify its special features, provide a formula that computes it, and draw managerial insights. In some cases, we also derive an explicit expression for the (unique) globally optimal solution and compare it with the Nash equilibrium.

3 - Modeling Social Dynamics in Counterinsurgency Situations: The Case of Tribal Society

Roberto Szechtman, Associate Professor of Operations Research, Naval Postgraduate School, Monterey, CA, 93943, United States of America, rszechtm@nps.edu, Moshe Kress, Michael Atkinson

Population behavior plays a key role in shaping the dynamics of counter-insurgency situations. In this talk we describe a model that captures the impact of the underlying social network structure when the government and insurgents behave strategically to win popular support.

4 - Queue Inference From Periodic Reporting Data

Edward Kaplan, William N and Marie A Beach Professor of Management Sciences, Yale University, School of Management, P.O. Box 208200, New Haven, CT, 06520, United States of America, edward.kaplan@yale.edu, Jesse Frey

We study queue inference problems with periodic reporting data. In each of several consecutive time periods, customer arrivals follow a Poisson process with period-specific arrival rates, but only the number of departing customers during each period is observed. Rather than exploiting relations with order statistics, our algorithms rely on direct recursions involving Poisson probabilities. We illustrate with several examples, some of which are not typically viewed as queueing applications.

■ MB53

C -Room 14, Level 2- Mezzanine

Network Design

Sponsor: Telecommunications
Sponsored Session

Chair: Gigyoung Park, Korea Univ, Anam-Dong 5Ga, Seongbuk Gu, Korea University, Seoul, Korea, Republic of, yhlee@korea.ac.kr

1 - Steiner Trees in Graphs - An Update of Research

Stefan Voss, Professor, IWI - University of Hamburg, Von-Melle-Park 5, Hamburg, 20146, Germany, stefan.voss@uni-hamburg.de

Connecting a set of points at minimum cost is among the most important issues in network design. Given a weighted graph, the Steiner problem in graphs is to determine a minimum cost subgraph spanning a set of specified vertices. While recent interest is not so much on the problem itself, various generalizations have received considerable interest. We survey the recent research on the problem and some generalizations from a telecommunications perspective.

2 - Heuristics for the Regenerator Location Problem
Mauricio Resende, Lead Member of Technical Staff, AT&T Labs Research, 180 Park Avenue, Florham Park, NJ, 07932, United States of America, mgcr@research.att.com, Rafael Martì, Abraham Duarte, Ricardo Silva

Given a network and a positive parameter M, in the regenerator location problem, we want to minimize the number of regenerators installed at nodes such that for any pair of nodes in the network, the path connecting these nodes does not contain a sub-path of length greater than M without at least one regenerator. We describe new GRASP and biased random-key genetic algorithm (BRKGA) heuristics for this problem.

3 - New Reformulation-linearization Techniques for the Design of Broadband Convergence Access Networks
Gigyoung Park, Korea Univ, Anam-Dong 5Ga, Seongbuk Gu, Korea University, Seoul, Korea, Republic of, yhlee@korea.ac.kr, Youngho Lee

The problem seeks to locate Layer 2 switches on a tree topology and to allocate broadband multi-media demand from residential gateways. Solving this hierarchical location-allocation problem, we develop a new reformulation-linearization-technique that enhances the strength of the proposed MIP model. Computational results demonstrate the effectiveness of the proposed procedure.

■ MB54

C -Room 15, Level 2- Mezzanine

Perspectives on Outsourcing and Offshoring of Knowledge Work

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Anant Mishra, Assistant Professor, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States of America, amishra6@gmu.edu

1 - How Provider Selection and Management Contribute to Successful Innovation Outsourcing
Zhijian Cui, PhD Candidate, INSEAD, Constance de Blvd, Fontainebleau, France, Zhijian.CUI@insead.edu, Christoph Loch, Bernd Grossmann, Ru He

We use studies of 31 innovation outsourcing projects at Siemens to develop grounded theory on (1) selection criteria for external technology providers, and (2) operational project management success factors in the collaboration with providers. A selection criterion is the needs to be a match between the firm's outsourcing motivation and the provider's strengths. We identify operational project success drivers for the management of technology outsourcing.

2 - Outsourcing Innovation: Structuring and Managing Global R&D Projects
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

Outsourcing providers are increasingly performing core tasks for their clients, calling into question traditional notions of firm boundaries. We explore this phenomenon and its implications, by examining the structures, challenges, management, and performance of global R&D projects conducted by a leading Indian outsourcing vendor with its customers. The findings enhance our understanding of the evolving modern firm, outsourcing implementation, and innovation management.

3 - The Linkage Between Motivation, Practices and Performance in Outsourcing Engagements
Sriram Narayanan, Assistant Professor, Michigan State University, N357 College of Business, Department of Supply Chain Management, East Lansing, MI, 48824, United States of America, sriram@msu.edu, Tobias Schoenherr, Ram Narasimhan

We examine the role of outsourcing motivation on the governance practices implemented in outsourcing engagements using survey data collected from more than 150 outsourcing engagements. We find that practices implemented are contingent on the outsourcing motivation, and that performance outcomes are contingent on the implemented governance practices.

4 - Managing Conflict Between Project Client and Project Team in Distributed Project Organizations
Anant Mishra, Assistant Professor, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States of America, amishra6@gmu.edu, Kingshuk K. Sinha

Conflicts are a stark reality of project execution in distributed project organizations. However, we know little about the dynamics of "sub-group" conflict between a project client and the project team in distributed project organizations. Using primary data from 830 technology projects, we examine the key drivers and performance consequences of sub-group conflict across four types of project organizations: Insourcing, Outsourcing, Offshoring, and Offshore-Outsourcing.

■ MB55

C -Room 16, Level 2- Mezzanine

Innovation and Growth Through Varied Organization Structures

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Raul Chao, Darden School of Business, 100 Darden Blvd., Charlottesville, VA, 22903, United States of America, ChaoR@darden.virginia.edu

1 - Compensation Challenges for Cross-functional Product Development Teams
Jeremy Hutchison-Krupat, Georgia Institute of Technology, 800 W. Peachtree St, Atlanta, GA, 30308, United States of America, jhk@gatech.edu, Stylianos Kavadias

New product development requires specialized competencies, and cross-functional collaboration. This implies inter-dependencies regarding the problem structure and organizational factors; and takes place in an uncertain setting, where the functional specialists' effort is non-verifiable. This study compares the operational implications to the firm when senior management offers either: incentives based on the specialists' functional contribution, or their overall team output (project profit).

2 - A Comparison of Revenue Growth at Recent-IPO and Established Firms: Influence of SG&A, R&D and COGS
Nitin Joglekar, Boston University, 595 Commonwealth Ave., Boston, MA, United States of America, joglekar@bu.edu, Jane Davies, Moren Levesque

We specify a production function to link aggregate allocation amongst SG&A, R&D and COGS expenses with the revenue. This function yields hypotheses on productivity of COGS, while controlling for the rate of growth. These hypotheses are tested on a comparable set of recent-IPO and established firms. Results show that stocks of resources can be substitutes rather than complements for COGS, and the manner in which recent-IPO firms allocate resources differs from their established counterparts.

3 - Incentives for Complex R&D Projects
Raul Chao, Darden School of Business, 100 Darden Blvd., Charlottesville, VA, 22903, United States of America, ChaoR@darden.virginia.edu

R&D projects often involve interactions between technology/market variables that define a project and the resources needed to create project value. The organization hierarchy further complicates matters because know-how and effort are decentralized from managerial authority. While standard economic theory says that management should always provide incentives for effort in risky projects, our results show that R&D projects need not always be rewarded with incentive pay.

■ MB56

C - Room 1, Level 1

Simulation Optimization

Sponsor: Simulation Society
Sponsored Session

Chair: Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Bldg., 104 S. Mathews, Urbana, IL, 61801, United States of America

1 - Root Finding via DARTS: Dynamic Adaptive Random Target Shooting

Bruce Schmeiser, Professor, Purdue University, School of Industrial Engineering, 315 N. Grant Street, West Lafayette, IN, 47907-2023, United States of America, bruce@purdue.edu, Raghu Pasupathy

Consider multi-dimensional root finding when the equations are available only implicitly via a Monte Carlo simulation oracle that for any solution returns a vector of point estimates. We develop DARTS, a stochastic-approximation algorithm that makes quasi-Newton moves to a new solution whenever the current sample size is large compared to the estimated quality of the current solution and estimated sampling error. We prove convergence, and show computational results.

2 - Sequential Monte Carlo Simulated Annealing

Enlu Zhou, Assistant Professor, University of Illinois at Urbana-Champaign, 117 Transportation Bldg., 104 S. Mathews, Urbana, United States of America, enluzhou@illinois.edu, Xi Chen

We propose sequential Monte Carlo simulated annealing (SMC-SA) for continuous global optimization. SMC-SA incorporates the sequential Monte Carlo method to track the converging sequence of Boltzmann distributions in simulated annealing, such that the empirical distributions converge weakly to the uniform distribution on the set of global optima. Numerical results show that SMC-SA is a great improvement of the standard simulated annealing in all test problems.

3 - Empirical Stochastic Branch and Bound for Optimization via Simulation

Barry L Nelson, Professor and Chair, Northwestern University, Department Industrial Engr. & Mgmt. Sci., 2145 Sheridan Road, C210, Evanston, IL, 60208-3119, United States of America, nelsonb@northwestern.edu, Wendy Xu

We introduce a new method for discrete optimization via simulation that combines the nested partitions method and the stochastic branch and bound method in the sense that we take advantage of the partitioning structure of stochastic branch and bound, but estimate bounds based on the performance of sampled solutions as the nested partitions method does. Our Empirical Stochastic Branch-and-Bound algorithm also uses bounds to guide sampling for better performance.

4 - An Approximate Stochastic Annealing Algorithm for Discrete Simulation Optimization

Jiaqiao Hu, Assistant Professor, State University of New York at Stony Brook, Math Tower 1-107, Stony Brook, NY, 11794, United States of America, jqhu@ams.sunysb.edu

We present an algorithm called Approximate Stochastic Annealing (ASA) for solving discrete simulation optimization problems. The algorithm iteratively estimates the optimal solution by sampling from a sequence of probability distribution functions over the solution space. We discuss a novel connection of ASA to the stochastic approximation method and present its global convergence properties. Numerical examples are provided to illustrate the algorithm.

■ MB57

C - Room 2, Level 1

Operational Flexibility and Supply Chain Network

Cluster: Risk Management
Invited Session

Chair: Jussi Keppo, Associate Professor, University of Michigan Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, keppo@umich.edu

Co-Chair: Jie Ning, University of Michigan, 1976 Traver Rd Apt 102, Ann Arbor, MI, 48105, United States of America, jien@umich.edu

1 - Pricing and Insurance in Online Advertising

Stanko Dimitrov, Assistant Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, sdimitro@connect.uwaterloo.ca, Jussi Keppo, Stefanka Chukova, Nedialko Dimitrov

It is known, that advertisers have S-shape revenue to advertisement spending function. Ad spending is used as proxy for ad exposure. For online ads, the number of clicks is a better measure of exposure than ad spending. An S-shaped function of clicks to revenue implies that advertisers have a desired number of clicks for their ads. Using real data, we price insurance on online advertisements so that an advertiser reaches his desired number of clicks.

2 - Operational Flexibility and Capital Structure

Jiri Chod, Carroll School of Management, Boston College, Chestnut Hill, MA 02467, jiri.chod@bc.edu, Jianer Zhou

We consider a firm that invests in a mix of flexible and dedicated capacities under demand uncertainty. Before choosing the optimal capacity investment, the firm selects the optimal levels of equity and debt to finance this investment. We show that financial leverage results in underinvestment in flexibility due to the asset substitution problem, i.e., the agency conflict between the shareholders and debtholders. The result is consistent with the existing empirical evidence.

3 - Supply Chain Network Design using Profit Maximization and Oligopolistic Competition

Anna Nagurney, John F. Smith Memorial Professor, University of Massachusetts Amherst, Isenberg School of Management, Amherst, MA, 01003, United States of America, nagurney@gbfin.umass.edu

In this paper, we model the supply chain network design problem with oligopolistic firms who are involved in the competitive production, storage, and distribution of a product. We formulate the Nash-Cournot equilibrium conditions as a variational inequality and identify several special cases. The proposed algorithm yields closed form expressions at each iteration. Numerical results are also presented.

4 - Diversification Effects in Subcontracting

Jie Ning, University of Michigan, 1976 Traver Rd Apt 102, Ann Arbor, MI, 48105, United States of America, jien@umich.edu, Lalit Patil, Romesh Saigal, Jussi Keppo

Subcontracting with outside suppliers is a common practice adopted by manufacturers in capital intensive business to hedge market demand risks. We show both theoretically and empirically that the value of subcontracts depends largely on the correlation between the subcontracted demand and the supplier's/manufacturer's overall business.

■ MB58

C - Room 3, Level 1

Order Book Modeling

Cluster: Quantitative Finance
Invited Session

Chair: Rama Cont, Columbia University, IEOR Dept, New York, United States of America, Rama.Cont@columbia.edu

1 - Stochastic Modeling of Order Books: High-frequency Dynamics and Diffusion Limits

Adrien De Larrard, Universite Pierre et Marie Curie, Laboratoire de Probabilites, Paris, France, larrard@clipper.ens.fr, Rama Cont

The high-frequency dynamics of prices in electronic stock markets may be described in terms of a limit order book, which contains all orders (prices, quantities) awaiting execution at a given time. We show that, under fairly general assumptions on the order arrival process, the dynamics of bid and ask queues may be approximated by a two-dimensional jump-diffusion process in the positive orthant.

2 - A Point Process Model for the High-frequency Dynamics of a Limit Order Book

Ekaterina Vinkovskaya, Columbia University, Dept of Statistics, New York, United States of America, eov2101@columbia.edu, Rama Cont, Allan Andersen

We study the statistical properties of market orders, limit orders and cancellations in a limit order book. We model the clustering in time and cross-correlation of these order book events using a multi-dimensional self-exciting point process. Using high-frequency data from the Trades and Quotes database, we perform a Maximum Likelihood Estimation of the model and assess its predictive performance for a variety of stocks.

3 - Price Dynamics in Limit Order Book Market

Rama Cont, Columbia University, IEOR Dept, New York, United States of America, Rama.Cont@columbia.edu, Adrien De Larrard

We explore the dynamics of the price of a financial asset in a market driven by market orders and limit orders. We model the limit order book as a queueing system and study the dynamics of the price. In the diffusion limit where the frequency of order arrivals is large, we show that the price may be described as a Brownian motion time-changed via an inverse subordinator.

4 - The Cost of Latency
Mehmet Saglam, Columbia Business School, 3022 Broadway, New York, NY, 10027, United States of America, MSaglam13@gsb.columbia.edu, Ciamac Moallemi

Technological investments have lead to dramatic improvements in latency, or, the delay between a trading decision and the resulting trade execution. We describe a model that allows for the quantitative valuation of latency. Our model is highly tractable and provides a closed-form expression for the cost of latency. We implement our model by estimating the latency cost of trading NYSE common stocks from 1999 to 2005 and show that median latency cost more than tripled during this time period.

■ MB59

H - Salon A, 4th Floor

2010 Dantzig Dissertation Award Finalists

Cluster: George B. Dantzig Dissertation Prize
Invited Session

Chair: Julie Swann, Associate Professor, Georgia Institute of Technology, School of Industrial and Systems Engineer, Atlanta, GA, 30332, United States of America, jswann@isye.gatech.edu

1 - Spatiotemporal Optimality in Radiation Therapy
Minsun Kim, University of Washington, Department of Radiation Oncology, Seattle, WA, 98195, United States of America, mk688@u.washington.edu, Archis Ghate, Mark Phillips

Success in radiotherapy depends on a complicated radiobiological interaction between radiation and tissues. We propose a spatiotemporal optimization strategy by constructing a discrete-time, stochastic control framework whose system states correspond to patient's biological condition and whose controls relate to radiation intensity. Numerical simulations show that a significantly higher tumor cell-kill can be achieved using our approach compared to the current static, deterministic approaches.

2 - A Unified State-space and Scenario Tree Framework for Multi-stage Stochastic Optimization
Steffen Rebennack, Assistant Professor, Colorado School of Mines, Division of Economics & Business, Boulder, CO, United States of America, steffen@ufl.edu, Bruno Flach, Panos Pardalos, Mario Pereira

In the hydro-thermal scheduling problem, one is interested in determining the optimal operating policy for the use of hydro and thermal resources. In this thesis, the classical stochastic dual dynamic programming algorithm commonly used to solve this problem has been extended in various ways by (1) a scenario tree framework to capture stochastic electricity demand and fuel prices (2) modeling of CO2 emission allowances, and (3) trading of CO2 emission allowances in a deregulated market.

3 - The Design of Large-Scale Radio Telescopes: Performance and Size (Will not be presented)
Lolke Schakel, University of Groningen, Nettelbosje 2, Groningen, Netherlands, lpschakel@gmail.com, Harvey Butcher, Diptesh Ghosh, Gerard Sierksma

The Low Frequency Array (LOFAR) is a huge radio telescope with more than 100 antenna systems to be located in the Netherlands and beyond. The relative location of these antenna systems is critical for the imaging performance of the observation instrument. A novel method is introduced to find a low-cardinality design given a predefined set of imaging performance constraints.

4 - Guiding Policy and Patient-specific Healthcare Decisions using Operations Research
Mariel Lavieri, Assistant Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, lavieri@umich.edu, Scott Tyldesley, Martin Puterman, Steven Shechter, Pam Ratner

This dissertation investigates healthcare operations research from both a system's and a patient's level. On one hand, we present a comprehensive methodology for workforce training, recruitment and promotion decisions. We provide valuable insights on how to achieve a sustainable nursing population in British Columbia. On the other, we develop novel patient specific prostate cancer models that allow clinicians to determine when to start the radiotherapy treatment based on disease progression.

■ MB60

H - Salon B, 4th Floor

Portfolio Decision Analysis I

Sponsor: Decision Analysis
Sponsored Session

Chair: Jeff Keisler, University of Massachusetts, Boston, MA, United States of America, Jeff.Keisler@umb.edu

1 - Military Portfolio Decision Analysis
Roger Burk, Associate Professor, U.S. Military Academy, Dept of Systems Engineering, West Point, NY, 10996, United States of America, roger.burk@usma.edu, Greg Parnell

We review the practice of portfolio decision analysis for military problems. Such problems include resource allocation, R&D, and personnel management. The primary reasons for using decision analysis are problem complexity and the need to show stakeholder and overseers an objective and transparent decision rationale. We show how portfolio decision analysis has been used for such problems and we propose and illustrate best practices.

2 - Portfolio Decision Quality
Jeff Keisler, University of Massachusetts, Boston, MA, United States of America, Jeff.Keisler@umb.edu

Decision quality is a useful concept where decision analysis is used. Decision analysis is used a lot in portfolios. Decision quality can be interpreted usefully in this context. Different levels of quality often correspond to different choices made in setting up the decision process. This provides a framework to think about how the value added by a portfolio decision process compares with its cost.

3 - A Method that Works-Portfolio DA in Pharmaceutical R&D
Jack Kloeber, Partner, Kromite LLC, 148 East Street Road, Suite 121, Feasterville, PA, 19053, United States of America, jkloeber@kromite.com

Many Pharma companies continue to struggle with the implementation of DA methods. Portfolio Decision Analysis requires yet another layer of complexity, one that seems counter to the project-oriented culture in most Pharma R&D organizations. We will discuss a method developed to improve insight into the portfolio itself, which involves using Value Focused Thinking with creative portfolio measures and simulation to align decision making with risk tolerance and strategic objectives.

4 - Risk Aversion and Optimal Natural Resources Extraction: Application to Harvesting of Forest Stands
Janne Kettunen, Assisstant Professor, University of Calgary, Calgary, Canada, jskettun@ucalgary.ca, Mikko Kurttila, Ahti Salo

We examine the impact of risk aversion on optimal harvesting of a forest stand portfolio under multiple correlated timber price uncertainties. The developed stochastic optimization approach includes forest stands that are at different stages, e.g., requiring thinning or terminal harvesting, and of mixed forest types and products. We demonstrate how the optimal harvesting strategy depends on risk aversion and how risks can be mitigated by selecting the structure of the forest stand portfolio.

■ MB63

H - Room 404, 4th Floor

Risk in Human-Environment Systems

Sponsor: Decision Analysis
Sponsored Session

Chair: Eva Regnier, Naval Postgraduate School, Monterey, CA, 93943, United States of America, eregnier@nps.edu

1 - The Value of Better Information on Technology R&D Projects in Response to Climate Change
Erin Baker, Associate Professor, University of Massachusetts Amherst, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu, Yiming Peng

In this talk we will estimate the Expected Value of Better Information over a selection of energy technology R&D projects, in the face of uncertain climate change damages. We focus on the value of the information gained in expert elicitations. More specifically, given baseline elicitations from one study, what is the value of revisiting these assessments to get better information? We find that better information has a very large value, ranging from $100 million to over $10 billion.

2 - Risk Assessment in Support of Command Decision Making
Eva Regnier, Naval Postgraduate School, Monterey, CA, 93943, United States of America, eregnier@nps.edu

Navy meteorologists and oceanographers are challenged to provide their best information about environmental uncertainty to commanders so that it is accessible and decision-relevant. This work develops a framework for using ensemble forecasts and the conventions of the U.S. Navy's Operational Risk Management process, to summarize risk as a function of course of action, rather than as a geo-temporal variable.

3 - Countering Piracy in the Next Generation
Leslie Esher, Lieutenant, Naval Postgraduate School, 1411 Cunningham Road, Monterey, United States of America, laesher@nps.edu

Pirate Action Groups [PAGs] off the coast of Somalia are affected by METOC [Meteorological conditions] and INTEL [Pirate CONOPs]. This study looks to explore the development and validation of the next generation Piracy Performance Surface model (PPS-Next) through Data Farming.

■ MB68

H - Room 415, 4th Floor

Social Media Analytics and Applications

Sponsor: eBusiness
Sponsored Session

Chair: Zhiqiang Zheng, Associate Professor, University of Texas-Dallas, 800 W. Campbell Dr., SM33, Richardson, TX, 75080, United States of America, ericz@utdallas.edu

1 - The Choice of Outsourcing Suppliers Under Different Contracting Options
MingFeng Lin, University of Maryland, College Park, Van Munching Hall, College Park, MD, 20742, United States of America, mingfeng@rhsmith.umd.edu, Ritu Agarwal, Siva Viswanathan

We empirically investigate contractural choice in one of the leading online software outsourcing marketplaces. Exploiting a comprehensive dataset from an online outsourcing company, we study factors that affect choice of contract forms in this virtual context.

2 - The Impact of Dynamic and Inconsistent Product Reviews on Sales - An Empirical Analysis
Wael Jabr, PhD Candidate, University of Texas at Dallas, 800 West Campbell Rd, School of Management, SM 33, Richardson, TX, 75080, United States of America, wael.jabr@student.utdallas.edu, Radha Mookerjee, Vijay Mookerjee, Zhiqiang Zheng

With consumers turning to the Internet to make purchases, product reviews have been found quite influential on consumers' purchasing decisions. However, user generated reviews and recommendations are often inconsistent and conflicting over time. Prior work has focused on aggregated effects of reviews which overlooks the review inconsistencies temporally. Using sales rank, reviews over time and characteristics of the reviewers, we study how the dynamic and inconsistent reviews impact book sales.

3 - Optimal Pricing and Revenue Sharing Strategies in User-Generated Application Market
Lin Hao, Foster School of Business, University of Washington, Box 353200, SEATTLE, WA, 98105, United States of America, linhao@u.washington.edu, Yong Tan

Apple Apps, a user-generated application platform, has become increasingly popular among Apple users over last few years. In this paper, we analyze app developers' optimal pricing strategies under two scenarios, one-time upfront charge with Lite/Full versioning scenario and in-app purchase scenario. Both incorporate the consumers' belief updating on product quality over different time periods. We also study the market equilibrium and derive the optimal revenue sharing rate Apple should propose.

■ MB69

H - Salon F, 6th Floor

Operations Research Application in Railroad Engineering

Sponsor: Railway Applications
Sponsored Session

Chair: Jagadish Jampani, Manager Operations Research, CSX Transportation, Inc., 500 Water St, J300, Jacksonville, FL, 32216, United States of America, Jagadish_Jampani@csx.com

1 - Rail Test Scheduling at CSX
Kamalesh Somani, Mgr Operations Research, CSX Transportation, 500 Water Street, Jacksonville, FL, 32258, United States of America, kamalesh_somani@csx.com, Fan Peng

Rail test is a way to inspect rail defects that could lead to catastrophic failures. Constraints such as test frequency, light travel time, geographic preference for vehicle, and conflict of resource assignment are considered in the schedule. CSX creates a schedule for about 20 rail test vehicles every week. A neighborhood search algorithm has been developed to create this schedule. The algorithm can also be used to perform long-term what-if analysis to determine the optimum number of vehicles.

2 - Scheduling Rail Grinding Operations
Kursad Derinkuyu, Student, University of Texas, Austin, Austin, TX, United States of America, kursad@mail.utexas.edu, Anant Balakrishnan, Juan Morales

To ensure safety of rail freight services, tracks require periodic grinding. Given the planned route of a rail grinder, we develop an optimization model to decide which grinding operations to perform on each visited segment so as to reduce deviations from desired inter-operation times. We show that the problem is NP-Hard, describe an efficient algorithm for a special case, embed this method in a heuristic for the general problem, and discuss successful results for practical problems.

3 - Routing and Scheduling Preventive Railway Maintenance with Predetermined Desired Reliability
Anand Retharekar, Student, University of Houston, University of Houston - Main Campus, Houston, TX, 77204-4008, United States of America, asrethar@mail.uh.edu, Azadeh Mobasher

Railway companies schedule periodic preventive maintenance to avoid hard and soft failures which are caused by shock loads and degradation processes to minimize the cost of unexpected and dangerous accidents. We have designed a MIP formulation and proposed a heuristic to allocate such maintenance activities considering train schedules, desired railroad reliability, railroad priorities and maintenance completion time. Several random instances demonstrate the feasibility of proposed algorithm.

■ MB70

H - Salon G, 6th Floor

Joint Session AAS/ TSL: Stochastic Models in Aviation

Sponsor: Aviation Applications/ Transportation Science and Logistics Society
Sponsored Session

Chair: Senay Solak, University of Massachusetts Amherst, Isenberg School of Management, Amherst, MA, United States of America, solak@som.umass.edu

1 - Diffusion Approximation to Model Airport Queues
Kleoniki Vlachou, Ph.D Candidate, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, kvlachou@umd.edu, David Lovell

The mathematical formulation to estimate delays in a single airport queue is presented based on diffusion approximation. We also present a stable and fast solution for the system of partial differential equations by using the Finite Element Method. Finally the results obtained by validating our model with Monte Carlo simulation are shown. We are able to reproduce exactly various steady state queue results with Markov arrivals.

2 - Robust and Adaptive Air Traffic Flow Management
Shubham Gupta, Graduate Student, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Building E40-139, Cambridge, MA, 02139, United States of America, shubhamg@mit.edu, Dimitris Bertsimas

We study robust and adaptive Air Traffic Flow Management (ATFM) problem. The existing models for network-wide ATFM which assume deterministic airspace capacities are difficult to implement in practice. Hence, we incorporate weather uncertainties into our capacity estimates by modeling it in two ways: i) a weather-front based; and ii) an interval-capacities based approach. We study the performance of affine policies in two-stage adaptive ATFM problem and report empirical results.

3 - Preemptive Re-routing of Airlines Passengers Under Uncertain Delays

Lindsey McCarty, University of Michigan, 530 Church St, Ann Arbor, MI, United States of America, lasel@umich.edu, Amy Cohn, Divakar Viswanath

Operational disruptions can lead to flight delays that impact passengers. We consider preemptive re-routing of passengers before the length of the delay is known. We model this problem as a two-stage stochastic programming problem, with first-stage decisions that assign passengers to itineraries to ensure an accurate objective function and second-stage decisions that use a flight-based network to ensure integer solutions. We present a Bender's Decomposition approach to solving this problem.

4 - Stochastic Scheduling of Runway Operations

Gustaf Solveling, Graduate Research Assistant, Georgia Institute of Technology, 765 Ferst Dr NW, GA Tech ISyE, Atlanta, GA, United States of America, gustaf.solveling@gatech.edu, Senay Solak, John-Paul Clarke, Ellis Johnson

We formulate the stochastic version of the runway planning problem for single and multiple runways as a two-stage stochastic program and present methods to solve the problem. For practical validity, it is necessary that the resulting stochastic integer programs are solved fast. We present efficient methods to achieve this, and use these algorithms to demonstrate the benefits and practicality of stochastic runway scheduling.

■ MB71

H - Salon H, 6th Floor

Stock Picking and DEA

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Joseph C. Paradi, University of Toronto, Canada, paradi@mie.utoronto.ca

1 - Looking for Positive Returns in the Brazilian Stock Market - A Data Envelopment Analysis Approach

Ana Lucia Miranda Lopes, Professor, Universidade Federal de Minas Gerais - UFMG, CEPEAD/FACE, Avenida AntÙnio Carlos, 6627 - Pampulha, Belo Horizonte, 30160042, Brazil, analopes@face.ufmg.br, Aureliano Angel Bressan, Helio Darwich Nogueira, Ruben Huamanchu Gutierrez

This paper presents a multi-period investment strategy using DEA in the Brazilian stock market. Three different portfolios are built with efficient DEA/BCC units for each quarter from 2005 to 2009. Using technical and fundamental indicators as inputs/outputs, the results indicate that the model outperforms the Brazilian market index, using Jensen's alfa as the evaluation criteria.

2 - Performance of Investment Fund Managers

Rajiv Banker, Temple University, Philadelphia, PA, United States of America, banker@TEMPLE.EDU, Yun-Sheng Chen, Paul J.M. Klumpes

We use Data Envelopment Analysis (DEA) to analyze fund managers' relative efficiency in their buying and selling activities. We find that fund managers have asymmetric abilities: some managers do well in buy transactions but not in sell transactions while others perform well in selling but not in buying.

3 - Can DEA be Used to Predict Stock Market Performance?

Joseph C. Paradi, University of Toronto, Canada, paradi@mie.utoronto.ca, Haiyan Zhu

Recent studies have provided evidence that higher returns can be generated if the investment decision is guided by forecasts of market direction changes. The proposed DEA-SVM model is tested by used to predict the direction (up or down) of daily Toronto Stock Exchange composite Index. We demonstrate the predictability of stock index movement direction using a combing DEA-SVM model; simultaneously incorporate information derived from the macro-economic factors, past market information, and the influence of the major international markets; and to supply new insights into stock market movements by using DEA models to aggregate multiple indicators into a composite index without requiring a priori weights.

■ MB72

H - Salon J, 6th Floor

Public Transit I: Transit Network Design, Assignment and Access

Sponsor: Transportation Science and Logistics Society
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 - Bi-level Optimization for the Public Transportation Network Planning Problem

Wei Fan, Assistant Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd., Tyler, TX, 75799, United States of America, wfan@uttyler.edu

An innovative Bi-level Optimization approach is presented to solving the Public Transportation Network Planning Problem (PTNPP) for the first time. The connection between this new approach and the existing model formulation is built. Detailed solution methodology is proposed and discussed. Numerical results are described. Future research directions are also given.

2 - A Hyperpath Assignment Algorithm on a Multimodal Network

Mark Hickman, Associate Professor, University of Arizona, Civil Engineering, 1209 E. Second St., Bldg 72, Tucson, AZ, 85721-0072, United States of America, mhickman@email.arizona.edu, Hyunsoo Noh

Multimodal trips are not always modeled but can serve as a critical mode of urban travel. We propose a hyperpath algorithm for assignment on a multimodal network. We define a specific multimodal network configuration, allowing specific mode-to-mode movements on each node, and introduce a stochastic user equilibrium assignment algorithm.

3 - Optimization of Public Transit Stop Locations and Demand Coverage with Budget Constraints

Sha Mamun, Graduate Student, University of Connecticut, 261 Glenbrook Road, Unit 2037, Storrs, CT, 06269, United States of America, msm08014@engr.uconn.edu, Nicholas Lownes

A maximal covering location problem was formulated to find the best transit stop locations at fixed construction cost. This model maximizes the demand coverage of transit service needy population. A multivariate public transit accessibility model is also developed as linearly weighted function of different spatial, temporal and trip coverage aspects. Measure of transport disadvantaged population was incorporated in this model in order to ensure equitable service delivery with new transit stops.

4 - A Comprehensive Comparison of Transit Accessibility Measures: Is Simple Really Better?

Jeffrey LaMondia, Dr., University of Texas at Austin, Austin, TX, 78712, United States of America, jeffrey.lamondia@gmail.com

In this study, we use transit trip and spatial GIS data from Brownsville Texas to compare 4 different accessibility measures, from gravity models to activity-based microsimulation. The study shows that, which more time consuming and data intensive, the more advanced methods provide better insights into patrons' accessibility.

■ MB73

H - Salon K, 6th Floor

Consolidation and Network Design II: Network Design Problems

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Leila Hajibabai, University of Illinois at Urbana-Champaign, 205 N. Mathews Ave. Room #3142, URBANA, IL, 61801, United States of America, hajibab1@illinois.edu

1 - Integrated Biofuel Supply Chain Design with Agricultural Land Use and Feedstock Market Equilibrium

Yun Bai, UIUC, B156 Newmark Civil Eng. Lab, 205 N. Mattews Ave., Urbana, IL, 61801, United States of America, yunbai1@illinois.edu, Yanfeng Ouyang

The rapid expansion of the biofuel industry is affecting regional agricultural economic development due to the utilization of crops as feedstocks. This research models the impact of bio-refinery location on farmers' decisions on biomass production and transportation, and incorporates it into the optimal biofuel supply chain design framework. Spatial equilibrium approach is utilized to estimate the supply and demand of corns and the associated price variations in local grain markets.

2 - Intermodal Network Design Under Hub Congestion
Rafay Ishfaq, Assistant Professor, Loyola University Chicago, 1 E. Pearson, Maguire Hall, Chicago, IL, 60611, United States of America, rishfaq@luc.edu, Charles Sox

In this research, logistics operations at a hub are modeled as a queuing network and the shipments as multiple job classes with deterministic routings. By integrating this hub-operation queuing model with a hub location-allocation model, this research investigates the effects of limited hub resources on the design of intermodal networks under service time requirements. The findings of a research study based on a 25-city intermodal logistics network are discussed.

3 - Network Design for Origin-Destination Freight Flows
Kathleen Lindsey, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, kate.abercrombie@gatech.edu, Alan Erera, Martin Savelsbergh

When creating a less-than-truckload network, assessing the value and role of terminals is crucial for identifying valuable freight consolidation opportunities. Our research focuses on determining the most cost-effective way of operating terminals given freight demands. We use a combination optimization and heuristic search to find terminal operating roles as well as an associated load plan for freight demands.

4 - Refinery Location, Shipment Routing and Roadway Capacity Expansion for Biofuel Supply Chain Design
Leila Hajibabai, University of Illinois at Urbana-Champaign, 205 N. Mathews Ave. Room #3142, URBANA, IL, 61801, United States of America, hajibab1@illinois.edu, Yanfeng Ouyang

This research aims to minimize the total costs associated with facility construction, roadway capacity expansion, and transportation of both biomass/biofuel and the general public. A genetic algorithm is developed to solve the optimization model, and an empirical case study for the state of Illinois is presented.

■ MB74

H - Room 602, 6th Floor

OD Estimation and DTA Model

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Yi-Chang Chiu, University of Arizona, Tucson, AZ, United States of America, chiu@email.arizona.edu

1 - On a Two-stage Time-dependent OD Calibration Methodology for Matching Link Counts and Speed Profile
Eric Nava, ejnava@email.arizona.edu, Yi-Chang Chiu, Jorge Villalobos, Yang Gao

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 - An Information-Theoretic Model for Locating Automatic Vehicle Identification Readers for Link Travel Time Estimation Applications
Tao Xing, Graduate Research Assistant, University of Utah, Department of Civil Engineering, Salt Lake City, UT, 84112, United States of America, tao.xing@utah.edu, Xuesong Zhou

Within a Kalman filtering based link travel time estimation framework, this talk introduces an information-theoretic framework for solving AVI sensor location problems. By deriving mathematical formulations for the system-wide uncertainty measurement, the marginal values of AVI sensor networks are systematically quantified and further maximized to improve network observability.

3 - Link-based Counting Sensor Location Problem for OD Calibration in Dynamic Traffic Assignment System
Yang Gao, University of Arizona, Tucson, Tucson, AZ, United States of America, gabegao@email.arizona.edu, Yi-Chang Chiu

We present a methodology to obtain time dependent OD matrices, which is a required input for dynamic traffic simulation, using partial static and partial dynamic link flows information. The main focus is on the practical guidelines to obtain time dependent OD matrices using existing data. The approach is applied to the Manhattan, NY network to demonstrate the challenges and we provide recommendations for future applications.

■ Interactive Session

Monday, 12:30pm -1:30pm
C - Exhibit Hall 3

Chair: Maciek Nowak, Assistant Professor, Loyola University Chicago, Graduate School of Business, 1 E. Pearson St., Chicago, IL, 60611, United States of America, mnowak4@luc.edu

Co-Chair: Sila Cetinkaya, Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States of America, sila@tamu.edu

1 - Union and Nonunion Employment: Factors That Could Influence the Development of Burnout
Rachel Costello, Student, Walden University, 990 Meadow Thrush Dr., Clayton, OH, 45315, United States of America, r.costello@earthlink.net

Employment places demands on the employee that may increase their risk of developing burnout. The purpose of the proposed research is to identify the demands and resources in the workplace and the level of burnout in union and nonunion factory workers. This case will contribute to social change by identifying negative and positive predictors, in both union and non-union employment settings that can aid in the development of programs to minimize the negative outcomes of burnout.

2 - Fuzzy PSO Process
Stephany Coffman-Wolph, Western Michigan University, 11704 Landers Drive, Plymouth, 48170, United States of America, stephany.s.coffman-wolph@wmich.edu

Particle Swarm Optimization (PSO) is an optimization strategy. Fuzzy PSO Process differs from PSO in 2 ways: data is fuzzifed and fuzzy operators replace traditional operators. Fuzzy PSO Process is evaluated using the weighted max-SAT problem and compared to the performance of Walk-Sat.

3 - Operations Research at Oracle Retail: Supply Chain and Revenue Management Applications
Andrew Vakhutinsky, Senior Principal Scientist, Oracle Retail Science Group, 10 Van de Graaff Drive, Burlington, MA, 01803, United States of America, andrew.vakhutinsky@oracle.com, Shiva Subramanian, Andrew Mastin, Peter Gaidarev, Alex Kushkuley

We will discuss two optimization problems that Oracle Retail Science team is currently working on: pre-pack planning and markdown optimization. The former is solved by large retail chains as part of their assortment planning process to optimize deliveries to the individual stores. The latter is one of the revenue management tools developed by Oracle for the retail industry. We are going to present our solution approaches and results of the computational experiments using the real-life data.

4 - Achieving Desired Sensitivity Out of Outer-linearized Clearing Functions
Ali Kefeli, PhD Candidate, North Carolina State University, 2717 Brigadoon Dr., Apt 24, Raleigh, NC, 27606, United States of America, akefeli@ncsu.edu

We present an iterative algorithm to solve planning models with nonlinear clearing functions. Previous studies have shown that an arbitrary piecewise linear approximation to such 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.

5 - An Interactive Narrative Asthma Program: Usability Testing of Okay with Asthma v.2.0
Xueping Li, Assistant Professor, University of Tennessee, 408 East Stadium Hall, Knoxville, TN, 37996, United States of America, Xueping.Li@utk.edu, Tami H. Wyatt

Despite medical advancements, increased funding, and numerous intervention programs, asthma remains the leading cause of missed school days and the third leading cause of hospitalizations in children. We develop Okay with Asthma v.2.0 to allow children to construct and interact with stories or narratives (interactive narratives). We test its usability and engagement through focus groups with children.

6 - Promotion Strategies and Backward Information Sharing in a Supply Chain
Hung Do, PhD Candidate, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States of America, hdo@purdue.edu

We address the following important questions in a supply chain: Should a manufacturer share her information on the current queue length (termed backward information sharing) with retailers? How is backward information sharing supposed to be used in promotion strategies of the retailers to benefit all in the supply chain?

7 - Competitive Facility Location Problem

Mona Asudegi, PhD Student, University of Maryland, 1173 G Glenn Martin Hall, College Park, 20740, United States of America, asudegi@umd.edu

Facility Location problem is the problem of finding the optimal locations for a facility and the quantity of supply/product that a firm should store/produce in each facility in order to maximize their revenue through satisfying the demand in the markets. In this study a new approach for solving competitive facility location problem is introduced.

8 - Multi-Valued Subsets for Binary Partitions in Generalized Iterative Dichotomizer 3.

Indraneel Dabhade, Clemson University, Clemson, SC, 29631, United States of America, idabhad@g.clemson.edu, Mary Beth Kurz

The aim is to analyze the effect of using multi-valued sets for binary partitioning in the process of creating decision trees. The main heuristic to make a decision on the choice of node and the attribute-value partition being information gain, the focus would be to analyze the behavior of non-binary attributes. The challenge is to find the appropriate partition for every attribute considering varying partition sizes in order to make the optimal binary division.

9 - OR in a Liberal Arts College: Motivating a Course, Engaging a Community

Barbara Anthony, Assistant Professor, Southwestern University, 1001 E University Ave, Georgetown, TX, 78626, United States of America, anthonyb@southwestern.edu

For years my liberal arts college scheduled by hand components of a course required of all students. This daunting manual task can be efficiently modeled and solved using OR techniques. The now-automated solution spreads awareness of OR and entices students to take an OR course, offered for the first time.

10 - Evaluation of Congestion Mitigation Strategies at Freeway Exit Ramps

Chi-Leung Chu, Texas A & M University, Texas Transportation Institute, College Station TX 77843, United States of America, c-chu@ttimail.tamu.edu, Geza Pesti

Vehicle queues forming on the exit ramp may grow and block the freeway traffic and pose potential safety threat. The objective of this study is to develop a methodology to evaluate different traffic control strategies that may mitigate the impact of exit ramp queue spill backs.

11 - Selective Asset Assignment in Recruiting

Kelly Bartlett, PhD Student, Georgia Institute of Technology, 5014 Gunners Run, Roswell, GA, 30075, United States of America, kelly.bartlett@gatech.edu, Joel Sokol, George L. Nemhauser

In a semi-centralized recruiting organization, individual departments schedule events and request the support of physical assets from an overarching body. Our multi-objective selection and routing model identifies optimal asset assignments using the framework of a multi-vehicle TSP with profits in a space-time network.

12 - Off-road Mobility Studies using Stochastic Terrain and Soil Models

Richard Lee, Cost Analyst, Technomics, 201 12th Street South, Suite 612, Arlington, VA, 22202, United States of America, rlee@technomics.net

For realistic predictions of vehicle performance in off-road conditions, it is critical to incorporate the accurate representations of the variability of the terrain profile. This research develops a comprehensive terrain and soil simulation environment for off-road mobility studies. Moreover, the techniques developed to simulate stochastic terrain profiles and stochastic soil models can be employed to simulate other stochastic systems.

13 - Optimization Research on Aviation Oil Hedges

Zhu ZhongYue, Civil Aviation University of China, BeiJing Xicheng District NiuJie, BeiJing, 100053, China, zzy1998_2001@hotmail.com, Li xiaojin

Hedging is the best method for Airlines to avoid the risks of sudden price fluctuations in oil. This paper will show a series of optimizations related to hedging varieties, ratio and cycles. It will give an optimized solution for Airlines on future hedging.

14 - Green Fleet Management Under Uncertainty: An Approximate Dynamic Programming Approach

Timon Stasko, Cornell University, Hollister Hall, Ithaca, NY, 14853, United States of America, ths9@cornell.edu, Oliver Gao

Many organizations strive to minimize fleet upkeep costs. This paper presents an approximate dynamic program for developing vehicle purchase, resale, and retrofit policies given known emission regulation and stochastic maintenance events. The algorithm estimates vehicle values and how they are altered by regulation. Extensions include uncertain regulation and fuel prices.

15 - A Scenario Planning Approach to Support Strategic Decision Making

Danielle Araujo, Researcher Engineer, Institute for Advanced Studies - IEAv/DCTA, Rodovia dos Tamoios, km 5,5 - Putim, São José dos Campos, SP, 12228001, Brazil, danielleaa@ieav.cta.br, Monica De Marchi, Nilton Lessa, Marcelo Zawadzki

Considering a military context where there is an imminent catastrophic situation, this work aims to assess the viability of applying the scenario planning approach in order to provide a larger situational awareness. With this it will be possible to support future strategic decision making taking into account multiple action options.

16 - Systems Engineering in the Humanitarian Context

Darren Dickenson, Industrial Engineering Graduate Student, Arizona State University, 1201 W. Laird St., Tempe, AZ, 85281, United States of America, darren.dickenson@gmail.com

Systems engineering's powerful organizational tools and life-cycle view make it a potential resource for the complexities of humanitarian engineering. This project surveys the connection between systems engineering and humanitarian work in the literature and proposes ways that systems engineering concepts and frameworks could benefit complex humanitarian projects.

17 - Optimized Scoring Function to Predict Solubility Mutagenesis

Ye (Alice) Tian, Washington State University, 1445NE North Fairway dr. L45, Pullman, WA, 99163, United States of America, fieldtianye@gmail.com, Christopher Deutsch, Bala Krishnamoorthy

We use concepts from computational geometry to define a three body scoring function that predicts the change in protein solubility due to mutations. Our database is the largest such collection with structural information known. We optimize the scoring function using linear programming(LP) to derive weights. We compare the LP method to machine learning techniques of SVM and the LASSO. Using statistics for cross validations, we demonstrate the LP method performs the best with an accuracy of 81%.

18 - A Mathematical Model for Required Number of EV Stations in Highway Networks

Yudai HONMA, Assistant Professor, Waseda University, 60-02-05A, Okubo 3-4-1, Shinjuku-ku, Tokyo, 169-8555, Japan, yudai@aoni.waseda.jp, Shigeki TORIUMI

Electric vehicles (EV) have attracted attention for decades, but short battery life and limited range are pointed out. These defects will be a serious problem in highway networks, where vehicles make long-distance driving. In this study, we calculate the required number of EV stations in actual highway networks.

19 - Total Energy Management System for Electric Vehicle Operation using Time-Space Network

Yuta Fukushima, Osaka University, 2-1, Yamadaoka , Suita, P2-426, Osaka, Japan, yuta.fukushima@ist.osaka-u.ac.jp, Hiroshi Morita, Shunji Umetani

With the improvement of green technology, the electric vehicles will be arranged to the enterprise facilities, and it will be required the total energy management system, because the electric vehicles can act as the temporal energy back-up facility. We consider the charge / discharge scheduling system to optimize the electric power flow by using time-space network model.

20 - Learning and Distributed Computing Approach for Solving Games in Carbon and Electricity Markets

Vishnu Nanduri, Assistant Professor, University of Wisconsin-Milwaukee, Department of Industrial Engineering, 3200 N. Cramer St., P.O. Box 784, Milwaukee, WI, 53201, United States of America, vnanduri@uwm.edu, Craig Struble

A critical research need at the present is the development of decision support models for policy makers and electric power producers operating under the constraints of new emissions control policies. In this research we develop a bi-level game-theoretic model to address this challenge and a reinforcement learning based solution approach. To alleviate computational burden in solving the model, we develop a novel distributed computing framework.

21 - Quadratic Spanning Tree Problem and its Variations

Annie Zhang, Simon Fraser University, 250-13450 102 Avenue, Surrey, BC, V3T0A3, Canada, rza1@sfu.ca, Abraham Punnen

We study the quadratic spanning tree problem(QSTP), together with two variations, the mininum spanning tree with conflict pairs(MSTC) and the quadratic bottleneck spannig tree problem(QBST). Complexity results are presented on certain special graphs such as fan, wheel and ladders. New polynomially solvable cases are explored. For QSTP, we give an if and only if condition when the quadratic obj function reduces to linear. Also, a tree enumeration formular is obtained for general ladder graph.

22 - Chain Reaction in Consumer Behavior by Network Analysis: How One Purchase Makes Next Purchase?

Hiroshi Kumakura, Professor, Senshu University, 2-1-1 Higashimita, Tama, Kawasaki, 2148580, Japan, kumakura@isc.senshu-u.ac.jp

Consumption/purchase of a certain product evokes sometimes next consumption of other products (e.g. viewing of the 1st weekly TV drama leads to that of the 2nd one). Hence, chain reaction, ripple effect, or domino effect in consumer behavior is discussed, by considering products/brands to be nodes, and consumption between products to be a link in network analysis.

23 - Switching Costs and Information Technology: The Case of IT Outsourcing

Christian Peukert, Ulm University, Helmholtzstr. 20, Ulm, 89081, Germany, christian.peukert@uni-ulm.de

Micro data from US credit unions for 1999 to 2009 reveals that with more than 98 percent, outsourcing has been by far the preferred mode of IT provision. However, the average credit union only sticks with the same vendor for 4 years. This paper empirically investigates determinants of the decision to switch suppliers. Moreover we provide evidence for the existence and magnitude of switching costs. The estimates suggest that average switching costs account for 3 percent of annual expense.

24 - Suggestions for Auto Industry Supply Chain Sustainability

Yu (Amy) Xia, Assistant Professor, Middle Tennessee State University, 1301 E. main, Murfreesboro, TN, 37130, United States of America, axia@mtsu.edu, Thomas Tang

Abstract: In this study, we explore what North American auto industry should do in supply chain management to maintain sustainability. We applied management theories, collected information from managers at different levels of auto industry's supply chain management, and developed a novel theoretical model of sustainability in SCM for the industry.

25 - ADCLUS and INDCLUS: Analysis, Experimentation, and Meta-Heuristic Algorithm Extensions

Stephen France, Assistant Professor, University of Wisconsin - Milwaukee, Sheldon B. Lubar School of Business, P. O. Box 742, Milwaukee, WI, 53207, United States of America, france@uwm.edu, Yumin Deng, Wen Chen

The ADCLUS and INDCLUS models, along with associated fitting techniques, provide methods of extracting overlapping clustering structure from proximity data. In this paper we examine the scalability of these methods. We provide an applied complexity analysis of the models. We introduce several meta-heuristic extensions to the SINDCLUS/SYMPRES algorithms used to fit the models. We experiment on multiple real world data sets.

26 - Decision Analysis Approach to PAS Obsolescence Cases

Rayan Hafiz, Engineering Specialist, Saudi Aramco, Saudi Aramco Eng Bld 728 Office 4410, P.O. Box 10659 Dhahran 31311, Dhahran, 31311, Saudi Arabia, rayan.hafiz@aramco.com

We develop a decision analysis model to generate replacement recommendations on the status of the process automation systems (PAS) at a number of plants with near obsolescence PAS. We identify major uncertainties and risks associated with any decision to run such systems beyond their lifetime along with the impact on monitory and operational values based on operational and asset utilization costs. In addition, we show how to generate recommendations for any obsolescence case.

27 - Two Steps Transportation Problem

Ezio Marchi, IMASL-UNSL. San Luis, Argentina, Chacbuco 218, Godoy Cruz, 5501, Argentina, emarchi@speedy.com.ar

We introduce a new model of two steps transportation problem, which generalizes the classical one. We characterize all the extremals, which appears to be those solutions whitout cycles. We provide some interesting applications. These models cannot be studied as a particilar case of one step transportation problems.

28 - Locating Emergency Response Facilities Under Uncertainty

Yuanchang Xie, Assistant Professor, South Carolina State University, 300 College Street NE, Civil and Mech. Eng. Tech., Orangeburg, SC, 29117, United States of America, yxie@scsu.edu, Jae-Dong Hong

Disastrous events such as hurricanes can cause severe damage to transportation infrastructure and emergency response facilities, making them temporarily unavailable or shut down completely. To ensure the timely delivery of disastrous relief goods to affected areas, this research develops a robust mixed integer transportation and facility location model for sitting emergency response facilities. Case studies are conducted to demonstrate the effectiveness and robustness of the new model.

29 - Optimal Bayesian Maintenance Policies for a Fleet of Auxiliary Power Units (APUs)

Zhe Li, PhD Student, Northwestern University, 2145 Sheridan Road Room C231, Evanston, IL, 60201, United States of America, lizhe@iems.northwestern.edu, Dinkar Mylaraswamy, Gordon Hazen

We examine optimal repair policies for a fleet of APUs on airline flights. We model fleet status as a closed queuing network with repair station. Repair can depend on observed condition indicators (CIs) modeled as Brownian motion with unobserved drift. APU failure is correlated with its CI. We allow drifts to be heterogeneous across the fleet, and examine repair policies that use historical CI data to make Bayesian inferences about unobserved drift and likelihood of failure of the APU.

30 - Modeling the Structure and Adaptation of Dynamic Organizations

Darby Grande, Aptima, Inc., 12 Gill St., Ste 1400, Woburn, MA, 01801, United States of America, dgrande@aptima.com, Shawn Weil, Tim Sorber, Alan Carlin, Todd Black, Jared Freeman

U.S. Navy Maritime Operations Centers (MOC) are headquarters manned by joint operational-level staffs and enabled by globally interoperable systems. We present a simulation to support assessment and refinement of MOC staffing, equipment, and schedules. A proposed extension to this model uses a POMDP to adapt the MOC in novel situations.

31 - From email Exchange Records to Inference of a Time Series of Random Dot Product Graphs

Nam Lee, Johns Hopkins University, 3400 N. Charles St., 100 Whitehead Hall, Baltimore, MD, 21218, United States of America, nhlee@jhu.edu

Consider graph G(t) with vertex set V and edge set E. We may think of G(t) as a social network, where each vertex represents a person, and edge uv in E(G(t)) signifies existence of strong collaboration potential between u and v. We are interested in detecting emergence of unusually intense collaboration amongst some vertices where the observed data M(t) is a collection of e-mail messages exchanged during [t-1,t) instead of G(t). We discuss the result of applying our theory to Enron e-mail data.

32 - Global Solution of Bi-Parametric Linear Complementarity Constrained Linear Programs

Yu-Ching Lee, University of Illinois at Urbana-Champaign, 104 S. Mathews Ave., Urbana, IL, 61802, United States of America, ylee77@illinois.edu, Jong-Shi Pang

A linear program with bi-parametric linear complementarity constraints is among the simplest linear program with linear complementarity constraints. Yet the global solution of this program remains difficult to find and verify. Reformulating this problem as a non-convex quadractically constrained program, we develop a domain-partitioning algorithm that solves LP or convex quadratically constrained programs obtained by relaxations of the complementarity constraint. Numerical results are presented.

33 - Stochastic Simulated Annealing For The Optimal Allocation of Health Care Resources

Talal Al-Khamis, Associate Professor, Kuwait University, P.O. Box 5969, Safat, 13060, Kuwait, talalohoud@gmail.com

We present a stochastic simulated annealing model for the optimal staffing distribution in an emergency department health care unit. In this model the optimization problem considered aims to maximize the probability that waiting time of critical patients should not exceed a pre-specified level subject to constraints imposed by the system. Computational results are given to demonstrate the performance of the proposed simulated annealing algorithm.

34 - Disjunctive Conic Cuts for Mixed Integer Second Order Cone Optimization (MISOCO)

Julio C. Goez, Ph.D Student, Lehigh University, 13 Duh Drive, Apt 212, Bethlehem, PA, 18015, United States of America, jcg207@lehigh.edu, Pietro Belotti, Imre Pólik, Ted K. Ralphs, Tamàs Terlaky

We develop disjunctive programming to MISOCO. In general no finite linear representation of the integer convex hull of the feasible set exists, thus any finite exact representation has to be conic. We consider the intersection between the relaxed feasible set, assumed to be an ellipsoid, and a disjunction. Under mild assumptions, we show the existence of a second order cone containing the convex hull of that intersection. One can use the conic cut in branch-and-cut algorithms for MISOCO problems

35 - The Impact of the User-It Artifacts Interaction on Technology Adoption: Mobile Social Networking

Donghyun Kim, The University of Mississippi, 218 Karen Dr., Oxford, United States of America, dkim@bus.olemiss.edu

e utilize social network theory to introduce the concept of "mobile social capital" for users of mobile technology and its impact on technology adoption to investigate the question (How do IT artifacts affect adoption via mobile social capital?) We empirically investigate IT artifacts as proxies for social actors that interact with users of these artifacts to extend (1) the traditional technology adoption model, (2) knowledge of mobile technology, and (3) IT artifacts in the IS discipline.

36 - Passenger Oriented Airline Scheduling and Fleet Assignment

Luis Cadarso, Universidad Politécnica de Madrid, Aeronàuticos, Pza. Cardenal Cisneros, 3, Madrid, 28040, Spain, luis.cadarso@upm.es, Ángel Marìn

The airline schedule development and fleet assignment problems consist of determining flight departure times and the assigned fleet type. They are usually solved sequentially without accounting for passenger flows through itineraries resulting in misconnected passengers. We propose a new integrated approach to design flight legs accounting for fleet assignment and providing robust itineraries for connecting passengers. An application of the model for a simplified IBERIA network is shown.

37 - Measuring Crosstalk in Biological Pathways

Mary McGuire, PhD Candidate, U of Texas Health Science Center at Houston, 7000 Fannin, Suite 600, Houston, TX, 77030, United States of America, mary.f.mcguire@uth.tmc.edu, M. Sriram Iyengar, David W. Mercer

Crosstalk relates to how biological pathways determine functional specificity, how ubiquitous messengers transmit specific information, and how redundant messages crosslink within the system while undesirable signals are minimized. Preliminary results using the matrix algebra XTALK measure of quantitative biological crosstalk ratios over time have implications for the timing of therapeutic interventions that target specific molecular interaction types found in disease progression in trauma.

38 - Managing and Mitigating Risk in the Supply Chain with New Postponement Strategies

Drew Stapleton, Professor, University Wisconsin La Crosse, 1725 State Street, 418 H CWH, La Crosse, WI, 54601, United States of America, stapleto.andr@uwlax.edu

Postponement refers to a concept whereby activities in the supply chain are delayed until a demand is realized (Bucklin 1965, Van Hoek 2001), and has become increasingly more strategic in nature (Boone, Craighead, and Hanna 2007). Firms are beginning to realize that postponement can be realized in many forms, not purely physical delay to the product - and can provide the impetus for completely redesigning the supply chain with greater responsiveness to various types of uncertainty.

39 - Entity Reduction Approach for Impedance-based Intermodal Network Design

EunSu Lee, PhD Candidate, North Dakota State University, 1616 12th Ave. N., CJPP Building Room#208, Fargo, ND, 58102, United States of America, eunsu.lee@ndsu.edu, Kambiz Farahmand

The intermodal transportation includes the large-scale networks between countries and continents. Optimizing the intermodal routes is cumbersome in terms of complexity to embrace the number of entities, agencies involved, and coverage. This research investigates the use of an efficient entity reduction approach to implement the impedance-based intermodal network (IIN) analysis utilizing Geographic Information Systems (GIS).

40 - Predictive Policing: Examining Departmental Needs and Tools

John Hollywood, Operations Researcher, RAND Corporation, 1200 South Hayes Street, Arlington, VA, 22202, United States of America, johnsh@rand.org

We discuss the emerging OR area of "predictive policing" - analyzing increasing volumes law enforcement data to help prevent (or solve) crimes. We discuss common departmental applications and needs for predictive policing; discuss major techniques and their common pros, cons, and pitfalls; and demonstrate an easy-to-create tool in Microsoft Excel that requires no programming.

41 - The Multi-period Market Selection Problem Under Uncertainty

Zohar Strinka, University of Michigan, 1031 Barton Dr, Apt 112, Ann Arbor, MI, 48105, United States of America, zstrinka@umich.edu, Edwin Romeijn, Jingchen Wu, David Linz

We examine the problem of selecting which of several potential markets should be served to maximize profits in a multi-period setting with newsvendor-type costs. We identify problem variants that can be solved using an adaptation of the single-period solution approach, and develop approximate and exact methods for more complicated variants.

42 - Supply and Demand Management of Gas Meters Based on Long-term Perspectives in the Gas Utility

Toshinori Sasaya, Tokyo Gas, 5-20, Kaigan 1-Chome, Minato-Ku, Tokyo, 105-8527, Japan, sasaya@tokyo-gas.co.jp, Shirou Kitaura, Hiroshi Kashio, Shinnosuke Kimura, Eiichi Kodama

This presentation discusses the efficient supply and demand management of gas meters in the gas utility. As gas meters should be verified every ten years by law in Japan, the gas utility exchange existing ones before their expiration. And they install new ones for their new customers. We predict the demand, and control the supply in view of leveling the exchange demand in the future for smooth installation works of gas meters.

43 - Identifying Changing Aviation Threat Environments in an Adaptive Homeland Security Advisory System

Adrian Lee, Central Illinois Technology and Education Research Institute, 2312 Connie Drive, Springfield, IL, 62704, United States of America, ajlee@citeri.org, Sheldon Jacobson

Passenger prescreening in aviation security serves primarily as a risk-based approach to screening passengers and baggage at security checkpoints. This presentation illustrates the use of Fisher information as a statistical measure for detecting changes in the threat environment and detection device responses according to the sequential realization of the perceived passenger risk.

44 - Sensitivity Analysis for Lexicographic Optimization in Radiation Therapy Treatment Planning

Troy Long, PhD Student, University of Michigan, 1745 Broadview Ln., Apt 510, Ann Arbor, MI, 48105, United States of America, troylong@umich.edu, Edwin Romeijn

We examine the problem of quantifying tradeoffs between and within different stages in lexicographic optimization for IMRT treatment planning. We propose appropriate sensitivity analyses and determine Pareto frontiers to identify improved treatment plans. We apply our approach to clinical cases of prostate cancer.

45 - A Simulation Study of a Community Health Clinic Operation

Lei Wang, University of Texas, Austin, Austin, TX, United States of America, lei.wang@mail.utexas.edu, Jennifer Duthie

This work follows a community health clinic in Austin, TX to help them find solutions to cope with increasing patient demand. Several scenarios for increasing efficiency were explored using an ARENA-based patient flow model. Multiple bottlenecks were identified and solutions were found to help the clinic minimize overall patient cycle time and to distribute the workload more evenly across staff.

46 - Risk Sharing in Supply Chains: Double Moral Hazard and Taiwanese Personal Computer Industry

Shieh-Liang Chen, Professor, Asia University, No.500, Lioufeng Rd., Wufeng, Taichung County, 41354, Taiwan - ROC, peterchen@asia.edu.tw, Chih-Liang Liu

We show manufacturer offers supplier a cost-plus contract with maintaining long-term relationships, and support that manufacturer absorb more risk:(1)the greater supplier's environmental uncertainty;(2)the more risk aversion supplier;(3)the less severe supplier's moral hazard; and (4)the more technological capability manufacturer. Manufacturer's technological capability is identified as important supporting factor in transforming firm's efforts into supplier production cost reductions.

47 - R&D, Market Competition and Executive Stock Options

Yi-Mien Lin, Professor, National Chung Hsing University, No.250, Kuo-Kuang Road, Taichung, 402, Taiwan - ROC, ymlin@dragon.nchu.edu.tw, Teng-Shih Wang, Shieh-Liang Chen

As firms face high competition and threat of liquidation, managers are obviously motivated by more incentives provided from firms. We find under controlling board's composition, when the firm suffer higher industry competition, it is likely to invest in more R&D expenditure to expand market share and to grant more stock options to managers. Moreover, when firms increase R&D, managers have opportunistic behavior to inflate firms' values, and lead to the rise of stock options value of managers.

48 - "Picturing" Work: A Photovoice Pilot of Frontline Workers in the Shanghainese Automotive Industry

Martin Stoesslein, Jilin University, 5988 Renmin Street, Changchun, 130022, China, stoessma@udayton.edu

Photovoice, an emerging research method in psychology, aims to tap the concerns and strengths of subjects who are usually "unheard". We explore the adaptation of this methodology to the business arena, with frontline workers in Shanghai, as an alternative to upgrading products, processes, and working conditions. Empirical results are presented.

49 - Survey on Strategic Forest Estate Modelling Under Uncertainty in the Context of Climate Change

Wenbin Cui, Forest modelling specialist, Ontario Ministry of Natural Resources, 70 Foster Drive, Suite 400, Sault Ste Marie, On, P6A 6V5, Canada, wenbin.cui@ontario.ca, Dan Rouillard, Peter Henry, Dirk Kloss

Climate change will not only affect the forest itself but also forest management and thus forest policy making. This may pose new challenges for strategic forest estate modeling. A questionnaire is designed to collect information on how each province or territory in Canada is incorporating or planning to incorporate climate change into forest estate modeling to support forest management planning and forest policy development.

50 - Implementing Multiple and Flexible Process Routes in the Intel Supply Chain Applications
Seon Ki Kim, Operations Research Engineer, Intel, 1040 E Tyson Ct, Chandler, AZ, 85225, United States of America, seon.ki.kim@intel.com

Flexibility plays critical role in reducing inventory cost and cycle time, providing better supply and demand mix and match, and improving supply chain performance. FlexBom (FB) project has been accepted as a part of those efforts to make the testing process more common and flexible for product differentiation by introducing multiple sets of bin split scenarios in Intel business processes.

Monday, 1:30pm - 3:00pm

■ MC01

C - Ballroom D1, Level 4

Renewables, Emissions Trading and Climate Change

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Yihsu Chen, Assistant Professor, University of California Merced, Merced, CA, 95343, United States of America, yihsu.chen@ucmerced.edu

1 - Unit Commitment with Plug-in Hybrid Vehicles
Jianhui Wang, Assistant computational engineer, Argonne National Laboratory, 9700 S. Cass Ave., Bldg 221, Argonne, IL, 60439, United States of America, jianhui.wang@anl.gov, Audun Botterud, Cong Liu, Vyas Anantray

In this talk, we investigate the impact of high penetration of plug-in electric vehicles (PHEVs) on power system operations. Due to the uncertainty in PHEV charging/discharging, we propose an improved stochastic security-constrained unit commitment and dispatch algorithm that captures the uncertainty in the use of PHEVs by scenarios as opposed to the traditional deterministic method.

2 - Equilibria in an Oligopolistic Pool-based Electricity Market
Carlos Ruiz Mora, PhD Student, University Castilla-La Mancha, Campus Universitario s/n, Ciudad Real, 13071, Spain, carlos.rmora@uclm.es, Antonio J. Conejo

We study the equilibria reached by strategic producers in a pool-based network-constrained electricity market. The behavior of each producer is modeled by an MPEC whose objective is maximizing profit and whose constraints describe market clearing. Under convexity assumptions, the KKT conditions of all these MPECs can be meaningfully written and constitute an EPEC that can be solved by nonlinear optimization techniques. Diverse strategies are explained to indentify meaningful equilibria.

3 - Peak Load Pricing and Production Planning in an Electricity Market
Mohammad Reza Skandari, University of Florida, ISE department, 303 Weil Hall, Gainesville, FL, 32611-6595, United States of America, skandari@ufl.edu, Yongpei Guan

In this paper, a problem of pricing and load planning for an electricity market is studied. In this study, the price-responsive demand goes through a pattern of behaviors for different hours of a day (on-peak, off-peak,Ö), and the objective is to maximize the social welfare. Two major decisions are made for each hour: price, and efficient operation of each generator. To analyze the problem, a dynamic programming model is proposed, and properties of the optimal policy are suggested and proved.

4 - Duopoly Competition Under Uncertain Electricity Demand and Permit Prices: When to Invest?
Chung-Li Tseng, Associate Professor, The Australian School of Business, University of New South Wales, Sydney, Australia, c.tseng@unsw.edu.au, Yihsu Chen

This paper discusses how emission trading may affect the investment timing of introducing a new technology for emission reduction under uncertain permit prices when market is imperfectly competitive. In particular, we apply a real options approach and consider two firms: each owns a coal power plant and is planning to introduce a natural gas plant. The timings for introducing the natural gas plants are evaluated under various market setting (e.g., one as the leader and one as the follower).

■ MC02

C - Ballroom D2, Level 4

Valuation and Risk Management of Energy Demand Response and Carbon Emission

Cluster: Energy: Modeling the Interface Between Markets and Operations
Invited Session

Chair: Shijie Deng, Assc. Professor, Georgia Tech, 765 Ferst Dr NW, Atlanta, GA, United States of America, deng@isye.gatech.edu

1 - Demand Response in Restructured Wholesale Electricity Markets
Hung-po Chao, ISO New England, hchao@iso-ne.com

An assessment of alternative approaches to demand response shows that if demand-response providers are to be paid the wholesale price for demand reduction, they must have a financial obligation to pay for the energy represented by the customer baseline whether or not they use it. Absent energy entitlement or ownership, demand response is likely to produce unintended effects. Retail reform is essential to leverage the demand-response programs in the wholesale markets for an efficient outcome.

2 - Carbon Emission Permit Price Volatility Mitigation via Financial Options
Li Xu, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, lxu34@isye.gatech.edu, Valerie Thomas, Shijie Deng

We develop a stylized model to investigate the impact of financial options on mitigating carbon permit price volatility under a cap and trade system. We show that both the spot price level and the price volatility of carbon permits can be reduced via financial options, while achieving the emission target. We also show that introducing financial options to banking environment is more flexible in managing carbon permit prices.

3 - Mixed Integer Programming Models for Selecting Ground-Level Ozone Control Strategies
Wei-che Hsu, The University of Texas at Arlington, P.O. Box 19017, Arlington, TX, 76019, United States of America, weiche.hsu@mavs.uta.edu, Neelesh V. Sule, Jay Rosenberger, Victoria Chen, Melanie Sattler

A State Implementation Plan (SIP) describes how a state will reduce the emissions of pollutants to satisfy air quality standards in a timely manner. We study three mixed integer programming models that seek to select control strategies for the Dallas-Fort Worth region to reduce emissions, so as to achieve SIP requirements with minimum cost. Linear regression metamodels based on an advanced photochemical model were constructed to estimate average 8-hour ozone concentrations.

■ MC03

C - Ballroom D3, Level 4

Forestry III: Fire Prevention and Management

Sponsor: Energy, Natural Resources and the Environment//Forestry
Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Avenue, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Goal Programming Helps the US Forest Service Award Firefighting Helicopter Contracts
Stephanie Snyder, U.S. Forest Service, Northern Research Station, 1992 Folwell Ave, St. Paul, MN, United States of America, stephaniesnyder@fs.fed.us, Keith Stockmann, Janet Sullivan, Eddie Morris

The US Forest Service utilizes contracted helicopter services as part of its wildfire suppression strategy. An optimization decision support system was recently developed to assist in awarding contracts. Assignment models were developed to optimize 3 contract selection criteria independently. These solutions formed the basis for a weighted goal programming model which minimized percent deviations. Experiences from using the models to assist in 2 contract award cycles will be discussed.

2 - Using Hybrid Goal Programming for Performing National Analysis of Wildland Fire Management in US

Tarun Kumar, IBM T.J. Watson Research Center, Yorktown Heights, NY, United States of America, ktarun@us.ibm.com, Soujanya Soni, Gyana Parija, Steven Carty

We present a multi-criteria budget allocation model for assigning national budgets across all the Fire Planning Units (FPU) in the US. We discuss the innovations we have made, based on users desire to perform a deep dive analytics. We showcase the flexibility of the model and its capability in performing analysis from multiple dimensions. We also look at the results of the computation using the national analysis data for budget year 2012.

3 - A Stochastic Programming Standard Response Model for Wildfire Initial Attack Planning

Julian A. Gallego Arrubla, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, kamizama77@tamu.edu, Lewis Ntaimo, Curt Stripling, Joshua Young, Thomas Spencer

The first step towards wildfire containment is to effectively perform an initial attack. We formulate a two-stage stochastic integer programming standard response model for initial attack. We report a study based on one of the Texas Forest Service fire planning units in East Texas involving seven fire bases and 28 dozers. We use our methodology to position the dozers and evaluate each deployment in terms of the number of resources positioned at each base and the expected number of escaped fires.

4 - Joint Allocation of Initial Attack Resources Across Fire Planning Units

Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Avenue, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us, Yohan Lee, Jeremy Fried, Jo Albers

Wildfire managers deploy suppression resources to bases and dispatch them to fires to maximize the number of fires contained before unacceptable costs and losses occur. While dispatchers typically share resources among planning units, budget and deployment decisions are made independently. We use a standard-response optimization model to allocate resources across planning units in central California, and a simulation model of initial attack to estimate potential gains from planning holistically.

■ MC04

C - Ballroom D4, Level 4

Integrating Renewables in Power Markets: Addressing Uncertainty, Dynamics and Strategic Behavior

Cluster: Electrical Energy Systems

Invited Session

Chair: Uday Shanbhag, Asst. Professor, University of Illinois at Urbana Champaign, Urbana, Il, United States of America, udaybag@illinois.edu

1 - Renewable Generation Intermittentcy and Demand Provided Reserves: Are Market Solutions Viable?

Michael Caramanis, Professor, Boston University, Boston, MA, United States of America, mcaraman@bu.edu, Evgeniy Goldis, Justin Foster

Despite optimistic GE studies, careful analyses (Makarov et al) indicate that 5-10% of wind generation nameplate capacity must be matched by fast (5 minute) Regulation Service Reserves representing today 1% of peak load and commanding prices comparable to the energy clearing price. We present a market solution involving demand side participation in the energy and reserves bids and offers and show how it can handle congestion at the wholesale as well as the retail (distribution) network.

2 - Optimizing Wind Generation Capacity in Electricity Systems: A Complementarity Programming Approach

Scott Rogers, Prof, Univ of Toronto, Dept of Mech and Ind Eng, Toronto, ON, m5s 3g8, Canada, rogers@mie.utoronto.ca, Paul Dabrowski

WCAPCOMP 1.0 represents both a wind capacity market (where gencos can purchase forward contracts for wind-generated electric output) and an electricity market (where gencos can sell output). Each genco has its own endowment of wind, nuclear, hydro, coal and gas generation and behaves strategically in ways which differ between the markets. We formulate a Complementarity Programming approach whose Nash Equilibrium solutions are applied to an Ontario System framework.

3 - The Value of Volatile Resources in Electricity Markets

Sean Meyn, Professor, University of Illinois at Urbana Champaign, Urbana, Il, United States of America, meyn@illinois.edu, Matias Negrete-Pincetic, Gui Wang, Anupama Kowli, Ehsan Shafiee

We consider the integration of wind energy resources in a multi-settlement electricity market. Closed-form expressions for supplier and consumer welfare are obtained for the competitive equilibrium in a dynamic stochastic market model. We conclude that the value of wind generation to consumers falls dramatically with volatility: We establish thresholds for the coefficient of variation beyond which the value of wind is questionable.

4 - Strategic Behavior in Power Markets Under Uncertainty

Uday Shanbhag, Asst. Professor, University of Illinois at Urbana Champaign, Urbana, Il, United States of America, udaybag@illinois.edu

We consider a class of stochastic risk-based game-theoretic problems motivated by integrating wind power into power markets. We provide a characterization of the resulting equilibrium problem, which arise from possibly nonsmooth objectives. Additionally, we develop distributed regularization-based projection schemes with error bounds that scale well with problem complexity. Policy insights pertaining to wind power integration are also discussed.

■ MC05

C - Ballroom D5, Level 4

Auctions/Mechanism Design I

Contributed Session

Chair: Diego Klabjan, Associate Professor, Northwestern University, 2145 Sheridan Road Room M239, Evanston, IL, 60208, United States of America, d-klabjan@northwestern.edu

1 - Alternative Pricing for the Day Ahead Electricity Market

Veronica Araoz, PhD Scholar, Norwegian School of Economics and Business Administration, Helleveien 30, Bergen, 5045, Norway, veronica.araoz@nhh.no, Kurt Jornsten

Uniform marginal prices scheme in a pool-based electricity market cannot clear the market. We propose an alternative approach that uses a Semi Lagrangean Relaxation technique and a second price auction. The method proposed accommodates the non-convexities found in this market and provides a shadow price which will be announced for the second price auction. The auction provides the final price for the day-ahead electricity. The demand is fulfilled at minimum cost and generators cover their costs.

2 - Mechanism Choice in Procurement Auctions: An Experiment

Timo Heinrich, University of Duisburg Essen, Universitätsstrafle 12, Essen, 45130, Germany, timo.heinrich@ibes.uni-due.de, Jeannette Brosig

The increasing popularity of procurement auctions begs two questions. First, how can problems of moral hazard be overcome? Second, which market mechanism will become prevalent? We experimentally study the behavior in two types of procurement auctions with moral hazard: price-based and buyer-determined procurement auctions. Our analysis of submitted bids, chosen quality, profits and mechanism choice behavior shows that in line with the empirical observation both auction types can coexist.

3 - Information Aggregation in Prediction Markets

Sasa Pekec, Duke University, Fuqua School of Business, Durham, NC, United States of America, pekec@mail.duke.edu

The main premise and promise of prediction markets is that they successfully aggregate diversely held information. The rules for price formation and market-clearing have an impact on information aggregation. We show that the market price properly aggregates information if and only if (a) the number of realized trades is non-negligible compared to number of market participants and (b) proportion of buyer offers is asymptotically matching the proportion of seller offers.

4 - Auction with Externalities

Jinxiang Pei, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, peipauj@u.northwestern.edu, Fikri Karaesmen, Diego Klabjan

We study a one-shot auction in which a set of equilibria are examined and expected revenues are compared. We also propose a two-stage auction game where we disentangle the standard auction and resale/sharing auction. Both first-price and second-price auction in stage 1 are studied and we characterize the unique perfect Bayesian equilibrium in either case. More importantly, the revenue equivalence between the two auctions holds in our two-stage auction for the initial seller.

■ MC06

C - Ballroom E, Level 4

Tutorial: Fraud Detection in Online Transactions

Cluster: Tutorials
Invited Session

Chair: Carolina Barcenas, PayPal, cbarcenas@paypal.com

1 - Fraud Detection in Online Transactions
Carolina Barcenas, PayPal, cbarcenas@paypal.com

With the advent of the Internet, e-commerce has seen significant growth of financial transactions and has connected sellers with potential buyers. Merchants can now do business with people living in countries all over the world. The additional freedom to conduct business quickly and globally gives rises to novel risks. "Bad" buyers hide amongst "good" buyers. Legitimate merchants and "scammers" all try to take advantage of the aforementioned new business paradigms. In this talk we will review some of the analytical techniques used to minimize the risk involved in online transactions. We will also review the modus operandi of online fraudsters and describe how we can combat them both with technology and mathematical analysis widely used in operations research and data mining.

■ MC07

C - Ballroom F & G, Level 4

Tutorial: Mathematical Approaches to Infectious Disease Prediction and Control

Cluster: Tutorials
Invited Session

Chair: Lauren Meyers, University of Texas at Austin, 1 University Station C0930, Austin, TX, United States of America, laurenmeyers@mail.utexas.edu

Co-Chair: Nedialko Dimitrov, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States of America, ned@alumni.cs.utexas.edu

1 - Mathematical Approaches to Infectious Disease Prediction and Control
Nedialko Dimitrov, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States of America, ned@alumni.cs.utexas.edu, Lauren Meyers

Mathematics has long been an important tool for understanding and controlling the spread of infectious diseases. Here, we begin with an overview of compartmental models, the traditional approach to modeling infectious disease dynamics, and then introduce contact network epidemiology, a relatively new approach that applies bond percolation on random graphs to model the spread of infectious disease through heterogeneous populations. As we illustrate, these methods can be used to address public health challenges and have recently been coupled with powerful computational methods to optimize epidemic control strategies.

■ MC08

C - Room 11A, Level 4

Competitive Location

Sponsor: Location Analysis
Sponsored Session

Chair: Tammy Drezner, Professor, California State University, Fullerton, 800 State College Blvd., Fullerton, CA, 92834, United States of America, tdrezner@Exchange.Fullerton.edu

1 - Strategic Competitive Location: Improving Existing Facilities and Establishing New Ones
Pawel Kalczynski, Professor, Cal State Fullerton, P.O. Box 6848, Fullerton, CA, 92834, United States of America, pkalczynski@fullerton.edu, Tammy Drezner, Zvi Drezner

Competitive facility location models consider two main strategies for increasing the market share captured by one's chain subject to a budget constraint. One strategy is the improvement of existing facilities attractiveness. The second strategy is the construction of new facilities. We consider these two strategies as well as a third joint strategy which is a combination of the two.

2 - Optimizing Access: A Network/Facility Location Design Problem
Rick Church, Professor, University of California, Santa Barbara, Department of Geography, Santa Barbara, CA, 93106-4060, United States of America, church@geog.ucsb.edu

This paper presents a specially defined network design/facility location problem in order to improve access to facilities across an urban area. It is based upon the relative access measure proposed by Church and Marston (2003). We present a model, an application to a small region, and discuss future needs for this type of model.

3 - Using Decomposition to Solve a Stochastic Facility Location/Fleet Management Problem
Mohammad M. Fazel-Zarandi, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, m.fazelzarandi@utoronto.ca, J. Christopher Beck, Oded Berman

We address a stochastic facility location and vehicle assignment problem in the presence of random travel times. The different travel time conditions are presented as different scenarios with known probabilities. We present a stochastic programming model based on a bounded penalty approach in which the expected recourse cost cannot exceed a given threshold. To solve the problem, logic-based Benders' decomposition models are proposed.

4 - Hospital Location - A Comparison of Reality and Optimized Locations
Ha Eiselt, Professor, University of New Brunswick, P.O. Box 4400, Fredericton, NB, E3B 5A3, Canada, haeiselt@unb.ca, Joy Bhadury, Mark L. Burkey

This research compares the locations of existing hospitals with the optimized locations in different regions. The optimized locations are determined by standard p-medians, as well as those that allow coverage of a percentage of the population. The results indicate the both the present level of service and the potential for improvement.

■ MC09

C - Room 11B, Level 4

Operations Economics: Dynamic Models

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Gabriel Weintraub, Columbia Business School, New York, NY, United States of America, gyw2105@columbia.edu

Co-Chair: Gad Allon, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu

1 - Social Norms in Queues
Gad Allon, Northwestern University, 2001 Sheridan Road, 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 - Dynamic Inventory Competition with Stockout-Based Substitution
Tava Olsen, Professor, University of Auckland, Business School, Private Bag 92019, Auckland, 1142, New Zealand, t.olsen@auckland.ac.nz, Rodney Parker

We examine when there is a commitment value to inventory in a dynamic duopoly under stockout-based substitution. The firms face independent direct demand but some fraction of a firm's lost sales will switch to the other firm. This problem has been previously studied in the stationary infinite horizon (open loop) setting but not in a Markov perfect (closed loop) setting. We give conditions under which the stationary infinite horizon equilibrium is also a Markov perfect equilibrium.

3 - A Two Tiered Dynamic Oligopoly Model
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 "two-tiered" 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 these models.

■ MC10

C - Room 12A, Level 4

Algorithms for Revenue Management Models

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Retsef Levi, Associate Professor of Management, Massachusetts Institute of Technology, Sloan School of Business, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, retsef@mit.edu

1 - Dynamic Pricing and Equilibrium Outcomes

Georgia Perakis, William F. Pounds Professor of Operations Research and Operations Management, Massachusetts Institute of Technology, 50 Memorial Drive, Cambridge, MA, United States of America, georgiap@mit.edu, Vivek Farias, Matthieu Monsch

We consider a market where several firms compete to sell substitutable products to price-sensitive customers. Each firm has a fixed amount of inventory that cannot be replenished. The time horizon is finite and demand is random. This problem arises in many settings: airline revenue management, hotel room bookings, retail with perishable products. The goal of this work is to predict the evolution of such markets: price dynamics, convergence to an equilibrium.

2 - How 'Dynamic' Should Dynamic Pricing Be?

Vivek Farias, Massachusetts Institute of Technology, Sloan School, 50 Memorial Drive, Cambridge, MA, United States of America, vivekf@mit.edu, Yiwei Chen

We develop a simple formula to aid managers in gauging how frequently they might need to revise prices in the context of dynamic pricing. The formula requires a measure of demand volatility and a 'load factor' estimate.

3 - Revenue Management of Reusable Resources with Advanced Reservations

Retsef Levi, Associate Professor of Management, Massachusetts Institute of Technology, Sloan School of Business, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, retsef@mit.edu, Cong Shi

We consider a class of revenue management problems of reusable resources with advanced reservations modeled using the loss network systems. We derive an asymptotic upper bound on the blocking probability in some heavy-traffic limit. In addition, we propose a control policy that we call the class selection policy (CSP) resulted from solving a linear program (LP). We show that the CSP has an asymptotic worst-case performance guarantee of two in the heavy-traffic limit.

■ MC11

C - Room 12B, Level 4

Operations Management and Marketing

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Xuanming Su, Haas School of Business, University of California, Berkeley, CA, 94720, United States of America, xuanming@haas.berkeley.edu

1 - Dynamic versus Static Pricing in the Presence of Strategic Consumers

Pnina Feldman, Haas School of Business, UC Berkeley, 2200 Piedmont Ave, Berkeley, CA, 94720, United States of America, feldman@haas.berkeley.edu, Gerard Cachon

The uncertain nature of demand suggests that firms can benefit from dynamic pricing, where pricing decisions are postponed until information about demand is revealed. Yet, many firms announce prices in advance and do not adjust them as a response to market conditions. This may seem suboptimal when demand is high and the firm can support a higher price. We find that the firm may benefit from static pricing when consumers are strategic and decide whether to visit based on the pricing strategy.

2 - Pricing and Sourcing Strategies for Short Life-Cycle Goods

Victor Martinez de Albeniz, Associate Professor, IESE Business School, Av. Pearson 21, Barcelona, Spain, valbeniz@iese.edu, Eduard Calvo

We consider the problem of a buyer that can source a product from faster or slower suppliers. Because demand is uncertain, using a faster supplier provides the advantage of using a more accurate forecast; however, this usually involves a higher cost. We characterize the optimal sourcing strategy, under single-sourcing and sequential multi-sourcing. In addition, we study the suppliers' competitive dynamics and find the prices that suppliers with different lead-times will quote in equilibrium.

3 - Strategic Customers and Commitments in a Decentralized Supply Chain

Ali Parlakturk, Assistant Professor, University of North Carolina at Chapel Hill, Chapel Hill, United States of America, pturk@unc.edu, Mustafa Onur 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.

4 - Dynamic Pricing with Competition and Strategic Customer Behavior

Xuanming Su, Haas School of Business, University of California, Berkeley, CA, 94720, United States of America, xuanming@haas.berkeley.edu

We study a dynamic pricing problem with competition and strategic customer behavior. We derive equilibrium purchasing and pricing behavior and characterize competitive market outcomes. We also discuss practical implications for firms and customers.

■ MC12

C - Room 13A, Level 4

Sustainable and Responsible Supply Chain Management

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Jose Cruz, Assistant Professor of Operations Manamgement, University of Connecticut, 2100 Hillside Road, Stois, CT, United States of America, Jose.Cruz@business.uconn.edu

1 - Consumer Environmental Awareness and Competition in Two-Stage Supply Chains

Zugang Liu, Assistant Professor of Business Administration, Pennsylvania State University - Hazleton, 76 University Drive, Hazleton, PA, United States of America, zxl23@psu.edu, Jose Cruz, Trisha Woolley

We focuse on the impact of consumers' environmental awareness on supply chains. We consider both the product competition and the retail competition, and use dynamic game models to investigate the interactions between the supply chain players given three supply chain network structures where the types of competition vary with each structure. Our results show how the profitability and the pricing strategy of each player changes at different environmental awareness and competition intensity levels

2 - Collection System Design, Strategy Choice and Financial Incentives for Product Recovery

Fuminori Toyasaki, Assistant Professor, York University, 4700 Keele St., Toronto, ON, M3J 1P3, Canada, toyasaki@yorku.ca, Tamer Boyaci, Rico Wojanowski, Vedat Verter

This paper presents a methodology for selecting collection strategies (drop-off and pick-up) by simultaneously optimizing the service area of each collection facility and the financial incentive provided by the collector. We represent the collection system via a continuous model and use a stochastic utility choice model to incorporate customers' return decisions. This enables us to establish the analytical properties of the optimal collection area and subsidy decisions under each strategy.

3 - Environmental and Cost Synergy in Supply Chain Network Integration in Mergers and Acquisitions

Trisha Woolley, Assistant Professor of Management, Texas Wesleyan University, 1201 Wesleyan Street, Fort Worth, TX, United States of America, twoolley@txwes.edu, Anna Nagurney

We quantify and assess, from a multicriteria decision-making supply chain network perspective, the environmental effects resulting when a merger/acquisition occurs and the resulting synergy from possible strategic gains. We capture the economic activities pre and post the merger and yield the system optima associated with the minimization of total costs and emissions under firm-specific weights. We propose a synergy measure that captures the total generalized cost and provide numerical examples.

4 - Mitigating Global Supply Chain Risks Through Corporate Social Responsibility

Jose Cruz, Assistant Professor of Operations Manamgement, University of Connecticut, 2100 Hillside Road, Stois, CT, United States of America, Jose.Cruz@business.uconn.edu

This paper presents a decision model that captures supply side risks, social risks, and demand side uncertainty within an integrated global supply chain and corporate social responsibility (CSR) framework. The global supply chain decision-makers must decide on the level of investment in CSR activities and the choice of trading partners in order to maximize profit and minimize their overall risk. The results show that CSR activities can potentially be used to mitigate global supply chain risks.

■ MC13

C - Room 13B, Level 4

Information and Coordination

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Neil Geismar, Assistant Professor, Texas A&M University, Mays Business School, College Station, TX, United States of America, NGeismar@mays.tamu.edu

1 - Value of Information to Manage Random Lifetime Products

Michael Ketzenberg, Texas A&M University, Department of Information and Operations Mgmt, 320H Wehner Buidling, College Station, TX, 77843, United States of America, MKetzenberg@mays.tamu.edu, Jacqueline Bloemhof

We address the value of information to manage random lifetime perishables. The lifetime is largely determined by the time/temperature history in a supply chain. With RFID such information is available and therefore so is the product lifetime. We formulate the problem as a Markov decision proces, introduce well performing heuristics of more practical relevance, and evaluate the value of information through an extensive simulation.

2 - Scheduling of Subcontracted Operations: Time Sensitive Capacity Allocation Issues

Tolga Aydinliyim, Assistant Professor of Decision Sciences, University of Oregon, Lundquist College of Business, Eugene, OR, 97403, United States of America, tolga@lcbmail.uoregon.edu, George Vairaktarakis

We study the subcontracting strategies of a manufacturer utilizing processing capacity both in-house and at a third-party common to competing manufacturers. In this setting, a time-sensitive capacity allocation problem arises since every manufacturer balances the in-house production and outsourcing costs, his sensitivity to delay, and the effect of competitors. We compare and contrast centralized and equilibrium schedules, and evaluate the players' performances in each scenario.

3 - Dynamically Adopting the Recommender System for DVD Rentals

Emre Demirezen, Texas A&M University, 320 Wehner Building 4217 TAMU, College Station, TX, United States of America, edemirezen@mays.tamu.edu, Subodha Kumar, Milind Dawande, Vijay Mookerjee

We consider the problem of adopting recommender system for a subscription based DVD rental firm based on the actual demand and return pattern. The goal of these firms is to satisfy the demand of as many customers as possible. Hence, it is important for them to observe the actual inventory status while making the recommendations. We formulate the problem as a mixed-integer program and present an effective heuristic to solve the problem. Based on our results, we provide useful managerial insights.

4 - Analysis of the Product-Line Extension Problem

Liying Mu, student, The University of Texas at Dallas, 800 Custer Rd. Apt 214, Richardson, TX, 75080, United States of America, muliying@student.utdallas.edu, Milind Dawande, Chelliah Sriskandarajah, Srinagesh Gavirneni

We build on the work of Ramdas and Sawhney (2001) to further investigate the operational issue of product-line extension problem. In this paper, we analyze two variants of this problem: one with cardinality constraint and the other with budget constraint. We resolve the complexities of both versions and develop efficient algorithms to obtain near-optimal solutions. Finally, based on a comprehensive test bed of realistic instances, we derive a variety of interesting insights.

■ MC14

C - Room 14, Level 4

Supply Chain Management III

Contributed Session

Chair: Ashok Mittal, Professor, IIT Kanpur, IME Deptt, IIT Kanpur, Kanpur, UP, 208016, India, mittal@iitk.ac.in

1 - Benefit of Demand Signals versus Risk Pooling

Jooyol Maeng, Purdue University, 403 W. State Street, West Lafayette, IN, 47907-2056, United States of America, maengjy@purdue.edu, Ananth Iyer

The company carries inventory of different products for sales in a single-period newsvendor framework. Before demand occurs, it can either choose to use the sales order received to forecast demand or the benefit of risk pooling, ignoring the demand. The paper presents a decision support rule to tell when to use the demand signal versus the pooling benefit to maximize its profit.

2 - A Heuristic Approach for Multi Echelon Supply Chain Networks

Beyza Ahlatcioglu Ozkok, Assistant Professor, Yildiz Technical University, Davutpasa, Istanbul, Turkey, bahlat@yildiz.edu.tr, Mujahid Syed, Panos Pardalos

Multi Echelon Supply Chain Networks (MESCN) can be viewed as a network structure where each node represents a production, assembly or distribution systems. One of the peculiar properties of this network structure is the precedence order among the nodes and their interdependencies. In this study we propose a Multi-objective mathematical model for MESCN and present a heuristic method to solve the problem.

3 - Coordination by Contracts in Decentralized Design Processes in the Automotive Industry

Kerstin Schmidt, Technische Universität Braunschweig, Institute of Automotive Management and Industrial Production, Katharinenstrasse 3, Braunschweig, 38106, Germany, kerstin.schmidt@tu-bs.de, Thomas Volling, Thomas S. Spengler

Design processes in the automotive industry are distributed over various companies. If inappropriate contract structures are used within such collaborations, inefficiencies in the design process occur due to existing uncertainties and differing objectives of the partners. To this end, we analyze fixed price and incentive contracts with regard to their coordination capability and apply them to the case of the compliance of recycling rates in the automotive industry.

4 - Sales Effort Free Riding and Coordination with Price Match and Channel Rebates

Dahai Xing, Oklahoma State University, 84S University PL APT7, Stillwater, OK, 74075, United States of America, dahai.xing@okstate.edu, Tieming Liu

We study a supply chain with one manufacturer and two retail channels, where an online retailer offers a lower price and free-rides a brick-and-mortar retailer's sales effort. The free riding effect reduces brick-and-mortar retailer's desired effort level, thus hurts the manufacturer's profit and the overall supply chain performance. We designed a contract with price match and selective rebate, which coordinates the supply chain with both exogenous and endogenous retail prices.

5 - Role of Third Party Service Provider Procuring One Commodity From a Single Source for Multiple Buyer

Ashok Mittal, Professor, IIT Kanpur, IME Deptt, IIT Kanpur, Kanpur, UP, 208016, India, mittal@iitk.ac.in, Peeyush Mehta, Lokesh Gupta

In this paper, we have analyzed the impact of coordination between different buyers in a cluster,by a 3 PL service provider procuring from a single source. We have identified conditions, in terms of cost (inventory, holding, ordering, transportation, shortages), and truck capacity, where benefits of coordination are high.

■ MC15

C - Room 15, Level 4

Behavior in Inventory Decisions

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Brent Moritz, Assistant Professor, Penn State University, Business Building, State College, PA, United States of America, morit022@umn.edu

1 - Who Controls the Channel? An Experimental Study of Inventory Risk on Supply Chain Performance
Andrew Davis, Penn State University, 462A Business Building, University Park, PA, 16802, United States of America, adavis@psu.edu, Elena Katok

We investigate how supply chain performance is affected by different parties incurring inventory risk. Specifically, we study push, pull, and advance purchase discount (APD) contracts from an experimental standpoint. Our results suggest that a pull contract results in a higher supply chain efficiency compared to a traditional push contract, and that the pull contract's efficiency is equivalent to the efficiency achieved by the coordinating APD contract.

2 - An Experimental Study of Optimal Ordering Behavior with Risk of Supply Disruption
Haresh Gurnani, University of Miami, 417B Jenkins Building, Coral Gables, FL, 33124, United States of America, haresh@miami.edu, Saibal Ray, Yusen Xia, Karthik Ramachandran

Using experiments, we study subjects' order quantities from one reliable and one unreliable supplier facing both full disruption and random yield uncertainties. The paper provides managerial insights into effects of degree of disruption probability of the unreliable supplier and cost differentiation between suppliers on subjects' ordering decisions. We also discuss how these results systematically deviate from the analytical findings in the supply disruption literature.

3 - The Effect of Payment Timing on Inventory Decisions in a Newsvendor Experiment
Jordan Tong, Duke University - The Fuqua School of Business, 1 Towerview Dr., Durham, NC, 27708, United States of America, jordan.tong@duke.edu, Li Chen, Gurhan Kok

We study newsvendor behavior under three payment schemes with identical net cost structures but different payment timing - the newsvendor, supplier, or customer pays for the newsvendor's order at time of purchase. We find that order quantities are highest under newsvendor financing but lowest under customer financing. We provide a model of mental accounting consistent with this behavior, contrast it with a discounted utility model, and test its robustness over high and low profit margins.

4 - Asymmetric Ordering Behavior in Newsvendor Decisions: Cognitive Dissonance and Customer Service
Brent Moritz, Assistant Professor, Penn State University, Business Building, State College, PA, United States of America, morit022@umn.edu, Karen Donohue, Arthur V. Hill

When solving a newsvendor problem, prior research shows that individuals tend to order too much in a low margin setting and too little in a high margin setting. However, ordering behavior is asymmetric relative to the mean of the demand distribution. This experimental research finds that cognitive dissonance surrounding customer service expectations differs by margin condition, and such dissonance explains a portion of the observed asymmetry in ordering behavior.

■ MC16

C - Room 16A, Level 4

Production and Scheduling I

Contributed Session

Chair: Mesut Yavuz, Shenandoah University, 1460 University Dr., Winchester, VA, 22601, United States of America, myavuz@su.edu

1 - Periodic Machine Rentals in a MTO System Under a Lead Time Performance Constraint
Cagdas Buyukkaramikli, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600MB, Netherlands, N.C.Buyukkaramikli@tue.nl

We analyze a MTO production system which consists of parallel machines.The system faces Poisson demand and operates under a service level that restricts the percentage of late orders.At the start of each period,if the workload is below a level,a part of the machines are rented out,with a price per time decreasing with the period length.We have shown that periodic hiring option increases the initial investment for the machines, but may bring substantial benefits under some market conditions.

2 - Optimal Production When the Demand is Stochastic
Abel Cadenillas, Professor, University of Alberta, Dept of Mathematical Sciences, University of Alberta, Edmonton, AB, T6G 2G1, Canada, acadenil@math.ualberta.ca, Peter Lakner, Michael Pinedo

We assume that the demand for a product is stochastic. There is a running cost associated with the difference between the inventory level and a given target. Besides, there is a running cost associated with the difference between the production level and a given production target. We obtain explicitly the optimal production policy. We solve this problem by applying the theory of classical stochastic control.

3 - A Realistic Capacitated Lot Sizing Problem: Solution Technique and Strong, Weak, Hybrid Formulations
Mayank Verma, PhD Scholar, Indian Institute of Technology Kanpur, Dept of Industrial & Management Engg., IIT Kanpur, Kanpur, 208016, India, mayankverma.p@gmail.com, RRK Sharma

We attempt to solve capacitated lot sizing problem with considerations of dynamic demand,backorders and setup times.This problem is formulated as classical and two types of transportation formulations and based on the strength of bounds we earmark them as strong and weak formulations.We propose hybrid formulation which is the best performer for large sized problems.With the use of bounded variable linear programs,we propose a solution technique which performs better than the commercial solvers.

4 - A Hybrid Greedy Algorithm for the Car Sequencing Problem
Hui Sun, Southeast University, School of Mechanical Engineering, Nanjing, 211189, China, hui.sun@seu.edu.cn

A hybrid heuristic combining the greedy algorithm with the ant colony algorithm is proposed to solve the car sequencing problem. The objective is to minimize the number of violations of assembly rules including cross-ratio constraints. The car to be added to the end of the assembly line is determined by using the pheromone and heuristic information. Computational studies are conducted to demonstrate the effectiveness and efficiency of this proposed algorithm.

5 - Due Date Determination for Smooth Production
Mesut Yavuz, Shenandoah University, 1460 University Dr., Winchester, VA, 22601, United States of America, myavuz@su.edu

We present a production smoothing problem arising in the construction industry. For each order, the company has to determine the due dates of 2 to 5 shipments for multiple stages of a construction project. The customer provides a time window for the first due date and specifies the differences between subsequent ones. Orders have different processing time and material requirements, which are desired to be level. We develop a new production smoothing model and a heuristic method for its solution.

■ MC17

C - Room 16B, Level 4

Operation Research in the Chemical Industry

Cluster: Practice of OR/MS
Invited Session

Chair: Jee Park, Senior Engineer, Dow Chemical Company, B1603, Egineering Science, 2301 North Brazosport Blvd., Freeport, TX, 77541, United States of America, JHPark3@dow.com

1 - Extending the Resource Task Network for Industrial Applications
John Wassick, Fellow, Dow Chemical Company, 1776/A13, Midland, MI, 48674, United States of America, JMWassick@dow.com, Jeff Ferrio

This talk presents several extensions to the discrete time resource-task network (RTN) model that have been utilized at The Dow Chemical Company for scheduling optimization problems. Modifications are proposed that allow tasks to interact not just with resources, but also with the bounds on those resources. The concept of multiple extents is introduced to extend the functionality of a task. An alternative formulation of the RTN is also introduced in spatial rather than temporal coordinates.

2 - Use of Simulation as a Decision-Making Tool at the Dow Chemical Company
Naoko Akiya, Research Scientist, The Dow Chemical Company, B-1603, 2301 North Brazosport Blvd., Freeport, TX, 77541, United States of America, NAkiya@dow.com, Scott Bury, Jee Park, Bikram Sharda

Discrete event simulation is used as a tool to support decision making by various businesses in The Dow Chemical Company in the areas of manufacturing, supply chain, and logistics. This presentation will describe the types of decisions supported, our approach for model design and development, several example applications, and challenges that we face.

3 - A Real Time Optimization Application for Process Industries
Ming Fang, AIMMS Specialist, Paragon Decision Technology Inc, 5400 Carillon Point, Kirkland, WA, 98033, United States of America, m.fang@aimms.com, Vijay Hanagandi, Paul Miller

Variation of external factors such as ambient temperature, demand quantities, and etc in process industry requires constant process monitoring and process adjustment in real time. To assist an operator run the plants in a least coast manner, Optimal Solutions Inc. incorporated with rich modeling features in AIMMS, developed a Real Time Optimization (RTO) application that entails gathering of process data in real time, and providing solution to the process adjustments in real time.

4 - Production Capability Assessment - Fundamentals and Applications
Jee Park, Senior Engineer, Dow Chemical Company, B1603, Egineering Science, 2301 North Brazosport Blvd., Freeport, TX, 77541, United States of America, JHPark3@dow.com, Naoko Akiya

One of issues in the analysis of manufacturing system is how the failure modes and process rates impact on the production yield. Discrete-event simulation, which is mostly used in this purpose, requires heavy efforts with the experts. The analytical model that estimates production capability by updating downstream downtimes with WIP levels, process rates and reliability is developed. This approach can be used in optimization framework and various analysis.

■ MC18

C - Room 17A, Level 4

Modeling Languages I

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Michael Bussieck, GAMS Development Corp., 1217 Potomac St. NW, Washington, DC, 20007, United States of America, mbussieck@gams.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Stochastic Optimization: Recent Enhancements in Algebraic Modeling Systems
Michael Bussieck, GAMS Development Corp., 1217 Potomac St. NW, Washington, DC, 20007, United States of America, mbussieck@gams.com

With all the uncertainty in data there is considerable demand for stochastic optimization (SO) in operational, tactical and strategically planning. Nevertheless, there exist a fairly small number of commercial applications building on SO techniques. After a decade without much progress on the software side, modeling system providers have recently entered the second round of providing support for SO. We will review the different concepts emphasizing on recent enhancements in the GAMS system.

2 - The Network Elucidation Template (NET)
Leo Lopes, Monash University Maths, Australia, leo.lopes@monash.edu, Victor Foulk, Jay Konieczka, Parker Antin

NET is a framework for evolving complex models interactively by solving large numbers of simple models, extracting information from those models, presenting that information to domain experts, then incorporating their feedback into search algorithms. The first application of NET uses min cost flow models to elucidate patterns of illicit material transshipment using partial information.

3 - Remote Optimization using AIMMS
Peter Nieuwesteeg, Senior AIMMS Specialist, AIMMS (Paragon Decision Technology), 5400 Carillon Point, Kirkland, WA, 98033, United States of America, p.nieuwesteeg@aimms.com

Did you ever wish that you could solve your time-consuming optimization model on that powerful server? The AIMMS Publishing and Remote Optimization framework makes it easy to solve your models remotely, as it will take care of all the computer-to-computer communication. In this presentation with demo, we will show you what modification you need to make to your existing AIMMS model and how you can solve that model on another computer without any IT knowledge.

■ MC19

C - Room 17B, Level 4

Miscellaneous Topics in Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Wei Ke, Novantas, 485 Lexington Ave, 20th Fl, New York, NY, 10017, United States of America, wke@novantas.com

1 - Optimal Pricing and Capacity Strategies in Dual Channel Revenue Management
Yaozhong Wu, Assistant Professor, National University of Singapore, 15 Kent Ridge Drive, Singapore, Singapore, bizwyz@nus.edu.sg, Qian Liu

We study a dual channel revenue management problem in which a firm manages a direct sales channel and an independent retail channel. We analyze the firm's optimal pricing and capacity decisions whose impacts on demand are captured through a consumer choice model. Our results suggest optimal revenue management policies in different channel structures.

2 - Dynamic Pricing and Price Communication Strategies Under Sticker Shock
Wei Ke, Novantas, 485 Lexington Ave, 20th Fl, New York, NY, 10017, United States of America, wke@novantas.com, Garrett Van Ryzin

We consider an extension on the work by Popescu and Wu (2006), who formulated a dynamic pricing problem of a monopolist firm facing demand that was sensitive to a consumer's memory and the firm's pricing history. They showed that consumers should perceive monotonic prices under the optimal pricing policy. Our extension separates the effect of price communications from price changes. We investigate the conditions under which the pricing path converges to a steady state or ends up in cycles.

3 - Modeling Demand for Retail Revenue Management
Loren Williams, Executive VP and Chief Scientist, Predictix, Two Midtown Plaza, 1349 W. Peachtree Street, Suite #1880, Atlanta, GA, 30309, United States of America, loren.williams@predictix.com

Managing revenue in a retail setting requires modeling consumer demand as a function of the management instruments available to retailers including regular price, assortment range and prices, and presentation intensity. This talk proposes an integrated demand model suitable for use in jointly optimizing these decisions and provides some evidence of the marginal gains available to retailers that are able to adopt a wholistic revenue management process.

4 - B2B Pricing Analytics: A Hierarchical Approach
Haining Yu, Sr. Operations Research Analyst, Walt Disney Parks & Resorts, 1375 Buena Vista Drive, Lake Buena Vista, FL, 32830, United States of America, haining.yu@disney.com, Hai Chu

We study pricing strategies for firms operating under business-to-business(B2B) environment. B2B firms face unique pricing challenges: fast-changing demand and inventory profile, highly negotiated pricing environment, considerable bargaining power by business customers, and extensive bundling. Motivated by such challenges, we present a hierarchical B2B pricing framework using simulation and optimization methodologies, focusing on list pricing and deal pricing models.

■ MC20

C - Room 18A, Level 4

Stochastic Approximation and Online Learning in Dynamic Pricing and Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Jeff McGill, Professor, Queen's University, Queen's School of Business, 143 Union Street, Kingston, ON, K7L3N6, Canada, jmcgill@business.queensu.ca

1 - Stochastic Approximation to Find Bid-Prices for Joint Overbooking and Capacity Allocation
Huseyin Topaloglu, Associate Professor, Cornell University, School of OR&IE, Ithaca, United States of America, ht88@cornell.edu, Sumit Kunnumkal

We develop a stochastic approximation algorithm to find good bid-price policies for the joint capacity allocation and overbooking problem over an airline network. Our approach visualizes the total expected profit as a function of the bid-prices and searches for a good set of bid-prices by using stochastic gradients. We show that the iterates of our stochastic approximation algorithm converge to a stationary point of the total expected profit function with probability 1.

2 - Improved Bid Prices for Choice-Based Network Revenue Management

Joern Meissner, Dr., Lancaster University Management School, Department of Management Science, www.meiss.com, Lancaster, LA14YX, United Kingdom, joe@meiss.com, Arne Strauss

In many implemented network revenue management systems, a bid price control is being used. We propose a simple and fast heuristic that iteratively improves on an initial bid price vector. We demonstrate that using dynamic marginal capacity values directly as bid prices can lead to significant revenue loss as compared to using our heuristic. We investigate numerically how much revenue performance is lost due to the confinement of product combinations that can be represented by a bid price.

3 - Adaptive Critics for Airline Revenue Management

Abhijit Gosavi, Missouri University of Science and Technology, 219 Engineering Management, Rolla, MO, 65409, United States of America, gosavia@mst.edu, Ketaki Kulkarni, Katie Grantham

We present the application of the adaptive (or actor) critic algorithm for solving a revenue management problem arising in airlines. The classical actor-critic based on approximate dynamic programming is for Markov control. We present a version for semi-Markov control over an infinite time horizon, which can be adapted for the booking control problem encountered in revenue management. We also present numerical results on a single-leg problem.

4 - Optimal Pricing using the Knowledge Gradient

Emre Barut, Princeton University, Sherrerd Hall, Princeton, United States of America, abarut@princeton.edu, Warren Powell

Finding the best price often requires experimenting, given that the response of the market is impossible to quantify precisely. We model the revenue using a logit demand model. We then use the knowledge gradient adapted to online applications to experiment with prices so that we learn the demand function as quickly as possible, while balancing the revenue we receive now against the value of the information we can acquire.

■ MC21

C - Room 18B, Level 4

Sustainable Energy Services

Sponsor: Service Science
Sponsored Session

Chair: Trevor Hale, Associate Professor, University of Houston - Downtown, One Main Street, Houston, TX, 77002, United States of America, halet@uhd.edu

1 - Energy Arbitrage and Carbon Footprint Reduction with Grid-energy-storage Systems: An Initial Study

Trevor Hale, Associate Professor, University of Houston - Downtown, One Main Street, Houston, TX, 77002, United States of America, halet@uhd.edu, Kelly Weeks, Coleman Tucker

This effort presents a model for grid energy arbitrage integrating time-of-use (TOU) kilowatt-hour tariff rate schedules with relatively small (1-100 MWh capacity) grid-energy-storage (GES) systems. The specific questions under investigation are as follows: Is it economically sound to invest in a GES system and is the system at least carbon footprint neutral? This research will show that when such systems are managed judiciously, the answer to both questions is in the affirmative.

2 - Planning and Control of a Virtual Power Plant Consiting of a Large Set of Domestic Houses

Johann Hurink, University of Twente, P.O. Box 217, Enschede, Netherlands, j.l.hurink@utwente.nl

To improve the energy efficiency and sustainability of electricity supply, during the last years new technologies have been developed. However, using them uncontrolled may waste parts of their potentials and may result in an instable grid. We present a general concept for planning and control of a large fleet of houses allowing the fleet to act as a VPP. Based on this, a three-step optimization methodology is proposed using offline prediction and global planning and online scheduling.

3 - Multi-objective Optimization for Transportation Problem Incorporating CO2 Emission Levels

Takashi Irohara, Professor, Sophia University, 7-1 Kioi-cho, Chiyoda-ku, Tokyo, 102-8554, Japan, irohara@sophia.ac.jp, Yudong Xue

The purpose of this study is to minimize both the transportation cost and CO2 emission during the transportation from oversea production base to domestic demand bases. In this study, Carrier choice, less-than carrier load and domestic transportation are considered as the three target areas. The model was formulated as multi-objective optimization problem, which is solved by genetic algorithm.

4 - Interdependency Modeling as a Tool for Analyzing Resource Sustainability

Zachary Walchuk, University of Oklahoma, 320 W Duffy St., Norman, OK, 73069, United States of America, zwalchuk@hickorytech.net, Kash Barker

As available supplies of high-demand resources such as oil and clean water begin to decrease, a variety of immediate and secondary effects will be seen in the economy. The Inoperability Input- Output Model can be used to model shortages in resource production and examine which interconnected industries will be most impacted. The model will allow decision makers to design systems which remain sustainable even as key resources are lost. Case studies illustrate the model's usefulness.

■ MC22

C - Room 18C, Level 4

Smart Energy and Utility Service - Smart Grids - Modeling and Optimization

Sponsor: Service Science
Sponsored Session

Chair: Wenjun Yin, Dr., IBM Research - China, Diamond building, ZGC Software Park, 8 Dongbeiwang West Road, Beijing, 100193, China, yinwenj@cn.ibm.com

1 - Building Engineered Complex System for Human Decision Making in the US Smart Grid

Moeed Haghnevis, Graduate Research Associate, Industrial Engineering PhD, Arizona State University, School of Computing, Informatics, and Decision Systems Engineering, 1249E., Spence Ave., Apt# 336, Tempe, AZ, United States of America, mhaghnev@asu.edu, Ronald G. Askin

In this research, an integrated method is developed to study emergent behavior and consequences of evolution and adaptation in complex systems. A descriptive model is developed to calibrate current structure of such systems and predict their future patterns. This study examines complexities in the structure of a decision network and behavior of characters as a result of connections and in correlation with the environment. The US Smart Grid demonstrates the applicability of the modeling approach.

2 - A Smart Load Shifting (SLS) Model Based on Time-pieces Topology Analysis

Jun Luo, IBM, Diamond,ZhongGuanCun Software Park, BeiJing, 100193, China, junluo04@gmail.com, XingBo Zhang, Wenjun Yin, XinJie Lv, Jin Dong, Hairong Lv

Dispatcher in power grid companies establishes power load transfer path based on overhaul plan to increase operational efficiency and keep the electricity sales level. Because of the dynamic, complex topology and numerous overhaul tasks, it's difficult to optimize the path. Through topology analysis on time pieces, Smart Load Shifting model based on GAs is proposed to find out the optimized load transfer path. The practice shows it operates effectively in a Chinese leading power company.

3 - An Optimization Model of Microgrid System

Ming-Che Hu, Assistant Professor, National Taiwan University, No 1, Sec 4, Roosevelt Rd, Taipei, 10617, Taiwan - ROC, mchu@ntu.edu.tw

This research formulates an optimization model to analyze microgrid system. In the model, microgrids provide energy locally and integrate distributed power generators and local renewable energy. Without long distance transmission, microgrids provide more stable power supply and higher reliability than the national power grid. Microgrids are able to improve energy utilization efficiency, take advantage of waste heat, and make greenhouse gas emissions reduction.

4 - Smart Micro Grid Energy Management System Integrated with Renewable Energies

Wenjun Yin, Dr., IBM Research - China, Diamond building, ZGC Software Park, 8 Dongbeiwang West Road, Beijing, 100193, China, yinwenj@cn.ibm.com

This paper describes an Advanced Micro Grid Energy Management System based on Analytics and Optimization technologies. It is composed of generation, storage and load systems. This smart system includes high-resolution weather forecasting, wind/solar power forecast, energy storage optimization, unit commitment, Electric Vehicle charging, load control, etc. We built a real-world simulation environment to enable better usage of renewable energy and load shifting performance.

■ MC23

C - Room 18D, Level 4

Risk Management in Services

Sponsor: Service Science
Sponsored Session

Chair: Victor Tang, Research, Massachusetts Institute of Technology, 55 Deerfield Lane South, Plesantville, MA, 10570, United States of America, victang@alum.mit.edu

1 - Stability of the Design of Experiments for Services
Genady Grabanik, Asst Professor, Department of Math and, Computer Science, Queens, NY, United States of America, genadyg@gmail.com, Larisa Shwartz, Yefim Haim Michlin

In the paper we explain how to design an experiment (DOE) for the service processes based on comparison estimation. The paper introduces SPRT test for the comparison estimation and analyzes the stability of the DOE under uncertainty due to variation in the input of the service. In addition we study the impact of the restricted SPRT on stability.

2 - Risk and Service Deployment Planning
Larisa Shwartz, Researcher, IBM T.J. Watson Research Center, 19 Skyline Dr, Hawthorne, NY, United States of America, lshwart@us.ibm.com, Genady Grabanik

The paper discusses the effects of uncertainty on managing business processes which have dependencies on common human and computing resources. We estimate resources required to maintain a given level of risk and a number of processes which may be hosted by available resources under given level of risk. Research presented in this paper addresses a number of scenarios. The examples include management on demand process deployments and Event processes management for the Business Continuity provider.

3 - The Effects of Cost Structure on Dynamic Server Allocation Policies in Service Centers
Hoda Parvin, 1205 Beal Ave, Ann Arbor, MI, 48105, United States of America, hoda@umich.edu, Matthew Philson, Mark Van Oyen

Despite much research on how to properly staff and operate service centers, the impact on efficiency of individual system factors such as cost structure and deadlines is not clear. We analyzed these effects and developed a new routing/scheduling algorithm. A simulation model using real-world data was used to test the results.

4 - The Vertical Integration Evolution of Sustainability Focused Companies
Kingsley Reeves, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, ozan79@gmail.com, Ozan Ozcan, Fethullah Caliskan

In this study, firstly, we compared the recently developed vertical integration measurement methods and selected the most accurate one. Secondly, we measured the vertical integration level of sustainability focused companies (SFCs) and compare this with their non-sustainability-focused competitors and found that in some industries SFCs are more vertically integrated than their counterparts. Finally, we measured and observed the organization-structure evolution of SFCs over a period of time.

■ MC24

C - Room 19A, Level 4

Simulation Modeling For Disaster Response

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Susan Heath, Naval Postgraduate School, 555 Dyer Road IN-233, Monterey, CA, 93943, United States of America, skheath@nps.edu

1 - Framing the Topic of Mass Casualty Disaster Response "Simulation Modeling"
Susan Heath, Naval Postgraduate School, 555 Dyer Road IN-233, Monterey, CA, 93943, United States of America, skheath@nps.edu

The topic of, and challenges related to, simulation modeling for mass casualty disaster response (MCDR) situations will be discussed. Key definitions will be given, characteristics of MCDR situations will be identified and described, and requirements for software will be specified. A discussion of discrete-event, agent-based, and system dynamics simulation paradigms relative to MCDR simulation modeling will be included. Implications and opportunities for research in this area will be discussed.

2 - Developing Agent Based Simulations of Emergency Response From GIS Data
Yu Wang, PhD Candidate, University of Pittsburgh, 3700 O'Hara St., Pittsburgh, PA, 15261, United States of America, yuw9@pitt.edu, Louis Luangkesorn

To evaluate policies for emergency response it is useful to model scenarios using agent-based simulation (ABS). After an ABS model is built for a given locale, analysts and managers must analyse and interpret the results. We develop a means to build an agent-based simulation of an arbitrary city based on Geographic Information System data. We then apply ranking and selection methods to the ABS model to assist in evaluating policies for a range of different scenarios.

3 - A Training and Research Simulator for Emergency Management
Greg Madey, University of Notre Dame, 384 Fitzpatrick Hall, College of Engineering, Notre Dame, IN, 46556, United States of America, gmadey@nd.edu, Michael Prietula, Cynthia Nikolai, Irma Becerra-Fernandez

We describe recent work on a socio-cognitive-technical training simulator for upper level emergency managers and a tool for cognitive scientists to study the decision making process under emergency conditions. In particular, we describe how the underlying architecture accommodates the various learning requirements inherent in a dynamic, evolving, and unique organizational structure situated in a highly variable complex threat environment.

4 - Data Farming and Disaster Response
Gary Horne, Research Professor, Naval Postgraduate School, 4924 Andrea Avenue, Annandale, VA, 22003, United States of America, gehorne@nps.edu, Ted Meyer

Data farming uses simulation modeling, high performance computing, experimental design, and analysis to examine questions of interest with large possibility spaces. This method allows for the examination of whole landscapes of potential outcomes and provides the capability of executing enough experiments so that outliers might be captured and examined for insights. This presentation will illustrate data farming in the context of application to questions inherent in disaster response scenarios.

■ MC25

C - Room 19B, Level 4

OR For the Public Interest

Cluster: Public Policy
Invited Session

Chair: Thomas Sharkey, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St., Troy, NY, United States of America, sharkt@rpi.edu

1 - Restoring Infrastructure Systems: An Integrated Network Design and Scheduling Problem
Thomas Sharkey, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St., Troy, NY, United States of America, sharkt@rpi.edu, Sarah Nurre, Burak Cavdaroglu, William Wallace, John Mitchell

We consider a novel integrated network design and scheduling problem that can help formulate efforts to restore services provided by civil infrastructure systems after an extreme event disrupts them. Our model and new optimization methods are tested on realistic data representing the infrastructure systems of Manhattan and New Hanover County, North Carolina.

2 - Game Theory or Not Game Theory? - Robustness of Hybrid Defense Resource Allocations
Xiaojun Shan, PhD Student, University at Buffalo, SUNY, 435 Bell Hall, Buffalo, United States of America, xshan@buffalo.edu, Jun Zhuang

The applicability of game theory to homeland security has been questioned, due to its strong assumption about rationality. Our work shows that defensive resource allocations based on game theory is much more "robust" or "conservative" (in the sense of incurring less expected loss) than the ones based on non-game theory.

3 - A Newsvendor Model with Pricing for Public Interest Goods
Gal Raz, Associate Professor of Business Administration, University of Virginia, Darden School of Business, 100 Darden Blvd., Charlottesville, VA, 22903, United States of America, razg@darden.virginia.edu, Anton Ovchinnikov

Supplying public interest goods (safety products, energy efficient appliances, health-related products, etc) is a process that includes three players: the firm that manufactures the good, the consumers who buy it and the government that can intervene by imposing rules and regulations in order to increase social welfare. We study this supply chain using a newsvendor model with pricing from the perspective of the social planner, and examine possible government actions and their implications.

4 - Multiple Defensive Resource Allocation Games
Noam Goldberg, Faculty of Industrial Eng. & Mgt., The Technion, Haifa Israel, 32000, noam.goldberg@gmail.com, Uriel Rothblum, Boaz Golany

We consider two player games where an attacker considers attacking a set of possible targets, and a defender seeks to allocate scarce resources to defend these targets. The expected damage to each target decreases in the amount of defensive resources that are allocated to it. We compute Nash equilibria for a zero-sum version of the game and discuss properties of the defender's strategy in equilibrium. We then consider a nonzero-sum extension of the game and compute its Nash equilibria in some cases.

■ MC26

C - Room 4A, Level 3

Mining Data Streams

Sponsor: Data Mining
Sponsored Session

Chair: Errol Caby, Principal Member of Technical Staff, AT&T Labs, 180 Park Ave, Florham Park, United States of America, ecaby@research.att.com

1 - Mining Port-level IP Data
Errol Caby, Principal Member of Technical Staff, AT&T Labs, 180 Park Ave, Florham Park, United States of America, ecaby@research.att.com

In this paper, we look at and resolve some issues involved in analyzing IP traffic at the port level. For example, we develop a mapping between alternative ways of measuring circuit utilization and describe a method of normalizing utilization to accommodate changes in bandwidth. We also prescribe a class of patterns that is suited to analyzing utilization for a large number of circuits in a dynamic environment.

2 - Online Learning of Domain Drifting Stream by Relevance Vector Machine Regression
Seung-kyung Lee, Seoul National University, Seoul, Korea, Republic of, sklee83@snu.ac.kr, Sungzoon Cho

In many practical environments for supervised learning, observations are updated continuously, forming an open-ended stream. In addition, future observations and their target values may come from different domains or functions from the historical ones. We propose an online relevance vector machine learning based on Kalman filter. The preliminary experimental results showed that the proposed approach dealt with stability-plasticity dilemma better than two adaptive k-nearest neighbor approaches.

3 - Knowledge Discovery From Papers: Building a Survey using Data Mining
Richard Weber, Universidad de Chile, Republica 701, Santiago, Chile, rweber@dii.uchile.cl, Gastón L'Huillier

Building a research survey is a challenging task, especially when hundreds of papers must be considered. Text mining has been applied to summarize information in order to extract relevant knowledge from different documental sources. We present a novel approach using topic modeling to build surveys. Results from a real survey on data mining applications are shown.

4 - Free-Text Keystroke Dynamics Authentication using Reduced Features Based on PC Keyboard
Sunghoon Park, PhD Student, Seoul National University, Seoul, Korea, Republic of, shpark82@snu.ac.kr, Jooseoung Park, Sungzoon Cho

Free-text keystroke dynamics analysis allows one to authenticate a user typing random texts. As classification features, digraphs or trigraphs of key combinations are generally used. But this approach has some problems because of its high dimensionality. We suggest use of a significantly fewer features; movement time among left-hand-key set, right-hand-key set, and spacebar. Our preliminary experimental results suggest that these three features are more efficient on keyboard.

5 - A Rule-based Classifying Framework with Minimum Redundancy
Houtao Deng, Research Associate, Arizona State University, Apt 16 East Orange Street 1020, Tempe, AZ, 85281, United States of America, hdeng3@asu.edu, Eugene Tuv, George Runger

Rule-based classifiers are comprehensive used due to its high interpretability and accuracy. This talk presents a new framework for selecting a minimum number of relevant rules and organizing the selected rules into a classifier. The experiments show that a classifier under this framework has much smaller number of rules than C4.5, but has higher accuracy.

■ MC27

C - Room 4B, Level 3

Understanding and Improving Organizational Processes

Sponsor: Organization Science
Sponsored Session

Chair: Joseph Broschak, Associate Professor, Management/Organizations, University of Arizona, McClelland Hall 405, Tucson, AZ, United States of America, broschak@email.arizona.edu

1 - Using Cross Understanding to Improve Design of Organizational Processes
George Huber, Professor Emeritus, University of Texas at Austin, McCombs School of Business, 1 University Station, B6300, Austin, TX, 78712, United States of America, George.Huber@mccombs.utexas.edu, Kyle Lewis

Organizational processes are designed by groups. Cross understanding (CU) theory (AMR, 35[1]) has dealt the effects of CU on group learning and on the quality of the group's product (i.e., the design of the organizational process). This paper examines the effects of CU on additional outcomes important to managers of organizational processes: (1) time taken to design the organizational process, (2) probability that the group stalemates, and (3) ability of the group to function in the future.

2 - Inter Organizational Arrangements, Supplier Trust, and Supply Chain Effectiveness
Anupam Agrawal, University of Illinois at Urbana-Champaign, Wohlers Hall, Champaign, IL, 61820, United States of America, anupam@illinois.edu

We focus on the linkages between the organizational structure of a buying firm, its relationships with its suppliers, and the resultant incoming quality of components. Current results show that a streamlined supplier improvement structure, focused on sustained investment of resources in supplier quality, can help bring significant benefits via (a) higher quality of incoming components and (b) increased supplier trust with the buyer firm.

3 - The Organization of Care Delivery in Practices with Electronic Medical Records
Julia Adler-Milstein, Harvard Business School, Wyss Hall, Boston, MA, 02163, United States of America, jadlermilstein@hbs.edu, Rob Huckman

Spurred by new Federal incentives, the health care industry is poised for a large increase in IT adoption. Evidence from other industries points to the need for complementary changes to increase productivity. We hypothesized that, in health care, greater delegation and intensity of IT use increase productivity. We also hypothesized how these may serve as complements or substitutes. Using panel data from 42 practices that adopted electronic medical records we find support for our hypotheses.

4 - Temporary Organizations and the Strategic Relevance of Knowledge Exchange Processes
Arnd Goerner, Research Assistant, EBS Business School, Strascheg Institute for Innovation, Rheingaustrafle 1, Oestrich-Winkel, 65375, Germany, arnd.goerner@ebs-siie.de, Matthias Tyssen

This paper investigates the process for leveraging and transmitting relevant knowledge within firms in the context of temporary organizations. It explores formal and informal ways of exchanging knowledge between (1) the line organization and (2) temporary organizations. Characteristics of relevant knowledge and its effective use are identified. Attention is drawn to executives' capability for guiding and improving these processes.

■ MC28

C - Room 4C, Level 3

Multivariate Methods for Manufacturing Process Improvement

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jian Liu, Assistant Professor, The University of Arizona, Engineering Bldg, Rm268, 1127 E. James E. Rogers Way, Tucson, AZ, 85741, United States of America

Co-Chair: Wezhen Huang, University of Massachusetts Dartmouth, 285 Old Westport Rd., North Dartmouth, MA, 02747, United States of America, whuang@umassd.edu

1 - Discovering Nonlinear Variation Patterns in Complex Data Sets
Daniel Apley, Northwestern University, 2145 Sheridan Rd., Evanston, IL, 60208, United States of America, apley@northwestern.edu, Joon-Ku Im

Many statistical problems can be viewed as discovering variation patterns in a set of multivariate observations. We view each multivariate observation as a structured component (due to some underlying systematic phenomena) plus noise, where the structured component lies on a lower-dimensional manifold. The objective is to learn, or discover, the manifold based only on the data. This provides insight into the underlying phenomena that cause the variation, which facilitates process improvement.

2 - Multivariate Process Capability (MPC) for Design and Manufacturing
Wezhen Huang, University of Massachusetts Dartmouth, 285 Old Westport Rd., North Dartmouth, MA, 02747, United States of America, whuang@umassd.edu

A process capability (PC) index is introduced to characterize the quality assurance capability of multivariate manufacturing processes. PC is represented as a conformance probability, i.e., a direct and transparent capability index. In design, it provides a single characteristic for quality evaluation, optimization, and sensitivity analysis. In manufacturing, it avoids the confusions in explanation, comparison, and evaluation with multiple univariate indices for each quality characteristic.

3 - Selecting Process Variables to Classify Production Batches into Two Classes using Multiple Criteria
Michel Anzanello, Professor, Federal University of Rio Grande do Sul, Av. Osvaldo Aranha, 99, Porto Alegre, 90.035-190, Brazil, michel.anzanello@gmail.com, Susan Albin, W. Art Chaovalitwongse

Many correlated, noisy process variables are often found in production data. Our method selects the important variables to classify batches into two quality classes according to multiple criteria. Integrating PLS regression, data mining tools, and Pareto analysis we classify 6 datasets and find the reduced set of variables yielding accurate classifications.

4 - Factor Significance and Robust Parameter Design of Shape-Response Experiments
Hussam Alshraideh, PhD Student, The Pennsylvania State University, 10 Vairo Blvd 215D, State College, PA, 16803, United States of America, haa134@psu.edu, Enrique del Castillo

We start by first reviewing previous Statistical Shape Analysis (SSA) techniques aimed at screening out significant factors in a shape-response experiment. SSA techniques are then compared based on their statistical performance. Finally, a new statistical approach to find the optimal controllable factors levels to achieve the targeted part geometry is introduced.

5 - Characterization of Machined Surface Texture for Root Cause Diagnosis
Hai Nguyen, PhD Candidate, University of Michigan, 3001 EECS, 1301 Beal Avenue, Ann Arbor, MI, 48109-2122, United States of America, haitn@umich.edu, Saumuy Suriano, Liang Zhou, Jingjing Li, Hui Wang

Surface texture of a machined part, including form, local distortion, waviness, has significant influence on performance of mated assembly and contain rich process information. High definition metrology provides opportunities to improve the root cause diagnosis. This research studies multi-scale surface texture to identify root cause. Methods to extract surface texture at each scale are introduced to obtain information about process such as tool wear, tool runout, tool breakage.

■ MC29

C - Room 5A, Level 3

Computer Experiments I

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Peter Qian, University of Wisconsin-Madison, 1300 University Ave, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

1 - Multi-layer Designs for Computer Experiments
Shan Ba, Georgia Institue of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, shan.ba@gatech.edu, Roshan Vengazhiyil

Space-filling designs, such as optimal Latin hypercube designs (LHDs), are computationally cumbersome to find. In this work, we present a new class of space-filling designs developed by splitting two-level factorial designs into multiple layers. The method takes advantages of available results in factorial design theory and therefore, the proposed Multi-layer designs (MLDs) are easy to generate. Moreover, numerical study shows that MLDs can have better space-filling properties than optimal LHDs.

2 - Sequential Experiment Design for Predictive Maturity
Brian Williams, Los Alamos National Laboratory, P.O. Box 1663; MS F600, Los Alamos, NM, 87545, United States of America, brianw@lanl.gov, Leslie Moore, Jason Loeppky

We introduce batch sequential experiment design strategies to improve global prediction of discrepancy when calibrating computer models to experimental data. Criteria used within a batch sequential design algorithm for efficiently achieving this objective are discussed. A new class of experiment designs is utilized with these criteria to obtain space-filling batch augmentation of existing space-filling designs. Comparisons of several optimization strategies will be presented.

3 - Non-collapsing Spacing-filling Designs for Bounded Regions
Angela Dean, Professor, The Ohio State University, Statistics Deaprtment, 1958 Neil Avenue, Columbus, OH, 43210, United States of America, amd@stat.osu.edu, Danel Draguljic, Thomas Santner

Many physical processes can be described via mathematical models, implemented as computer codes. A surrogate model (emulator) may be fitted for exploring the region of interest. Its performance depends on the space-filling properties of the design. Designs that avoid replicating input values ("non-collapsing") are most efficient when some inputs do not affect the output. An algorithm is described for space-filling, non-collapsing designs for computer experiments when the input region is bounded.

4 - Mixed-integer Surrogate Modeling Extensions to Surfpack
Brian Adams, Sandia National Laboratories, P.O. Box 5800, MS-1318, Albuquerque, NM, 87185, United States of America, briadam@sandia.gov, Laura Swiler, Keith Dalbey

Surfpack is a library of multidimensional function approximation methods useful for efficient surrogate-based sensitivity/uncertainty analysis or calibration/optimization. I will survey current Surfpack meta-modeling capabilities for continuous variables and describe recent progress generalizing to both continuous and categorical factors, including relevant test problems and analysis comparisons.

■ MC30

C - Room 5B, Level 3

Recent Advances in Bayesian Hypothesis Testing and Model Selection

Cluster: Bayesian Models
Invited Session

Chair: Valen Johnson, Professor and Deputy Chair of Biostatistics, MD Anderson Cancer Center, 1400 Pressler Street, Unit 1411, Houston, TX, 77030, United States of America, vejohnson@mdanderson.org

1 - Bayes Factors for One-way ANOVA
Paul Speckman, Professor, University of Missouri, Department of Statistics, MO, United States of America, Dongchu Sun

We consider the problem of choosing objective priors for consistent Bayes factors in linear models. We analyze the special case of one-way ANOVA with fixed or random effects, letting the number of factor levels be fixed or increasing with sample size. We show that the popular Zellner-Siow and related priors are not necessarily consistent in the large parameter case. However, a simple modification based on notions of "effective sample size" produces consistent Bayes factors in all cases.

2 - Neutral-data Comparisons for Bayesian Testing

Dan J. Spitzner, Professor, University of Virginia, VA, United States of America

A novel approach to evidence assessment in Bayesian testing is proposed as a (neutral-data comparison,) which modifies the Bayes factor by reformulating its baseline of comparison to reflect data that are (neutral) between the hypotheses of interest. Whereas a Bayes factor (BF) is the ratio of posterior to prior odds, a neutral-data comparison (NDC) is the ratio of posterior odds given observed data to that given on neutral data. Neutral data are, specifically, imaginary data that are believed to exhibit evidence for neither the null nor the alternative hypothesis. An important advantage of NDC over BF is that it is drastically less sensitive to modifications of the prior, and is thus quite suitable for problems involving a degenerate null hypothesis with a vague prior on the alternative hypothesis. In particular, NDC avoids the Jeffreys-Lindley paradox. The talk will discuss a conceptual rationale for NDC, as well as an approach for eliciting neutral data in standard problems. Comparisons with established testing approaches based on BF will be made, and an associated methodology will be demonstrated on some existing data sets.

3 - Non-local Prior Densities for Model Selection

David Rossell, IRG Barcelona, Barcelona, Spain, Valen Johnson, Donatello Tellesca

Bayesian model selection is an appealing choice to perform variable selection, as Bayes factors penalize model complexity and therefore favor par- simony. However, the penalty imposed by Bayes factors derived from most currently popular approaches is relatively mild. This results in unbalanced rates of accumulation of evidence, i.e. as the sample size grows, Bayes factors increase at an exponential rate for variables which should be included in the model, but they decrease only at an inverse square root rate for variables which should be excluded. In practice this means that, for small up to mod- erately large sample sizes, it is usually hard to obtain conclusive evidence for excluding any one variable. We propose a framework based on non-local priors, an intuitively appeal- ing alternative which specifies a better a priori separation of the model space, and therefore favors the exclusion of unnecessary variables. As shown in Johnson and Rossell (2010), our framework achieves better balanced conver- gence rates and a highly improved performance in a wide variety of scenarios. For instance, in sequential clinical trials there are substantial savings in sample sizes, as ineffective treatments are discarded earlier. In high-dimensional setups such as prediction or functional data analysis, the strong model complexity penalty imposed by non-local priors results in improved inference. Importantly in such high-dimensional setups, our approach is computation- ally effcient, as we provide closed-form expressions and approximations for linear models and generalized linear models, respectively.

■ MC31

C - Room 5C, Level 3

Statistical Learning

Sponsor: Data Mining
Sponsored Session

Chair: Mohammad Khoshneshin, The University of Iowa, S210 John Pappajohn Business Building, Iowa city, IA, 52242, United States of America, mohammad-khoshneshin@uiowa.edu

1 - Dynamics of Message Passing Algorithms for Statistical Learning

Mohsen Bayati, Stanford University, 350 Serra Mall, Packard Building, room 278, Stanford, CA, 94305, United States of America, bayati@stanford.edu, Andrea Montanari

In a series of recent results by Donoho, Maleki and Montanari, 'approximate message passing (AMP) algorithms' and 'state evolution' have been shown to be extremely effective in reconstructing sparse signals from a small number of measurements, and calculating the operating characteristics of the LASSO. In this talk we will show the first rigorous foundation to the state evolution. Our results hold for a general family of iterative algorithms beyond AMP.

2 - Clustered Low Rank Matrix Approximations

Berkant Savas, Postdoc, University of Texas at Austin, 1 University Station, Mail Code C0500, Austin, TX, 78712, United States of America, berkant@cs.utexas.edu, Inderjit Dhillon

Low rank matrix approximation is an important tool in many modern statistical learning applications. We present a novel technique that combines clustering and low rank matrix approximation. We generalize recently developed stochastic algorithms with efficient clustering methods to obtain low rank approximations of large networks. We give theoretical bounds that guarantee low approximation errors, and demonstrate the performance of our method on synthetic data and large on-line social networks.

3 - Classification for Time Series Data

Blakeley McShane, University of Pennsylvania, The Wharton School, Philadelphia, PA, 19104-6340, United States of America, mcshaneb@wharton.upenn.edu

We present a methodology to adapt existing statistical classification algorithms such as logistic regression and random forests to accommodate time series data. Our method is able to account for very general dependence structures in the response, in particular those that can be modeled by high order, generalized, and variable length Markov chains. We apply our method to the problem of sleep scoring based on video data, demonstrating large advances over methods currently used in sleep medicine.

4 - Probabilistic Embedding Models and Applications

Mohammad Khoshneshin, The University of Iowa, S210 John Pappajohn Business Building, Iowa city, IA, 52242, United States of America, mohammad-khoshneshin@uiowa.edu, Nick Street

We propose a novel Euclidean embedding approach for dyadic data called the probabilistic embedding model (PEM). In PEM, objects are embedded in a Euclidean space and a joint probability distribution function is defined based on the distance between those objects. Closer objects are more likely to be related. We describe the advantages of PEM over methods like SVD and multi-dimensional scaling, and its applications in areas such as document-word modeling and collaborative filtering.

■ MC32

C - Room 6A, Level 3

Joint Session ICS/ ENRE:

Sponsor: Computing Society/ Energy, Natural Resources and the Environment
Sponsored Session

Chair: Miguel Anjos, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, manjos@uwaterloo.ca

1 - Offering Strategies for a Power Producer Based on Robust Optimization

Antonio J. Conejo, Professor, University Castilla-La Mancha, Campus Universitario s/n, Ciudad Real, 13071, Spain, Antonio.Conejo@uclm.es, Luis Baringo

This presentation describes a robust optimization technique to build offering curves for a producer participating in a pool-based electricity market. Price uncertainty is described through confidence intervals. These intervals are successively divided into a sequence of nested subintervals, which allow formulating a collection of meaningful robust mixed-integer LP problems. The solutions of these problems provide adequate information to build hourly offering curves.

2 - Wind Uncertainty Model using Chance-Constrained Programming in Electricity Markets

William (Bill) Rosehart, rosehart@ucalgary.ca, Mahmoud Mazadi

Wind generation is incorporated into a Cournot model of an electricity market to study suppliers' strategic behavior in the presence of uncertainty. An iterative solution approach, based on a joint Chance-Constrained formulation, is enhanced to find the market equilibrium such that all firms' profits are maximized with a pre-specified probability. Impact of transmission line limits, wind standard deviation, and amounts and location of wind on the strategic behavior of suppliers is studied.

3 - On Mixed Integer Linear Programming Formulations for Unit Commitment Problems

Miguel F. Anjos, University of Waterloo, 200 University Avenue West, Waterloo, ON, Canada, anjos@stanfordalumni.org, Anthony Vannelli, Jim Ostrowski

We use computational tests to compare different formulations for the unit commitment problem. In addition, we introduce a new class of inequalities that give a tighter description of feasible schedules for generators. Computational results show that these inequalities can significantly reduce overall solution times.

4 - From Theory to Practice: Implementation of the California Electricity Market

Guillermo Bautista, Sr Market Performance Analyst, CAISO, 1504 Guzzetti Way, Folsom, CA, 95630, United States of America, bautista.guillermo@gmail.com

The California Independent System Operator launched its new market design in April 2009. The market consists of various inter-temporal financial and physical submarkets, and uses a detailed model of the physical and financial elements which results in a highly non-linear non-convex optimization problem. The market clearing process uses state of the art mixed integer programming techniques. This presentation describes the market design and mathematical models implemented by the California ISO.

■ MC33

C - Room 6B, Level 3

Algorithms & Solvers for SOCP & Stochastic SDP

Sponsor: Optimization/Computational Optimization and Software (Joint Cluster ICS)
Sponsored Session

Chair: Robert Fourer, AMPL Optimization, 900 Sierra Place SE, Albuquerque, NM, 87108, United States of America, 4er@ampl.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Second-order Cone Program (SOCP) Detection and Transformation Algorithms for Optimization Software
Jared Erickson, Northwestern University, Dept of Industrial Eng & Mgmnt Sciences, 2145 Sheridan Road, Evanston, IL, 60208-3119, United States of America, jarederickson2012@u.northwestern.edu, Robert Fourer

Diverse forms of convex optimization problems can be recast as second-order cone programs (SOCPs) and solved efficiently by interior-point methods. We present algorithms for detecting many such forms and converting them to the varied canonical forms required by several solvers. Our implementation operates on conventional objective and constraint expressions of the AMPL modeling language without recourse to any SOCP-specific syntax extensions.

2 - Large-scale Heterogeneous SOCP Solver Under Octave
Yuriy Zinchenko, University of Calgary, Calgary, Canada, yzinchen@ucalgary.ca

We describe an implementation of an interior-point algorithm for Second-Order Cone Programming (SOCP) under Octave/MATLAB. The solver particularly targets problems with nearly dense or block-dense linear constraints. Of special interest is adaptation of interior-point method machinery to mixed-precision arithmetic and subsequently exploiting GP-GPU architecture to gain non-negligible speed-up.

3 - On Solving Stochastic Semidefinite Programs
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 present our efforts on solving Stochastic Semidefinite Programs (SSDPs). Several methods will be discussed as well as a preliminary version of a software package implementing the methods.

■ MC34

C - Room 7, Level 3

Approximate Dynamic Programming in Operations

Sponsor: Computing Society
Sponsored Session

Chair: Dan Adelman, Professor, University of Chicago, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States of America, dan.adelman@chicagobooth.edu

1 - Optimized Scheduling of Complex Production Systems Through Approximate Dynamic Programming
Spyros Reveliotis, Professor, ISyE, Georgia Tech, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, spyros@isye.gatech.edu

This talk considers the use of approximate dynamic programming (ADP) as a means of developing near-optimal policies for stochastic scheduling problems that arise in complex production systems. Some challenges that arise while applying ADP in the context of these problems are discussed, and a promising framework for obtaining robust and practical solutions to these challenges is outlined.

2 - An Approximate Dynamic Programming Policy for the Economic Lot Scheduling Problem
Christiane Barz, UCLA Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, christiane.barz@anderson.ucla.edu, Dan Adelman

We introduce a price-directed dynamic policy for the well-known economic lot scheduling problem with sequence dependent setup times and costs, which is based on approximate dynamic programming. Since in the underlying Semi-Markov decision process, the set of feasible actions is neither convex nor closed, we suggest a dynamic approximation of this set and test the policy in numerical examples.

3 - Managing Customer Goodwill using Approximate Dynamic Programming
Dan Adelman, Professor, University of Chicago, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States of America, dan.adelman@chicagobooth.edu, Adam Mersereau

We use approximate dynamic programming to study the problem of a supplier dynamically allocating limited capacity among a portfolio of customers, where each customer's orders depend positively on the fill rates provided to her in the past. Motivated by a fluid analysis of a deterministic version of the problem, we consider polynomial approximations to the value function. We show under special conditions a linear approximation lacks strength.

■ MC35

C - Room 8A, Level 3

Its 'EZ' to use EZPublish CMS to Create and Maintain Your Community Website

Cluster: IOL Technical
Invited Session

Chair: Gary Bennett, INFORMS, 7240 Parkway Drive, Suite 300, Hanover, MD, 21076, United States of America, Gary.Bennett@informs.org

1 - Introduction to EZPublish, a Free Tool For Updating Your Community Web Site From Your Browser
Shirley Mohr, INFORMS, 7240 Parkway Drive, Suite 300, Hanover, MD, 21076, United States of America, Shirley.Mohr@INFORMS.org

This special informative session is for INFORMS Communities and Subdivisions that need a website, or those that have a site but could benefit from simpler tools to keep it updated. INFORMS introduces EZ Publish, a Content Management System (CMS) that is a free and easy-to-learn tool for creating and updating your web site directly from your browser. Special features you can take advantage of include blogs, forums, and password protected members-only areas. Any community or Subdivision that wishes to utilize a ready-made INFORMS template and intuitive tools to create and maintain their website should attend. Watch the demo and decide for yourself!

■ MC36

C - Room 8B, Level 3

Teaching OR Through Active Learning II

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 - An Inquiry-Based Operations Research Course
Kevin Hutson, Associate Professor, Furman University, 3300 Poinsett Hwy., Greenville, SC, 29613, United States of America, kevin.hutson@furman.edu

Inquiry-based learning is a problem-solving-based approach to teaching a subject. The approach suggests that instruction should begin with problems or questions and allow students to search for solutions, discover the interconnections of the subject matter, and develop directions for future inquiry without the instructor lecturing to the students beforehand. This talk will focus on implementing this instructional approach in an introductory OR course.

2 - Inquiry-Based Learning in Undergraduate Probability and Statistics
Jeffrey Heath, Assistant Professor of Mathematics, Centre College, 600 W. Walnut St., Danville, KY, 40422, United States of America, jeffrey.heath@centre.edu

Inquiry-Based Learning (IBL) is a teaching philosophy that promotes student learning by enabling them to discover knowledge themselves. I will discuss a few IBL modules implemented in my undergraduate probability and statistics courses, and provide instructor and student observations that resulted.

3 - Using a Spreadsheet for Active Learning Projects in Operations Management
L. Leslie Gardner, Professor of Mathematics, University of Indianapolis, 1400 East Hanna Avenue, Indianapolis, IN, 46227, United States of America, lgardner@uindy.edu

This paper describes a set of active learning strategies using or supplemented by spreadsheets that enables students to learn the logic behind software packages, to gain experience using a spreadsheet to solve real problems, to have a more clear view of the dynamics of business systems, and to learn to organize and manage small scale projects.

4 - Introducing Computation and Modeling to Science Students
Jessen Havill, Denison University, P.O. Box 810, Granville, Oh, 43023, United States of America, havill@denison.edu

Undergraduate science students typically have little exposure to computational modeling and optimization. To address this, we have developed an introductory course that aims to simultaneously introduce programming in Python and modeling in the sciences. The primary feature of this course is a sequence of loosely guided projects in which students design and implement simple algorithms (e.g., cellular automata, random walks, a genetic algorithm, graph searches) and answer questions about them.

■ MC37

C - Room 8C, Level 3

The Applied Probability Society Markov Lecture

Sponsor: Applied Probability
Sponsored Session

Chair: Ward Whitt, Professor, IEOR Department, Columbia University, 500 West 120th Street, New York, NY, 10027, United States of America, ww2040@columbia.edu

1 - Multi-server Queues with Time-varying Arrival Rates
Ward Whitt, Professor, IEOR Department, Columbia University, 500 West 120th Street, New York, NY, 10027, United States of America, ww2040@columbia.edu

Motivated by potential applications to health-care systems and call centers, we propose fluid models and Gaussian-process refinements to describe the performance of a multi-server queueing system that experiences periods of overloading. The model has time- varying arrival rate and staffing, customer abandonment and non-exponential service and patience distributions.

■ MC38

C - Room 9A, Level 3

Advances in Global Optimization

Sponsor: Optimization/Global Optimization
Sponsored Session

Chair: Hong Seo Ryoo, Associate Professor, Korea University, 1, 5-Ga, Anam-Dong, Seongbuk-Gu, Seoul, 136-713, Korea, Republic of, hsryoo@korea.ac.kr

1 - Relaxations of Factorable Functions with Convex-transformable Intermediates
Aida Khajavirad, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, United States of America, aida@cmu.edu, Nick Sahinidis, Jeremy Michalek

We propose to strengthen factorable relaxations through the use of functional transformations of intermediate expressions. Instead of relying on convexity of intermediate expressions, we exploit convex transformability of the component functions of factorable programs to generate bounds for global optimization problems. We define suitable forms of transforming functions and provide theoretical and numerical comparisons of the sharpness of the resulting relaxations with those of existing schemes.

2 - A Branch-and-bound Algorithm for a Class of Computer Vision Problems
Takahito Kuno, Professor, Tsukuba University, Tennoh-dai 1-1-1, Tsukuba, Ibaraki, 305-8573, Japan, takahito@cs.tsukuba.ac.jp, Yinqiang Zheng

Computer vision provides a rich area of application of optimization. A typical example is a class of problems including multiple-view triangulation, camera resectioning and homography estimation. These are known to be formulated into a problem of minimizing a sum of linear ratios, or a sum of quadratic ratios, depending on the noise model. In this talk, exploiting its special structure, we develop a practical branch-and-bound algorithm for finding a globally optimal solution.

3 - Simultaneous Convexification of Nonlinear Functions and Sets
Mohit Tawarmalani, Associate Professor, Purdue University, 100 S.Grant Street, West Lafayette, IN, 47907-2076, United States of America, mtawarma@purdue.edu

We generalize convex extensions to study simultaneous convexification of nonlinear functions. The result generalizes earlier polyhedral characterizations of convex hulls of multilinear functions and provides insights into orthogonal disjunctions. We discuss applications of barycentric coordinates in simultaneous convexification, relate them to transportation problems, and to certain entropy maximization problems.

4 - MILP Approach to Separation of Nonconvex Data
Hong Seo Ryoo, Associate Professor, Korea University, 1, 5-Ga, Anam-Dong, Seongbuk-Gu, Seoul, 136-713, Korea, Republic of, hsryoo@korea.ac.kr, Kwangsoo Kim

We present an MILP model that implements a decision boundary that best separates different types of data by optimizing the interplay of a finite number of functions. Noting difficulties associated with solving MILPs, we develop a metaheuristic procedure for the MILP model that minimizes the number of misclassified data. With experiments on benchmark datasets, we illustrate the utility of the new MILP-based data classification and the proposed metaheuristic procedure for its solution.

■ MC39

C - Room 9B, Level 3

MIP - Root LP Basis and Cuts

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Tobias Achterberg, CPLEX Developer, IBM, Zuse Institute Berlin, Takustr. 7, Berlin, 14195, Germany, achterberg@de.ibm.com

1 - A Computational Investigation on Two Row Tableau Cuts
Andrea Tramontani, DEIS, University of Bologna, Viale Risorgimento 2, Bologna, 40136, Italy, andrea.tramontani@unibo.it, Santanu Dey, Andrea Lodi, Laurence Wolsey

We present a computational investigation on cutting planes derived from two row mixed integer group relaxations of an LP tableau and based on lattice-free triangles having more than one integer point on one side. We propose a heuristic procedure to generate such triangles, and we report on extensive computational experiments. Our tests are carried out on different classes of randomly generated instances designed to represent different models in the literature, as well as on MIPLIB instances.

2 - Generation of Splitcuts via Lift & Project and Reduce-and-Split
Giacomo Nannicini, nannicin@andrew.cmu.edu, Gerard Cornuejols, Tamas Kis, Egon Balas

Splitcuts are an effective class of cutting planes for MILP. Given a split disjunction and a basis of the LP relaxation, we can generate a splitcut; but how do we obtain these two basic ingredients? In this work, we use the Reduce-and-Split algorithm to compute a split disjunction, and the Lift & Project framework to obtain a basis from which the cut is derived, combining the two ideas together. We will address both theoretical and computational issues.

3 - A Heuristic for Generating Violated GMI Cuts From Non-optimal Bases
Marcos Goycoolea, Universidad Adolfo Ibañez, School of Business, Peñalolén, Chile, mgoycool@gmail.com, Sanjeeb Dash

Gomory Mixed Integer (GMI) cuts are among the most effective cutting planes used for solving MIP problems in software packages. Traditional GMI cut algorithms only generate these from the optimal bases of LP relaxations. Instead, we considering other (non-optimal and possibly infeasible) bases. This allows us to generate many consecutive rounds of rank-1 GMI cuts, which are both effective and sparse. Also, it allows us to apply GMI cuts in new contexts, such as branch-and-bound, and others.

4 - LP Basis Selection and Cutting Planes
Tobias Achterberg, CPLEX Developer, IBM, Zuse Institute Berlin, Takustr. 7, Berlin, 14195, Germany, achterberg@de.ibm.com

Typically, the LP relaxation of a MIP model has multiple optimal solutions. Experiments of Danna (2008) demonstrate that the choice of the optimal LP basis can have a significant impact on the total MIP solving time. As a first step towards improving MIP solvers by selecting "good" LP bases, we describe a heuristic implemented in IBM ILOG CPLEX Optimization Studio 12 to produce an optimal LP solution with favorable properties during the cutting plane loop at the root node.

■ MC40

C - Room 9C, Level 3

COIN-OR's Coopr Package: Highlights and Applications

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: William Hart, Sandia National Laboratories, PO Box 5800, Albuquerque, NM, United States of America, wehart@sandia.gov

1 - Recent Developments in Pyomo
William Hart, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, United States of America, wehart@sandia.gov, Jean-Paul Watson

The Pyomo modeling package can be used to formulate optimization models using the Python scripting language. Pyomo is being actively developed to support COIN-OR users in a variety of application areas. This talk will highlight recent developments in Pyomo, as well as new Coopr capabilities that can be leveraged to analyze Pyomo models.

2 - PySP: Modeling and Solving Stochastic Mixed-Integer Programs in Python
Jean-Paul Watson, Sandia National Laboratories, jwatson@sandia.gov, David Woodruff, William Hart

We describe PySP, an open-source extension of Pyomo - a Python-based modeling language for mathematical programming - that enables modeling and solution of stochastic mixed-integer programs. PySP contains a number of generic decomposition-based solution strategies made possible through Python language features such as introspection. We discuss the design and implementation of these generic strategies, in addition to computational results on standard stochastic benchmarks.

3 - Representation and Solution of Generalized Disjunctive Programming Problems using Pyomo
Daniel Word, Texas A&M University, 3122 TAMU, College Station, TX, 77843, United States of America, dword@harding.edu, William Hart, John Siirola, Carl Laird

Generalized Disjunctive Programming (GDP) is a common technique used in mathematical programming to describe discrete decisions in optimization problems, however, converting this representation to an MILP can be tedious and error-prone. We develop a plug-in for the python-based modeling language Pyomo that accepts GDP problems directly, and automatically performs the necessary big-M or convex-hull transformations. Example problems demonstrate the capabilities of this software.

4 - Global Optimization for Estimation of On/Off Seasonality in Infectious Disease Spread using Pyomo
Gabe Hackebeil, Texas A&M University, 3122 TAMU, College Station, TX, 77843, United States of America, gabehack@gmail.com, Carl Laird

Estimating an unknown On/Off seasonal input to infectious disease models is challenging because of the nonlinear equality constraints governing the dynamics and the need for discrete decisions to represent the On/Off behavior. Using the Pyomo framework, we can easily manage construction of linear underestimators and piecewise linear overestimators within a scripting language (python) that allows straightforward implementation of the global optimization algorithm.

■ MC41

C - Room 10A, Level 3

Large-Scale/PDE-Constrained Optimization

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Frank E. Curtis, Lehigh University, 200 W. Packer Ave., Bethlehem, PA, United States of America, frank.e.curtis@gmail.com

1 - A Matrix-Free Trust-Region SQP Method for Large-Scale Optimization
Denis Ridzal, Sandia National Labs, P.O. Box 5800, MS 1320, Albuquerque, NM, 87185, United States of America, dridzal@sandia.gov

For large-scale PDE-constrained optimization problems, the inexactness in the iterative (matrix-free) solution of linear systems severely limits the use of conventional SQP algorithms. We have developed a new 'inexact' trust-region SQP method that efficiently controls stopping tolerances for linear solvers based on the progress of the optimization algorithm. The effectiveness of the inexact SQP algorithm is demonstrated on several classes of PDE-constrained optimization problems.

2 - POD-like Methods for Non-linear Inversion
Lior Horesh, Research Scientist, IBM TJ Watson Research Center, 1101 Kitchawan Rd, Yorktown heights, NY, 10598, United States of America, lhoresh@us.ibm.com, Eldad Haber

We present here an adaptation of Proper Orthogonal Decomposition (POD) method for inverse problems. While basis selection of PDE-based problems was studied extensively, limited research has been done in the context of inverse problems. In this study, we formulate the basis design problem in terms of stochastic optimization, based on the Stochastic Sampling Average (SSA) approach. Results for several PDE problems confirm the efficiency and utility of the proposed approach.

3 - Large-Scale Bayesian Inversion for Electromagnetic and Acoustic Scatterings
Tan Bui, Dr., Institute for Computational Engineering and Sciences, 1 University station C0200, Room 4.252, Austin, TX, 78712, United States of America, tanbui@ices.utexas.edu, Omar Ghattas

We present a statistical view point of typical deterministic inverse problems in engineering and sciences based on Bayesian statistics. It will be shown that the statistical approach is a natural one and how it relates to the deterministic counterpart. Examples from inverse electromagnetic and acoustic scattering will be shown to demonstrate the ideas.

4 - An Interior-Point Method for Large-Scale Optimization
Frank E. Curtis, Lehigh University, 200 W. Packer Ave., Bethlehem, PA, United States of America, frank.e.curtis@gmail.com

We present a globally convergent interior-point method for large-scale optimization. The method avoids matrix factorizations by employing iterative methods for the (inexact) linear system solves. We present the algorithm, describe its convergence behavior under loose assumptions, and illustrate its practical performance with an implementation in the IPOPT software package.

■ MC42

C - Room 10B, Level 3

Developments in Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Oleg A. Prokopyev, University of Pittsburgh, 1048 Benedum Hall, University of Pittsburgh, Pittsburgh, PA, 15261, United States of America, droleg@pitt.edu

1 - Two-stage Quadratic Integer Programs with Stochastic Right-hand Sides
Osman Ozaltin, University of Pittsburgh, Pittsburgh, PA, United States of America, oyo1@pitt.edu, Oleg A. Prokopyev, Andrew J. Schaefer

We consider two-stage quadratic integer programs with stochastic right-hand sides, and present an equivalent reformulation using value functions. We first derive some basic properties of value functions of quadratic integer programs. We then propose a two-phase solution approach. The first phase constructs value functions of quadratic integer programs in both stages. The second phase solves the reformulation using a global branch-and-bound algorithm or a level-set approach.

2 - Mixed Integer Programming Problems with P-order Conic Constraints in Stochastic Optimization
Paul Krokhmal, University of Iowa, 3131 Seamans Center, Iowa City, IA, 52242, United States of America, krokhmal@engineering.uiowa.edu, Policarpio Soberanis

We consider mixed integer problems with p-order conic constraints that arise in a certain class of stochastic optimization models. The proposed solution approach is based on (1) construction of polyhedral approximations of p-cones and a cutting plane procedure that allows for fast solving of approximating problems at the nodes of BnB tree, and (2) a compact representation of rational-order p-cones via quadratic cones. Computational results of a portfolio optimization case study are presented.

3 - Dual Decomposition with Fenchel Cutting Planes 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 binary first stage variables and mixed integer second stage variables. Our algorithm uses scenario decomposition and subgradient optimization to restore nonanticipativity. To make solving the subproblems tractable, we use cutting planes on the LP relaxations of the subproblems, generating Fenchel cuts planes to find integer solutions. Preliminary computational results with instances from the literature will be presented.

4 - Stochastic Unit Commitment Problem with Demand Response and Renewable Energy

Bo Zeng, Assistant Professor, University of South Florida, Department of IMSE, Tampa, FL, 33620, United States of America, bzeng@usf.edu, Long Zhao, Lingling Fan

In this talk, we consider unit commitment problem with price responsive demand and renewable energy. As renewable energy is generally random while demand is sensitive to prices, we develop stochastic programming and robust optimization models to consider these two factors. Then, we present the decomposition based algorithm. Computational study using CPLEX and our algorithm will be presented to investigate the effectiveness of our models.

■ MC43

C - Room 1, Level 2- Mezzanine

Joint Session HAS/ SPPSN: Optimization Models for Disease Management

Sponsor: Health Applications/ Public Programs, Service and Needs
Sponsored Session

Chair: Jennifer Mason, North Carolina State University, 375 Daniels Hall, Raleigh, NC, 27695, United States of America, jemason2@ncsu.edu

1 - A Two-phase Method for Selecting IMRT Treatment Beam Angles: Branch-and-Prune and Local Search

Wenhua Cao, Research Assistant, University of Houston, E206 Engineering Building 2, Houston, TX, 77204, United States of America, wcao@mail.uh.edu, Gino Lim

We have developed a new two-phase solution approach to the beam angle and fluence map optimization problem in IMRT planning. In Phase I, we introduce a Branch-and-Prune algorithm for generating a good robust feasible solution in a fast manner. In Phase II, a local neighborhood search algorithm is developed to find a local optimal solution of the Phase I starting point. Numerical experiments show that the Phase I solutions are typically very close to the corresponding local optimal solutions.

2 - Can Risk Preferences Explain Liver Transplantation Decisions in Practice?

Sakine Batun, University of Pittsburgh, Pittsburgh, PA, United States of America, sab79@pitt.edu, Andrew J. Schaefer, Mark S. Roberts, Atul Bhandari

It has been shown that many living-donor liver transplants are occurring earlier than the time that maximizes life expectancy. In this study, we investigate whether risk preferences can be the reason of this discrepancy by trying to determine a range of risk-sensitivity level that explains the patient behavior.

3 - Assessing Colonoscopy Screening and Surveillance Strategies for Colorectal Cancer

Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, United States of America, nkong@purdue.edu

We develop optimal CRC screening and surveillance strategies with a partially observable Markov model, which is based on a biological colorectal adenoma natural history model. This model primarily aims at assessing various recommended and hypothesized screening strategies during precancerous stage which often span tens of years. To compute a large number of scenarios, we apply a sample-path enumeration approach.

4 - The Optimal Timing of Prearranged Paired Kidney Exchanges

Murat Kurt, PhD Student, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15217, United States of America, muk7@pitt.edu, Andrew J. Schaefer, Mark S. Roberts, M. Utku Unver

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 present necessary and sufficient conditions to characterize the stationary equilibria of this game. Due to vast multiplicity of such equilibria, we consider equilibrium selection and characterize the welfare maximizing equilibrium as an optimal solution to an MIP.

■ MC44

C - Room 2, Level 2- Mezzanine

Pierskalla Finalists II

Sponsor: Health Applications
Sponsored Session

Chair: Mariel Lavieri, Assistant Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, lavieri@umich.edu

1 - Phase I Risk-adjusted Control Charts for Monitoring Surgical Performance by Considering Categorical Covariates

Kamran Paynabar, PhD Candidate, The University of Michigan, Industrial & Operations Engineering, 1205, Ann Arbor, Ann Arbor, MI, 48109-2117, United States of America, kamip@umich.edu, Judy Jin, Arthur Yeh

Existing research on risk-adjusted control charts focuses on Phase II monitoring and very little work has been done on Phase I control of surgical outcomes. In this paper, a general Phase I risk-adjusted control chart is proposed for monitoring binary surgical outcomes. Despite existing methods, this paper shows that binary surgical outcomes depend on not only the patient conditions described by the Parsonnet scores, but other categorical operational covariates, such as different surgeons.

2 - A Multi-class Queue Equilibrium Model for Kidney Allocation

Yichuan Ding, Stanford University, 14 Comstock Circle, Apt 106, Stanford, CA, 94305, United States of America, y7ding@stanford.edu, Stefanos Zenios

We consider a multiclass queuing system for scarce resource allocation, in which heterogeneous customers choose a queue to join. Each queue corresponds to a different level of resource quality. By properly designing the priority rules in different queues, we prove an equilibrium queue-length exists and the waitlist asymptotically converges to a multi-dimensional O-U process centered at that equilibrium. We illustrate the use of this result in cadaver kidney allocation policy design.

3 - Assessment of Benefits of Anesthesia Patients Risk Reduction Measures

Elisabeth Pate-Cornell, Professor and Chair, Stanford University, Management Science and Engineering, 475 via Ortega, Stanford, CA, 94305, United States of America, mep@stanford.edu

We modeled the unfolding of anesthesia accidents, the effects of the alertness and competence of the anesthetist on the risk, and the risk reduction benefits of management measures. The analysis is based on a stochastic Markov model of the evolution of the patient and the anesthesia system following each accident initiator. The data included statistics (e.g., occurrences of accident initiators) and expert opinions (e.g., anticipated effect of a policy on the time to detection of a problem).

4 - A Dynamic Patient Network Model of Hospital-acquired Infections

Sean Barnes, University of Maryland, College Park, MD, United States of America, seanlbarnes@gmail.com, Bruce Golden, Edward Wasil

Hospital patients who share a health care worker are connected to each other and those connections form a network through which the transmission of infectious diseases can occur. We use an agent-based model to explore how the structure of a patient network and the behavior of the health care workers affect the extent and rate of transmission. Our results suggest the practice of assigning health care workers to patients should be done in a structured manner to minimize transmission.

5 - The Weighted Set Covering Game: A Vaccine Pricing Model For Pediatric Immunization

Matthew Robbins, Dr., AFIT/ENS, WPAFB, Dayton, OH, United States of America, matthew.robbins@afit.edu, Uday Shanbhag, Sheldon Jacobson

This paper analyzes the United States pediatric vaccine manufacturing market using a game theoretic framework. A static Bertrand oligopoly pricing model is formulated that characterizes oligopolistic interactions between firms in a multiple product market. Firms satisfy demand by selling bundles of one or more products. Consumers seek to purchase a set of products at an overall minimum cost. Conditions for the existence of pure strategy Nash equilibria (some in the limiting sense) are provided.

■ MC45

C - Room 6, Level 2- Mezzanine

Operations Research Applications in Long-Term Care

Sponsor: Health Applications
Sponsored Session

Chair: Murray Côté, Associate Professor, Texas A&M Health Science Center, School of Rural Public Health, Health Policy and Management, College Station, TX, 77843, United States of America, mjcote@srph.tamhsc.edu

1 - A Comparison of Service-based and Ratio-based Policies for Long-term Care Capacity Planning

Martin Puterman, Professor, University of British Columbia, 2053 Main Mall, Vancouver, BC, V6T 1Z2, Canada, Martin.Puterman@sauder.ubc.ca, Yue Zhang, Derek Atkins

This talk describes a service-based approach for setting long-term care capacity levels over a multi-year planning horizon. The approach integrates demographic and survival analysis, discrete event simulation, and optimization. Through case studies in British Columbia, Canada, we illustrate this service-based approach, compare it to the ratio-based approach used in practice, and derive several policy insights.

2 - The Market for Lemons: Predicting Patient Referrals From MD Owners to Cardiac and Legacy Hospitals

Liam O'Neill, Associate Professor, University of North Texas - Health Science Center, SPH, 3500 Camp Bowie Blvd, Fort Worth, TX, 76107, United States of America, loneill@hsc.unt.edu, Arthur Hartz

We examined the potential impact of adverse selection on the risk-adjusted mortality (RAMRs) for PCI for cardiac and community hospitals. RAMRs were determined for physician-hospital owners performing PCIs who split their caseload among two or more hospitals within the same market. Physician owners doing procedures at cardiac hospitals had excellent RAMRs (0.68%). These same physicians performing PCIs at legacy hospitals had poor outcomes (2.31%).

3 - Staffing-based Quality Measures in Long-term Care

Murray Côté, Associate Professor, Texas A&M Health Science Center, School of Rural Public Health, Health Policy and Management, College Station, TX, 77843, United States of America, mjcote@srph.tamhsc.edu

It is well-known that the delivery of quality healthcare is strongly associated with staffing. In this presentation, we describe the staffing-based quality measures used by the Centers for Medicaid and Medicare in evaluating nursing home performance. We discuss some practical and conceptual challenges associated with each and identify areas for future research opportunities.

■ MC46

C - Room 7, Level 2- Mezzanine

Undergraduate Research Showcase III

Cluster: Undergraduate Operations Research Prize
Invited Session

Chair: Amy Cohn, Associate Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, amycohn@umich.edu

1 - Optimizing Restaurant Reservation Scheduling

Jacob Feldman, Cornell University, Ithaca, NY, United States of America, jbf232@cornell.edu, Susan Martonosi, John Bossert

We consider a yield-management approach to determine whether a restaurant should accept or reject a pending reservation request. This approach was examined by Bossert (2009), where the decision for each request is evaluated by an approximate dynamic program (ADP) that bases its decision on a realization of future demand. This model only considers assigning requests to their desired time slot. We expand Bossert's ADP model to incorporate flexibility thus allowing requests to be assigned to a time slot that differs from their initially requested time. When compared against naive seating models, our model produced significant gains in seat utilization

2 - The Fast-Food Diet Problem

Rebecca Waldrip, Furman University, United States of America, John Harris, Kevin Hutson

In 1945, economist George J. Stigler published The Cost of Subsistence where he determined the minimum-cost diet meeting basic nutritional guidelines for an average man. The diet consisted of foods that could be purchased at supermarkets and prepared at home. Today, Americans dine out frequently. As the percentage of Americans that dine out regularly increases, concerns over healthcare costs and obesity has risen, leading individuals to become increasingly concerned with nutritional diets. Here, we consider the fast-food diet problem. We attempt to determine a minimum-cost diet satisfying nutritional constraints and comprised of foods that can be purchased at fast food restaurants.

3 - The Effective Application of a New Approach to the Generalized Orienteering Problem

John Silberholz, University of Maryland, University of Maryland, College Park, MD, 20742, United States of America, josilber@umd.edu, Bruce Golden

The Orienteering Problem (OP) is an important problem in network optimization in which each city in a network is assigned a score and a maximum-score path from a designated start city to a designated end city is sought that is shorter than a pre-specified length limit. The Generalized Orienteering Problem (GOP) is a generalized version of the OP in which each city is assigned a number of scores for different attributes and the overall function to optimize is a function of these attribute scores. In this paper, the function used was a non-linear combination of attribute scores, making the problem difficult to solve. The GOP has a number of applications, largely in the field of routing. We designed a two-parameter iterative algorithm for the GOP, and computational experiments suggest that this algorithm performs as well as or better than other heuristics for the GOP in terms of solution quality while running faster. Further computational experiments suggest that our algorithm also outperforms the leading algorithm for solving the OP in terms of solution quality while maintaining a comparable solution speed.

■ MC47

C - Room 8, Level 2- Mezzanine

Emergent Dynamics and Behavior in Biology and Life Sciences

Cluster: Complex Systems
Invited Session

Chair: Natarajan Gautam, Associate Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, gautam@tamu.edu

Co-Chair: Ezgi Eren, Industrial and Systems Engineering, Texas A&M University, College Station, TX, United States of America, ezgieren@tamu.edu

1 - A Mathematical Model of Ant Raft Formation

Craig Tovey, Professor, Gerogia Tech, School of ISyE, Georgia Tech, Atlanta, Ga, 30332, United States of America, ctovey@isye.gatech.edu, David Hu, Nathan Mlot

A single ant dropped in water will drown, but a cluster of a few thousand will form a raft and survive for days. We form a mathematical model that accurately predicts the shape and rate of growth of the raft area in experiments on ant groups of size 1000 to 8000. The model needs little tuning. Instead it uses parameter values obtained by observation of the ants.

2 - Cells as Agents: Multi-cell Simulations of Biological Development and Disease

James Glazier, Professor, Indiana University, 727 E 3rd St./ SW159, Department of Physics, Bloomington, IN, 47405, United States of America, glazier@indiana.edu

Embryonic development and diseases like cancer, all result from a basic repertory of cell behaviors. Biochemical networks inside cells control these behaviors and cells remodel their environment, creating additional complexity. Multi-cell simulations can help disentangle these multiple feedback mechanisms. I will discuss building simulations of the formation of the early body plan, tumor growth and Age-Related Macular Degeneration to illustrate the questions this type of simulation can address.

3 - Low-dimensional Functionally Relevant Dynamics From Distributed Neural Networks

Ajay Pillai, NIDCD, National Institutes of Health, Rm 8S235B, 10 Center Dr., Bethesda, MD, 20892, United States of America, pillaiaj@mail.nih.gov, Viktor Jirsa

The emergence of low-dimensional, functionally relevant dynamics from high-dimensional networks is addressed. Starting from the basic notions of dynamical systems theory, we introduce a functional architecture, entitled "Structured Flows on Manifolds". How such functional architectures maybe obtained from distributed neural networks is shown. Properties of the distributed functional architecture such as flexibility, redundancy and robustness are also discussed.

4 - Modeling Self-organization of Microtubules Inside the Plant Cell

Ezgi Eren, Industrial and Systems Engineering, Texas A&M University, College Station, TX, United States of America, ezgieren@tamu.edu, Natarajan Gautam, Ram Dixit

Microtubules are dynamic polymers which regulate critical processes inside living cells. In plant cells, microtubules are created in arbitrary locations on the cell wall growing in random directions. Their interaction leads to an organized structure where they are co-aligned to each other. We replicate this self-organization using simulation and explain how it emerges by a coarse-grained model that we develop.

■ MC48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - LINDO Systems, Inc. - The Latest Optimization Modeling Software From LINDO Systems

Mark Wiley, LINDO Systems, Inc., 1415 North Dayton, Chicago, IL, 60642, United States of America, mwiley@lindo.com

LINDO Systems will demonstrate the latest enhancements to LINDO API, LINGO and What'sBest - their popular linear, integer, quadratic, general nonlinear, and global optimization tools. Improvements include capabilities for solving extremely large LPs. Heuristics for quickly finding excellent solutions to integer and nonlinear programs. imaAutomatic exploitation of quadratic expressions, second order cone and nonconvex quadratic expressions in the global solver.

2 - Imagine That - ExtendSim-Power Tools for Simulation

Dave Krahl, ExtendSim, 6830 Via Del Oro, Suite 230, San Jose, CA, 95030, United States of America, davek@extendsim.com

Experience for yourself the ease of use, flexibility, and power of a professional simulation tool - ExtendSim. Use custom interactive model interfaces and hierarchical submodels to rapidly explore simulation concepts and design options. Realize why ExtendSim is the tool to watch in the simulation industry. Don't miss this demo!

■ MC49

C -Room 10, Level 2- Mezzanine

Recommender Systems and Personalization

Sponsor: Information Systems
Sponsored Session

Chair: Zan Huang, Assistant Professor, Pennsylvania State University, 419 Business Building, University Park, United States of America, zanhuang@psu.edu

1 - Stability of Recommender Systems

Jingjing Zhang, University of Minnesota, Carlson School of Management, Minneapolis, United States of America, zhang818@umn.edu, Gedas Adomavicius

We introduce stability as a measure of recommender systems performance. We discuss the notion of stability in predictive models, provide its formal definition for recommendation algorithms, and empirically evaluate stability of popular recommendation techniques. In summary, we advocate that stability should be a desired property of recommendation algorithms, because unstable recommendations can lead to user confusion and, therefore, reduce trust in and acceptance of recommender systems.

2 - Shilling Attack Detection - A New Approach for a Trustworthy Recommender System

Jong-Seok Lee, SAS Inc., SAS Inc., Cary, NC, United States of America, jong-seok.lee@jmp.com, Dan Zhu

Recommender systems are vulnerable to even small data inputs of malicious information. This research proposes to identify a cluster of profiles by focusing on 'filler' ratings. We examine a number of properties of such profiles, followed by empirical evidence and detailed analysis of various characteristics of the shilling attacks. We then propose a hybrid two-phase procedure for shilling attack detection.

3 - Analysis of the User Similarity Network for Distributed Recommendation

Zan Huang, Assistant Professor, Pennsylvania State University, 419 Business Building, University Park, United States of America, zanhuang@psu.edu

The paper proposes a distributed recommender system based on the construction and maintenance of a user similarity network in which each user only maintains a small number of close neighbors for peer-to-peer neighbor discovery and recommendation generation. Empirical results using the Netflix dataset showed that our proposed system achieved comparable recommendation quality as the centralized recommendation.

4 - A Framework for Personalized Sponsored Search

Pelin Atahan, Assistant Professor, Ozyegin University, Kusbakisi Cad. No:2 Altunizade Usküdar, Istanbul, 34662, Turkey, Pelin.Atahan@ozyegin.edu.tr, Sumit Sarkar, Abhijeet Ghoshal

Sponsored search is a major revenue source for search engines. Search engines can improve customer experience by personalizing the sponsored search results. In this research, we develop a framework that the search engines can use to order the sponsored search results in order to customize the results to each visitor and also enhance their profitability.

■ MC50

C -Room 11, Level 2- Mezzanine

Cloud Performance and Capacity

Cluster: Cloud Computing
Invited Session

Chair: Li Zhang, IBM T.J. Watson Research Center, 19 Skyline Drive, Hawthorne, NY, 10532, United States of America, zhangli@us.ibm.com

1 - SLA Driven Capacity Planning for Cloud Based Systems

Vijay Naik, IBM Research, 19 Skyline Dr, IBM T. J. Watson Research Center, Hawthorne, NY, 10532, United States of America, vkn@us.ibm.com, Murthy Devarakonda, Rahul Ghosh, Kishor Trivedi, DongSeong Kim

We present a capacity planning engine for cloud services using a hierarchical analytical model. Our novelty is in reducing the complexity of capacity planning analysis by dividing the model into multiple interacting sub-models and then obtaining the final solution by iteration over sub-model solutions. We show how changes in job-arrival, job-service time and machine failure can affect the capacity requirement of a cloud to maintain SLAs (service availability and provisioning delay) to users.

2 - Consolidating Virtual Machines with Dynamic Resource Demand in Cloud

Xiaoqiao Meng, IBM T.J. Watson Research Center, 19 Skyline Dr, Hawthorne, NY, 10532, United States of America, xmeng@us.ibm.com, Li Zhang

Cloud capacity planning refers to allocating resources to virtual machines (VMs) that host customers' workload. This talk presents a capacity planning method based on profiling VM resource demand as statistical distributions. To solve the formulated problem, We propose algorithms with worst-case performance bound. We use numerical experiments to evaluate the proposed consolidation algorithm and observe 30% server reduction compared to benchmark algorithms.

3 - Modeling Provisioning Time in Cloud Environments

Parijat Dube, IBM TJ Watson Research Center, Yorktown Heights, NY, United States of America, pdube@us.ibm.com, Li Zhang

Provisioning time for virtual machines is a major bottleneck affecting the performance of cloud offerings. A clear understanding of the provisioning time and its dependency on system resources and provisioning parameters will facilitate design and deployment of cloud environments. We propose a queueing model of the cloud environment and use it to characterize the provisioning time. The model identifies system resources that can become performance bottleneck and hinder the cloud scalability.

4 - Optimization and Simulation in the Vanguard Cloud

Brian Lewis, Vice President, Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

Vanguard Software recently launched Vanguard Cloud, a new cloud computing service for running large-scale simulations and optimizations. We will discuss the rationale behind creating this service for our Vanguard System customers, the model types that tend to require a high-performance computing grid, the details of how Vanguard Cloud operates (such as security, compression, load-balancing, and other issues), and our expectations about the future of cloud computing for advanced analytics.

■ MC51

C -Room 12, Level 2- Mezzanine

DoD Supply Chain Modeling

Sponsor: Military Applications
Sponsored Session

Chair: Alan Johnson, Air Force Institute of Technology, 2950 Hobson Way, Bldg 641, W-P AFB, OH, 45433, United States of America

1 - Supply Chain Synchronization: Improving Distribution Velocity

Ben Skipper, Asst Professor, Air Force Institute of Technology, 2950 Hobson Way, WPAFB, OH, 45433, United States of America, jskipper@afit.edu, Chris Lanier

We examine whether pallet group size was a significant factor in determining total time enroute for recent pallets bound from the Defense Logistics Agency warehouse in Susquehanna, Pennsylvania to Aerial Ports of Delivery (APODs) in Iraq. Average port hold times for transship locations and total time enroute were calculated. Multiple regression models were tested to determine if a significant relationship existed between pallet group size and total time enroute.

2 - Effect of Transloading Variance on Total Logistics Costs: An Inventory Theoretic Approach

Tiffany Harper, Air Force Institute of Technology, 2950 Hobson Way, Bldg 641 Room 211, WPAFB, OH, 45433-7765, United States of America, tharper@afit.edu

This study combines the inventory theoretic approach with discrete event simulation to analyze logistics costs of the U.S. military supply chain. When the U.S. military conducts operations, it requires a lot of materiel, thus logistics is a critical component of military success. The analysis focuses on aerial transportation of supplies into Afghanistan and the affect of transloading (moving materiel between transportation modes) variance reduction on total logistics costs.

3 - Optimal CV-22 Centralized Intermediate Repair Facility Locations and Parts Repair

William Cunningham, Professor, Air Force Institute of Technology, 2950 Hobson Way, Wright-Patterson AFB, OH, 45433, United States of America, william.cunningham@afit.edu, Ryan Rowe, Ben Skipper

The CV-22 Osprey is currently being fielded by Air Force Special Operations Command. As part of sustainment efforts for this new weapons system, the USAF is interested in determining where Centralized Intermediate Repair Facilities (CIRFs) for the CV-22 should be located and what parts should be repaired at a CIRF. This study analyzed cost and transportation time data to identify locations and historical failure and demand data for particular CV-22 parts.

4 - Fuel Savings Opportunities From Air Refueling

Alan Johnson, Professor, Air Force Institute of Technology, ajohnson@afit.edu, Murat Toydas, Doral Sandlin

Fuel is critical for aviation operations, yet is increasingly expensive. Air refueling can extend range and save fuel by enabling transport aircraft to depart with less fuel in exchange for more cargo. We introduce two non-linear optimization models that examine the tradeoff between departure fuel weight and loaded cargo for given origin, destination, and tanker base positions and freight quantities to be moved. We use two example scenarios to show that substantial fuel savings are possible.

■ MC52

C -Room 13, Level 2- Mezzanine

Homeland Security: Challenges and Advances in Biodefense

Cluster: Homeland Security and Defense
Invited Session

Chair: Eva Lee, Professor & Director, Georgia Institute of Technology, Center for Operations Research in Medici, Industrial & Systems Engineeriing, Altanta, GA, 30332-0205, United States of America, eva.lee@gatech.edu

1 - Development of Metrics for Evaluating Operational Biosurveillance Models

James Chung, PNNL, 902 Battelle Blvd, MSIN K7-20, Richland, WA, 99352, United States of America, james.chung@pnl.gov, Courtney Corley, Mary Lancaster, Ronald Walters, Robert Brigantic, Taylor McKenzie

DHS through the National Biosurveillance Integration Center (NBIC) has tasked the Pacific Northwest National Laboratory to characterize, evaluate, and catalog operational event-detection biosurveillance systems. We present the findings of a supporting first element of this task to engage a panel of subject matter experts and stakeholders to develop a set a metrics and approaches for evaluating and characterizing syndromic surveillance, indicator, and event detection biosurveillance systems.

2 - Will the New Health Care Financing Legislation Improve Biodefense Readiness?

Douglas A. Samuelson, President and Chief Scientist, InfoLogix, Inc., Annandale, VA, United States of America, samuelsondoug@yahoo.com

The U.S. has now mandated broader access to health care, more training for medical professionals and others, and more effectiveness research. Nevertheless, a number of needed readiness-related improvements remain to be made. These include better monitoring of population health status and early recognition of incipient epidemics, attention to longer-acting infectious and toxic agents, and best practices for dealing with threats as they emerge. We discuss recent events and implications.

3 - Strategies for Population Protection - In the Event of Bioterrorism

Eva Lee, Professor & Director, Georgia Institute of Technology, Center for Operations Research in Medici, Industrial & Systems Engineeriing, Altanta, GA, 30332-0205, United States of America, eva.lee@gatech.edu, Chien-Hung Chen

In this talk, we will share our experience in biosurveillance and large-scale population health and emergency response. An integrative information-decision support system that is designed for establishment of service constructs to mount an effective medical countermeausre dispensing will be described. General challenges will be outlined. This work is joint with Strategic National Stockpile at the Centers for Disease Control and Prevention.

4 - Disease Propagation Analysis and Mitigation Strategies for Effective Mass Dispensing

Chien-Hung Chen, Georgia Tech, Atlanta, GA, United States of America, cchen@isye.gatech.edu, Eva Lee

Large-scale dispensing of medical countermeasures creates a large influx of individuals to dispensing centers which raises the risk of high degree of intra-facility infections. Proper design of dispensing centers, and understanding of operational factors that can mitigate infection are critical. We investigate disease propagation characteristics within large-scale dispensing sites and offer effective strategic intervention. This work is joint with CDC.

■ MC53

C -Room 14, Level 2- Mezzanine

Network Design in Telecommunications

Sponsor: Telecommunications
Sponsored Session

Chair: Si Chen, Assistant Professor, Murray State University, Murray, KY, 42071, United States of America, si.chen@murraystate.edu

1 - The Network Design Problem with Relays

Abdullah Konak, Penn State Berks, Tulpehocken Road, P.O. Box 7009, Reading, PA, United States of America, konak@psu.edu

In this paper, we present a new path-based formulation of the network design problem with relays (NDPR) in which the problem is modeled as two independent decisions, path and relay decisions. We show that for a given set of the paths for each commodity, the location of relays can be determined by solving a set-covering problem. Then, this approach is used in a genetic algorithm (GA) to solve the NDPR in two phases.

2 - The Stochastic Connected Facility Location Problem

M Gisela Bardossy, University of Maryland, R.H.Smith School of Business, and Institute for Systems Research, College Park, MD, United States of America, bardossy@umd.edu, S. Raghavan

The Stochastic Connected Facility Location (SConFL) problem is a variant of the ConFL problem that explicitly models uncertainty in some of the input costs. We propose a transformation strategy to obtain a deterministic equivalent formulation of the problem, and consequently apply a successful heuristic based on dual-ascent and local search to obtain high-quality solutions and lower bounds for the problem.

3 - Degree Constrained Spanning Tree Problem with Node Dependent Costs

Luis Gouveia, University of Lisbon - CIO, Campo Grande - Cidade Universitària, Lisboa, Portugal, legouveia@fc.ul.pt, Pedro Moura

We model the Degree constrained Spanning Tree Problem with Node dependent Costs in a directed graph with 0,1 arc variables and 0,1 variables for each possible degree of each node. In order to enhance the LP of this model, two reformulations were proposed before: a knapsack reformulation of a subproblem and a disctetization of the arc variables. Both lead to larger sized models. In this talk we discuss inequalities projected on the original space and implied by each of the two reformulations.

4 - Fixed-charge Relay Network Design

Halit Uster, Associate Professor, Industrial and Systems Eng, Texas A&M University, College Station, TX, 77843, United States of America, uster@tamu.edu, Panitan Kewcharoenwong

We consider the design of a multi-commodity network utilizing relays with applications in telecommunications. We provide a MILP model for the associated location and routing decisions and a Benders decomposition based solution algorithm. Computational results illustrating the efficiency of the approach are also presented.

■ MC54

C -Room 15, Level 2- Mezzanine

Panel Dicussion: Games and Exercises in Management of Technology and New Product Development Courses

Sponsor: Technology Management/New Product Development
Sponsored Session

Moderator: Cheryl Druehl, Assistant Professor, George Mason University, 4400 University Dr, MS 5F4, Fairfax, VA, 22030, United States of America, cdruehl@gmu.edu

1 - Panel Discussion: Games and Exercises in Teaching MOT and NPD
Panelists: Cheryl Druehl, Assistant Professor, George Mason University, 4400 University Dr, MS 5F4, Fairfax, VA, 22030, United States of America, cdruehl@gmu.edu, Raul Chao, Darden School of Business, 100 Darden Blvd., Charlottesville VA 22903, United States of America, ChaoR@darden.virginia.edu, Jürgen Mihm, INSEAD, Constance de Blvd, Fontainebleau, France, jurgen.mihm@insead.edu

Please join us to discuss and share games in teaching MOT and NPD. Panelists will include Raul Chao (Darden) discussing the vending machine exercise, Jurgen Mihm (INSEAD) explaining the portfolio game and others.

■ MC55

C -Room 16, Level 2- Mezzanine

Managing Innovation in Complex Product Development and Service Systems

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Bilal Gokpinar, Assistant Professor, University College London, Management Science and Innovation, London, United Kingdom, b.gokpinar@ucl.ac.uk

1 - Value Chain Dynamics: From Scope to Profit Evolution Given Modular Innovation
Francisco Veloso, Catolica Lisbon and Carnegie Mellon, Palma de Cima, Lisbon, Portugal, fveloso@cmu.edu, Michael Jacobides, Claudio Wolter

Existing research has not adequately studied the interplay between sector evolution and firm vertical scope, or how these factors shape profitability. We study the profitability implications of scope changes and how these relate to changes in firms' underlying capabilities. It sheds light on a the dynamics of sector evolution by looking at how modular innovations affect both specialists and integrated firms, and ultimately shape both the sector's scope and the profit distribution within it.

2 - The Cost of Software Complexity and the Impact of Architectural Redesign
Alan MacCormack, Visiting Associate Professor, MIT Sloan School of Management, 50 Memorial Drive, Cambridge, MA, 02142, United States of America, alanmac@mit.edu

Software systems rarely die. Instead, new versions are built on top of older ones, with a consequent increase in the costs related to complexity. When should you throw out the old version and start anew? We report data from an empirical study of the costs of software complexity, and the potential benefits of redesign. We show that greater complexity is associated with higher maintenance costs, and provide data from one firm that highlights the impact of a redesign in reducing these costs.

3 - Software Architecture and Bug Fixing in Open Source Software Development
Manuel Sosa, INSEAD, Boulevard De Constance, Fontainebleau, France, manuel.sosa@insead.edu, Jürgen Mihm, Tyson Browning

We examine a large longitudinal sample of bugs associated with several open source applications developed by Apache. We estimate a hazard model to study the link between software architectural properties and time to fix bugs. Our results establish a link between product architecture and the organizational capability to repair defects.

4 - Bottlenecks and Productivity in White-Collar Work: A Networks Approach
Bilal Gokpinar, Assistant Professor, University College London, Management Science and Innovation, London, United Kingdom, b.gokpinar@ucl.ac.uk, Seyed Iravani, Wallace Hopp

Bottleneck analysis in blue collar work has been central in determining and improving key performance metrics such as the throughput of the line and cycle time of the process. However, an analogous bottleneck analysis is missing in white-collar work. In this study, we first develop an analytical model of bottleneck in white-collar work, and then examine performance implications of bottlenecks using archival data in new vehicle development.

■ MC56

C - Room 1, Level 1

Simulation Optimization and its Applications

Sponsor: Simulation Society
Sponsored Session

Chair: Seong-Hee Kim, Associate Professor, Georgia Institute of Technology, 765 Ferst Dr, Atlanta, GA, 30332, United States of America, skim@isye.gatech.edu

1 - Sequential Sampling for Selection: The Undiscounted Case
Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu, Stephen E. Chick

In the context of sequential sampling for selection, we extend recent work on knowledge gradient methods and the economics of simulation sampling. We derive new allocation and stopping rules by thinking of sequential sampling as a "real option" to learn before selecting an alternative. These new rules have attractive theoretical properties based on dynamic programming and a continuous-time free boundary problem. Empirically, they perform better than all previously proposed procedures.

2 - Performance Measures for Ranking and Selection Procedures
Rolf Waeber, Cornell University, 206 Rhodes Hall, Ithaca, NY, 14853, United States of America, rw339@cornell.edu, Peter Frazier, Shane Henderson

To efficiently compare Ranking and Selection procedures, we present a three-layer performance evaluation process. The two most popular formulations, namely the Bayes and Indifference Zone formulations, have a common representation analogous to convex risk measures used in quantitative risk management. We study decision makers' acceptance sets via an axiomatic approach and introduce a new performance measure using computational cost.

3 - Speeding Up COMPASS for High-Dimensional Discrete Optimization via Simulation
Barry L Nelson, Professor and Chair, Northwestern University, Department Industrial Engr. & Mgmt. Sci., 2145 Sheridan Road, C210, Evanston, IL, 60208-3119, United States of America, nelsonb@northwestern.edu, Jeff Hong, Jie Xu

The COMPASS algorithm is a locally-convergent random-search algorithm for solving discrete optimization-via-simulation problems. While the asymptotic convergence of COMPASS does not depend on the problem dimension, the finite-time performance of the algorithm often deteriorates as the dimension increases. We identify reasons for this deterioration and propose a change that significantly speeds up COMPASS without affecting its convergence guarantee.

■ MC57

C - Room 2, Level 1

INFORMS-FSS Best Student Research Paper Award

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 - Improved Seller Transaction Costs in Blind Portfolio Auctions via Intermediaries
Michael Padilla, Stanford University, Packard 247, Stanford, CA, 94107, United States of America, mtp@stanford.edu, Benjamin Van Roy

As much as 12% of the daily traded volume in number of shares on the NYSE are sold by institutional investors to brokers through blind portfolio auctions. Such transactions typically take the form of a first-price sealed-bid auction in which the seller engages a few potential brokers and provides limited information about the portfolio being sold. Uncertainty about the portfolio contents reduces bids, effectively increasing the transaction cost paid by the seller. We consider the use of a trusted intermediary or equivalent cryptographic protocol to improve the efficiency of such a transaction. In particular, we propose a mechanism through which each party provides relevant private information to an intermediary who ultimately reveals only the portfolio contents and price paid, and only to the seller and winning bidder. Through the analysis of a game-theoretic model, we demonstrate substantial potential benefits to sellers. For example, under reasonable and standard assumptions on brokers' utility functions and investment preferences, it is possible to realize a reduction in the seller's expected transaction costs of over 10%.

2 - A Non-zero-sum Game Approach to Convertible Bonds: Tax Benefit, Bankrupt Cost and Early/Late Calls

Xiangwei Wan, The Chinese University of Hong Kong, 814, William Mong Engineering Building, The Chinese University of Hong Kong, Hong Kong, Hong Kong - PRC, xwwan@se.cuhk.edu.hk, Nan Chen, Min Dai

Convertible bonds are hybrid securities that embody the characteristics of both straight bonds and equities. The conflict of interests between bondholders and shareholders affects the security prices significantly. In this paper, we investigate how to use a non-zero-sum game framework to model the interaction between bondholders and shareholders and to evaluate the bond accordingly. Mathematically, this problem can be reduced to a system of variational inequalities. We explicitly derive Pareto-optimal Nash equilibrium to the game. Our model shows that credit risk and tax benefit have considerable impacts on the optimal strategies of both parties. The shareholder may issue a call when the debt is in-the-money or out-of-the-money. This is consistent with the empirical findings of "late and early calls" (Ingersoll (1977), Mikkelson (1981), Cowan et al. (1993) and Asquith (1995)). In addition, the optimal call policy under our model offers an explanation for certain stylized patterns related to the returns of company assets and stock on calls.

3 - Short Sales in Log-robust Portfolio Management

Ban Kawas, Lehigh University, 200 W Packer Ave, Bethlehem, PA, 18015, United States of America, bhk206@lehigh.edu, Aurelie Thiele

This paper extends the Log-robust portfolio management approach to the case with short sales, i.e., the case where the manager can sell shares he does not yet own. We model the continuously compounded rates of return, which have been established in the literature as the true drivers of uncertainty, as uncertain parameters belonging to polyhedral uncertainty sets, and maximize the worst-case portfolio wealth over that set in a one-period setting. The degree of the manager's aversion to ambiguity is incorporated through a single, intuitive parameter, which determines the size of the uncertainty set. The presence of short-selling requires the development of problem-specific techniques, because the optimization problem is not convex. In the case where assets are independent, we show that the robust optimization problem can be solved exactly as a series of linear programming problems; as a result, the approach remains tractable for large numbers of assets. We also provide insights into the structure of the optimal solution. In the case of correlated assets, we develop and test a heuristic where correlation is maintained only between assets invested in. In computational experiments, the proposed approach exhibits performance superior to that of the traditional robust approach.

4 - Empirical Analysis of Tick Sizes and Exchange Efficiency

Waraporn Tongprasit, Stanford University, Department of Management Science and Eng, Palo Alto, CA, United States of America, waraporn@stanford.edu, Benjamin Van Roy

We present findings from an empirical analysis of the efficiency of the Stock Exchange of Thailand (SET) and the impact of a tick size reduction. Contrary to the common belief that the change enhanced efficiency, our analysis suggests that it leads to significant decreases in efficiency for some stocks. In particular, our results indicate that, though tick size reduction did increase trading volume, the average utility gain per trade decreased. For some stocks the latter effect dominated the former, resulting in overall efficiency losses.

■ MC58

C - Room 3, Level 1

Risk Management and Regulation

Cluster: Quantitative Finance
Invited Session

Chair: Paul Glasserman, Columbia University, IEOR Department, New York, NY, United States of America, pg20@columbia.edu

Co-Chair: Jussi Keppo, Associate Professor, University of Michigan Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, keppo@umich.edu

1 - Contingent Capital with a Capital-Ratio Trigger

Behzad Nouri, IEOR Department, Columbia University, New York, United States of America, bn2164@columbia.edu, Paul Glasserman

Among the solutions proposed to the problem of banks "too big to fail" is contingent capital in the form of debt that converts to equity when the firm's capital ratio falls below a threshold. We derive closed-form expressions to value such securities when the firm's assets are modeled as geometric Brownian motion and the conversion trigger is based on a book-value capital ratio. We find an explicit formula for the fraction of equity held by the original holders of the contingent capital debt.

2 - Measuring Systemic Risk: A Network Approach

Rama Cont, Columbia University, IEOR Dept, New York, United States of America, Rama.Cont@columbia.edu

We propose a quantitative approach for assessing the systemic impact of the failure of a financial institution, based on a simple model of default contagion in a banking system. Our approach takes into account both volatility and correlation of market factors and contagion effects due to counterparty exposures. We illustrate its implementation using a database of interbank exposures obtained from the Brazilian central bank.

3 - External Risk Measures and Basel II Accord

Xianhua Peng, Assistant Professor, Hong Kong University of Science and Technology, Clear Water Bay, Kowloon, Hong Kong, China, xp2102@caa.columbia.edu, Steven Kou

Basel II Accord and its recent revision in 2009 use Value-at-Risk (VaR) with scenario analysis as the risk measure for setting capital requirement. We propose new data-based risk measures called natural risk statistics that are characterized by a new set of axioms. Natural risk statistics include VaR with scenario analysis, in particular Basel II risk measures, as special cases and therefore provide the axiomatic justification for using them as external risk measures in financial regulation.

4 - The Impact of Volcker Rule on Bank Profits and Loan Spreads

Jussi Keppo, Associate Professor, University of Michigan Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, keppo@umich.edu, Holly Chung

Banks trade in order to hedge their cash flows and to increase their value through alpha generating trading strategies. We analyze the impact on bank profits and loan spreads if the trading is prevented by regulation.

■ MC59

H - Salon A, 4th Floor

Panel Discussion: The Academic Job Search

Cluster: Job Placement Services
Invited Session

Moderator: Bala Shetty, Professor, Texas A & M University, 8413 Wildewood Circle, College Station, TX, 77845, United States of America, BShetty@mays.tamu.edu

1 - Panel Discussion: The Academic Job Search

Panelists: Lawrance Seiford, Professor, University of Michigan, Ann Arbor MI, United States of America, seiford@umich.edu, Edward Anderson, Associate Professor, University of Texas, 1 University Station B6500, Austin TX 78733, United States of America, Edward.Anderson@mccombs.utexas.edu

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.

■ MC60

H - Salon B, 4th Floor

Group Decision Making

Sponsor: Decision Analysis
Sponsored Session

Chair: Ralph Keeney, Fuqua School of Business, 101 Lombard St., #704W, San Francisco, CA, 94111, United States of America, KeeneyR@aol.com

1 - Opinion Aggregation in Small Groups

Jack Soll, Associate Professor of Management, Duke University: Fuqua School of Business, One Towerview Drive, Box 90120, Durham, NC, United States of America, jsoll@duke.edu, Lehman Benson, John Payne, Albert Mannes

In any 3-person group, one member's quantitative opinion will typically be more discrepant than the others. This outlier opinion should usually be included in any composite estimate. This is despite the fact that outliers tend to be the least accurate group members individually. Interacting groups often underweight outliers, to the detriment of group accuracy.

2 - Individual Heuristics and Group Decision Rules

Manel Baucells, Universitat Pompeu Fabra, Ramon Trias Fargas 25-27, Barcelona, 08005, Spain, manel.baucells@upf.edu, Matthias Seifert

Individuals are rationally bounded and use decision rules that require limited information processing. In addition, some of the partial information they use might not be accurate. The role of group decision rules is to eliminate these individual defects by extracting the signal from the noise. We study simple group decision rules, and explore their performance in terms of cumulative dominance compliance.

3 - Foundations for Group Decision Analysis

Ralph Keeney, Fuqua School of Business, 101 Lombard St., #704W, San Francisco, CA, 94111, United States of America, KeeneyR@aol.com

This presentation provides a natural and logical extension of the Bayesian expected utility model for guiding individual decisions to a group expected utility model for group decisions.

■ MC63

H - Room 404, 4th Floor

Portfolio Decision Analysis II

Sponsor: Decision Analysis
Sponsored Session

Chair: Ahti Salo, Professor, Aalto University School of Science and Technology, Systems Analysis Laboratory, P.O. 11100, Aalto, 00076, Finland, ahtisalo@cc.hut.fi

1 - Portfolio Optimization with Enhanced Behavioral Features

Philippe Delquié, GWU School of Business, Decision Sciences, Washington, DC, 20052, United States of America, delquie@gwu.edu, Alessandra Cillo

We present results of stocks portfolio optimization using a behaviorally motivated risk measure. The resulting portfolios tend to be more diversified, and retain more positive skewness in the returns, than the Mean-Variance portfolios, which are desirable characteristics. Also, unlike the standard model, our risk measure allows the investor to decline holding an efficient portfolio if its risk/reward profile is insufficiently favorable.

2 - Selecting Better Portfolios Based on Uncertainty-Adjusted Performance Estimates

Ahti Salo, Professor, Aalto University School of Science and Technology, Systems Analysis Laboratory, P.O. Box 11100, Aalto, 00076, Finland, ahtisalo@cc.hut.fi, Juuso Liesiö, Eeva Vilkkumaa

When projects are chosen based on uncertain estimates about their future performance, the selected project portfolio tends to offer less value than what the prior estimates would suggest. This disparity can be particularly significant when the level of uncertainty varies considerably from one project to the next. We develop an approach for adjusting prior performance estimates in recognition of these uncertainties and discuss its relevance for the selection of better project portfolios.

3 - Creating Rather Than Optimizing Portfolios

Christoph Loch, INSEAD, Constance de Blvd, Fontainebleau, France, Christoph.LOCH@insead.edu, Stylianos Kavadias

The portfolio literature conceptualizes projects as given entities to fit capacity. In many contexts, the organization starts with a set of problems or opportunities, and then designs initiatives to fulfill these goals, which can morph and change size depending on circumstances. Can we do better portfolio management with this perspective?

■ MC68

H - Room 415, 4th Floor

New Business Models for eBusiness

Sponsor: eBusiness
Sponsored Session

Chair: Hyoduk Shin, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, hyoduk-shin@kellogg.northwestern.edu

1 - An Analysis of Voluntary Profiling Policy in Online Markets

Byungwan Koh, The University of Texas at Dallas, School of Management, 800 W. Cambell Rd. SM33, Richardson, TX, 75083, United States of America, byungwan.koh@utdallas.edu, Srinivasan Raghunathan

The supposed rationale for the voluntary profiling policy is that only consumers that expect to benefit will participate in profiling; hence, no consumer will be worse off under the policy. We find that this rationale does not hold and show that all those that do not participate and some that do participate in profiling are worse off under the voluntary profiling policy. We also find that the voluntary profiling policy is Pareto Optimal only when the search cost saving is sufficiently high.

2 - Evaluation of Payment Methods for Online Games

Michael Savoie, Director, CITM, The University of Texas at Dallas, 800 W. Campbell Road, M/S SM23, Richardson, TX, 75080, United States of America, Michael.Savoie@utdallas.edu

Online games have exploded in recent years. For example FarmvilleÆ, played on Facebook, has 78 million monthly players with 35 million playing every day. A recent addition to online games is the opportunity to use real dollars to significantly reduce the time necessary to move through the game and achieve higher levels of game play. This paper looks at various methods used by online games and evaluates their effectiveness in enticing players to invest real dollars into their virtual game play.

3 - Optimal Auctioneer Fee Policy

Justin Jia, Smeal College of Business, The Pennsylvania State University, Business Building, University Park, PA, 16802, United States of America, zuj100@psu.edu

In online eBay-like auctions, auctioneers provide platforms for sellers to hold auctions and collect fees from sellers. This study formulates the problem as a Bayesian game with an auctioneer and a private-type seller, and investigates auctioneers' optimal fee policies. The study shows that linear policies are not generally optimal - they are optimal if and only if the seller's value follows a power distribution. The study also proposes three generally optimal policies for implementation.

4 - Software Giant's Entry in Open Source Software Support Market

Hyoduk Shin, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, hyoduk-shin@kellogg.northwestern.edu, Byung Cho Kim, Tridas Mukhopadhyay

This paper examines competition among open source software (OSS) support providers. Inspired by Oracle's Unbreakable Linux program which synchronizes with the codes of Red Hat Linux, we investigate how a software giant's entry affects existing OSS support providers. Interestingly, we find the conditions under which Oracle's entry helps Red Hat and hurts its competitor, Novell. Our results also indicate that social surplus increases with the quality gap between Oracle and Red Hat.

■ MC69

H - Salon F, 6th Floor

Fleet Management Models in Rail Transportation

Sponsor: Railway Applications
Sponsored Session

Chair: Brian Lunday, Assistant Professor, Department of Mathematical Sciences, U.S. Military Academy, Department of Math. Sci. (Building 601), United States Military Academy, West Point, NY, 10996, United States of America, lunday@vt.edu

1 - Estimating Order Flow Times in Freight Rail Networks

Ram Gopolan, Assistant Professor, The Fox School of Business, 517, Alter Hall, Temple University, Philadelphia, PA, 19122, United States of America, gopalan@temple.edu, T.T. Narendran, T. Godwin

We consider the problem of providing order delivery time quotations in an unscheduled rail network. Each order is fulfilled as soon as the required rolling stock, e.g., locomotive and rake, can be assembled at the origin. An order's delivery time depends upon the available fleet capacity, deadhead policy and the level of congestion present. We develop an analytic approximation to estimate delivery time quotations, along with required fleet capacity.

2 - An Approximate Dynamic Programming Model for Locomotive Optimization

Belgacem Bouzaiene-Ayari, Princeton University, 113A Sherrerd Hall, Princeton, NJ, 08540, United States of America, belgacem@princeton.edu, Warren Powell

We present a locomotive optimization model that can be used for strategic, tactical, and real-time operations, based on the modeling and algorithmic framework of approximate dynamic programming. The model captures locomotives and the complex process of assigning locomotives to trains at a high level of detail. ADP makes it possible to model uncertainty in transit and yard times. We present the results of a series of simulations testing the ability of ADP to produce robust solutions.

3 - Probabilistic and Possibilistic Optimal Wagon Management Models for Stochastic Railways Networks

Loukas Dimitriou, National Technical University of Athens, 5, Iroon Polytechniou Str., Athens, Greece, lucdimit@central.ntua.gr, Athanasios Ballis

In the current paper, optimal strategies of network-wide empty railways wagons allocation are identified by solving alternative combinatorial programming problems, for taking into account stochasticity. Namely, a probabilistic model -analysed by means mathematical simulation- and a possibilistic counterpart -utilizing concepts from fuzzy sets theory. Results from a part of the European railway network are presented, illustrating the applicability of the proposed frameworks to similar cases.

4 - Equitable Apportionment of Railcars Within a Pooling Agreement for Shipping Automobiles

Brian Lunday, Assistant Professor, Department of Mathematical Sciences, U.S. Military Academy, Department of Math. Sci. (Building 601), United States Military Academy, West Point, NY, 10996, United States of America, lunday@vt.edu, Hanif Sherali

Examining the apportionment of railcars to car manufacturers and railroads participating in a pooling agreement for shipping automobiles, given a dynamically-sized fleet, we demonstrate two potential inequities in current practices. Considering several proposed alternative allocation schemes for shippers and carriers, we present computational results from realistic instances derived from data representative of the current business environment and conclude with recommendations for implementation.

■ MC70

H - Salon G, 6th Floor

Joint Session AAS/ TSL: Aviation Policy: Evaluation of Congestion Management Alternatives

Sponsor: Aviation Applications/ Transportation Science and Logistics Society
Sponsored Session

Chair: Michael Ball, Professor, University of Maryland, Robert H Smith School of Business, College Park, MD, 20742, United States of America, mball@rhsmith.umd.edu

1 - Congestion Pricing and Auctions to Manage Airspace and Runway Congestion

Karla Hoffman, Professor, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States of America, khoffman@gmu.edu, Frank Berardino, George Hunter

We present a two-staged approach to the management of runway congestion. The first stage imposes a service standard on runway access that is consistent with an airport's good-weather capacity. Then, when capacity is reduced below that standard, we propose using congestion pricing to allocate flights based on the congestion they impose on the system.

2 - The Impact of Demand Management on Delays and Flight Schedule Reliability in Europe and the US

Amedeo Odoni, Prof, MIT, Rm 33-219, Cambridge, MA, 02139, United States of America, arodoni@mit.edu

We report on a study that compared the performance of the busiest airports in Europe and in the United States with respect to delays and flight schedule reliability. The use of slot coordination and slot limits in Europe is one of the principal reasons for the major differences observed.

3 - Decision-theoretic Prediction and Policy Design: GDP Slot Auctions in the National Airspace System

James Bono, Assistant Professor, American University, 4400 Massachusetts Avenue, 107 Kreeger Hall, Washington, DC, 20016, United States of America, bono@american.edu, David Wolpert

We use Predictive Game Theory (PGT) to examine the potential for simple auctions to efficiently allocate arrival slots during Ground Delay Programs (GDPs). The results show that a second price auction has higher expected efficiency, lower variance in efficiency, lower probability of significant efficiency loss and higher probability of significant efficiency gain than a first price auction. This is despite the fact that dominant strategy implementation does not apply to the GDP slot auction.

4 - Social Welfare Justification for Market-based Approaches for Airport Congestion Management

Prem Swaroop, Robert H Smith School of Business, 3330C, Van Munching Hall, University of Maryland, College Park, MD, 20742, United States of America, pswaroop@rhsmith.umd.edu, Michael Ball

Most US airports allow airlines to offer flights on first-come-first-served basis, unlike EU. The few exceptions with High Density Rules, have recently had exemptions granted - with severe consequences for entire National Air Space. This brings congestion management to the fore, as without controls, an airport naturally evolves to a highly congested state. We look at key tradeoffs in setting limits on operations at an airport, thru marginal analysis of schedule delay and delay-to-schedule costs.

■ MC71

H - Salon H, 6th Floor

Panel: Studying Research with William W. Cooper

Cluster: In Honor of Bill Cooper
Invited Session

Moderator: Yuji Ijiri, Carnegie Melon University, Pittsburgh, PA, United States of America

1 - Studying Research with William W. Cooper

Panelists:Yuji Ijiri, Carnegie Melon University, United States of America, Tae Sik Ahn, Dean of the Business School, Seoul National University in Korea., Seoul, ahnts@snu.ac.kr, Ray Stephens, Ohio University, United States of America, Andrew Whinston, University of Texas at Austin, Information, Risk, and Operations Manage, McCombs School of Business, Austin TX, United States of America, abw@uts.cc.utexas.edu, Rajiv Banker, Temple University, Philadelphia PA, United States of America, banker@temple.edu

This session features some of Bill Cooper's doctoral students discussing his research philosophy and his contributions to diverse fields ranging from accounting to policy analysis.

■ MC72

H - Salon J, 6th Floor

Public Transit II

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Don Eisenstein, Professor of Operations Management, University of Chicago, Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, Don.Eisenstein@chicagobooth.edu

1 - Self-equalizing Headways Reduce Bus-bunching

Don Eisenstein, Professor of Operations Management, University of Chicago, Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, Don.Eisenstein@chicagobooth.edu, John Bartholdi

The main challenge for an urban bus system is to maintain constant headways between successive buses. Most bus systems try to adhere to a schedule, but the natural dynamics of the system tends to collapse headways so that buses travel in bunches. We propose a method of coordinating buses that abandons the idea of a schedule and any a priori headway and instead allows equal headways to emerge spontaneously. We also report on the implementation of our scheme for a public bus route in Atlanta.

2 - An Assignment Problem Based Algorithm for a School Bus Scheduling Problem

Byung-In Kim, Associate Professor, Pohang University of Science and Technology, Nam-Gu, Hyoja-Dong, POSTECH, Pohang, Korea, Republic of, bkim@postech.ac.kr, Junhyuk Park

This talk presents a school bus scheduling problem wherein trips for each school are given. Each school has its time window. A school bus can serve multiple trips for multiple schools. The school bus scheduling problem seeks to optimize bus schedules to serve all the given trips considering the school time windows. An assignment problem based algorithm with an improvement method is proposed for the problem. Computational experiments show the effectiveness of the proposed approaches.

3 - Extraboard Work Assignment Problem

Fei Li, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, lixxx768@umn.edu, Diwakar Gupta

Faced with varying workforce requirements and availability, transit operators have a certain fraction of their drivers serve as extraboard (XBD) operators. XBD drivers are not assigned specific work in advance. Instead, they cover any open work that becomes available during the course of daily operations. We present models and approximation algorithms for the extraboard work assignment problem. We also report results based on simulated and actual data that establish the benefits of our approach.

■ MC73

H - Salon K, 6th Floor

Collaborative Logistics Applications

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Avinash Unnikrishnan, Assistant Professor, West Virginia University, ESB 621, P.O. Box 6103, Dept of Civil Engineering, Morgantown, WV, 26506, United States of America, avinashu@gmail.com

1 - Distributed Consolidation to Minimize Transportation and Inventory Costs

Don Warsing, Associate Professor, North Carolina State University, Department of Business Management, Raleigh, NC, 27695, United States of America, don_warsing@ncsu.edu, Michael G. Kay

We develop a procedure that allows shippers to build coalitions with other shippers to share the cost of freight transportation. Through this distributed consolidation procedure, each shipper seeks to minimize the sum of its own transportation and cycle stock holding costs on a shipment-by-shipment basis. This allows most shippers in the pool to significantly improve their costs as compared to shipping independently or being part of a joint solution that imposes a common shipment frequency.

2 - Collaboration in Cyber Transportation Logistics: Paradigms and Technologies

Yupo Chan, University of Arkansas at Little Rock, 2801 S. University Avenue, Little Rock, AR, United States of America, yxchan@ualr.edu, Albert K. Toh

This presentation analyzes the role of e-SupplyChain/Logistics (e-SC/L) in global business-to-business electronic-commerce. A major beneficiary of e-SC/L is the small and medium enterprises, who can leverage technologies to bypass the extra cost associated with employing a third-party broker, who traditionally bridges the gap between suppliers and retailers. Among the technologies included in the e-SC/L paradigm are transportation, identification, and modeling/simulation.

3 - A Stochastic Multicommodity Flow Approach to Combinatorial Truckload Auctions

Richard Chen, Hillsborough, CA, United States

We consider fully-enumerated stochastic combinatorial truckload procurement auctions characterized by uncertainties in carriers' repositioning capacities and costs. We present an implicit bidding approach for combinatorial auctions to derive a tractable winner determination problem that is fully expressive and completely captures carriers' uncertain repositioning capacities and costs. We then present an accelerated decomposition algorithm for solving the resulting winner determination problem.

4 - Models for Minimizing Backhaul Costs Through Freight Collaboration

Avinash Unnikrishnan, Assistant Professor, West Virginia University, ESB 621, P.O. Box 6103, Dept of Civil Engineering, Morgantown, WV, 26506, United States of America, avinashu@gmail.com, Erin Bailey, Dung-Ying Lin

This work focuses on how a carrier can introduce collaboration in their operations by fulfilling a collaborative carrier's or shipper's delivery requests on its backhaul route. Two optimization models are developed to route the carrier of interest's backhaul routes and select collaborative shipments to fulfill. Two solution methodologies, a greedy heuristic and tabu search, are used to solve the two problems.

■ MC74

H - Room 602, 6th Floor

Network Science in Transportation

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Lili Du, NEXTRANS Center, Purdue University, 2700 Kent Avenue, West Lafayette, IN, 47906, United States of America, ldu@purdue.edu

1 - Semi-Markov Chain Modeling of Human Mobility

Samiul Hasan, samiul.hasan@gmail.com, Satish Ukkusuri

Individual mobility is a fundamental need of all societies to participate in a wide variety of activities including work and leisure. Many factors influence individuals' mobility patterns including the home and work location, transportation environment and the urban land use. Therefore a clear characterization and probabilistic modeling of human mobility patterns has significant impacts: it will allow the development of more realistic agent-based simulation models to forecast urban travel demand which is an important input for traffic simulation. This will influence policy making and transportation decision making. In addition, it will impact the design of transportation infrastructure and the provision of different services to travelers. Such agent-based simulation models have a wide range of applications from urban planning and traffic forecasting to simulating the spreading of biological and mobile viruses. Previous mobility studies have identified interesting insights on human mobility patterns. However, to the best of our knowledge, a rigorous model that captures the spatio-temporal characteristics of the observed mobility patterns is lacking.

2 - Threshold Model of Social Contagion Process on Mixed Networks: Application to Evacuation Decision Making

Samiul Hasan, samiul.hasan@gmail.com, Satish Ukkusuri

Over the last decade, the study of complex networks spanning from the Internet to social networks has grown enormously. Understanding the coupled dynamics between the structural properties and the functions of complex networks has been the principal focus of a wide area of research. A fundamental question relates to how the interactions between the nodes or vertices of the network may cause a small movement in the network to propagate throughout the whole network. Such phenomenon called as cascades or contagion can occur, for example, in the transmission of infectious diseases through communities, global spread of computer viruses on the web, diffusion of activities, beliefs, ideas, and emotions in social networks, failures in electrical systems and the collapse of financial systems. Such contagious behavior can also become a vital component to investigate transportation demand analysis under specific situations. Since transportation systems, have a significant coupling between the dynamic demand (manifestation of human behavior) and the supply, small changes in the behavior can have significant impact on the transportation network. For example, the social contagion process in the social network can be applicable to the modeling of the complex process of information propagation within the social network in hurricane evacuations.

3 - A Dynamic Model for Analyzing Interdependent Infrastructure Systems

Srinivas Peeta, Professor of Civil Engineering, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States of America, peeta@purdue.edu, Pengcheng Zhang

Based on a market-based economic approach and a multilayer infrastructure network (MIN) framework, this study discusses a dynamic model to analyze the interdependencies among various infrastructure systems with explicit consideration of their temporal interactions. Illustrative numerical examples using realistic data are presented to demonstrate the modeling abilities of the proposed approach, as well as the impacts of key dynamic parameters.

4 - Numerical Analysis of Infrastructure Interdependencies

Srinivas Peeta, Professor of Civil Engineering, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States of America, peeta@purdue.edu, Pengcheng Zhang

We present numerical examples for modeling interdependent infrastructure systems. A market-based CGE model is briefly discussed first, followed by numerical experiments using real-world data to illustrate the implications of infrastructure interdependencies in the contexts of capturing cascading failure and the importance of holistic decision-making.

Monday, 4:30pm - 6:00pm

■ MD01

C - Ballroom D1, Level 4

Modeling Benefits of Demand Management in Power Systems

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Ramteen Sioshansi, Assistant Professor, The Ohio State University, 240 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu

1 - Modeling the Impact of Advanced Metering Infrastructures on Electricity Prices

Suvrajeet Sen, Professor, Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, sen.22@osu.edu, Praneeth A.V.S

Smart meters and other metering infrastructures hold the promise of changing the demand profile for electricity through time-of-use pricing. This presentation will present models to assess demand response and its impact on production costs and electricity prices. A case study using data for the Eastern Interconnect will be presented.

2 - Optimization Mechanisms for Residential Electricity Demand in SmartGrids

Lawrence V. Snyder, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, larry.snyder@lehigh.edu, Shalinee Kishore

We consider mechanisms to optimize electricity consumption within a home and across multiple homes. We first present a simple model to choose the timing of appliance operation to take advantage of off-peak electricity rates. We then propose a distributed scheduling mechanism to reduce peak demand within a neighborhood of homes. Finally, we introduce a more powerful optimization model, based on dynamic programming, that accounts for the potential for electricity capacity constraints.

3 - Impact of Coupling Deferrable Demand with Renewable Generation on Operating Reserves Requirements

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

Reliable large scale renewable energy integration places significant operating reserves requirements. We present a two-stage stochastic unit commitment and economic dispatch model for estimating operating reserve requirements, and we use the model to estimate the potential contribution of demand flexibility in replacing operating reserves. We present simulation results for the Western Interconnection for large scale (20-33%) wind integration scenarios.

4 - The Impact of Electricity Tariffs on PHEVs

Ramteen Sioshansi, Assistant Professor, The Ohio State University, 240 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu

We use a unit commitment and PHEV model to examine the impacts of different electricity pricing tariffs on PHEV charging patterns and the net cost and emissions impacts of PHEV use. We show that because of non-convexities in electricity generation costs and difficulties in signaling those costs through tariffs, real-time prices are suboptimal from a cost and emissions standpoint.

■ MD02

C - Ballroom D2, Level 4

Valuation and Management of Energy Storage

Cluster: Energy: Modeling the Interface Between Markets and Operations
Invited Session

Chair: Guoming Lai, Assistant Professor, McCombs School of Business, University of Texas at Austin, Austin, TX, 78712, United States of America, Guoming.Lai@mccombs.utexas.edu

1 - An Hourly Electricity Price Model for Heavy-Tailed Markets

Jae Ho Kim, Princeton University, Department of Oper Res and Fin Engg, Princeton, NJ, 08544, United States of America, jaek@Princeton.EDU

We conduct an empirical study of hourly electricity prices in the Texas (Ercot) region and establish that the price process is non-stationary and heavy-tailed. 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 and study the theoretical implications of our model.

2 - Seasonal Energy Storage Operations with Limited Flexibility

Derek Wang, Doctoral Student, Ross School of Business, University of Michigan, 701 Tappan Street, Ann Arbor, United States of America, wangdd@umich.edu, Owen Wu

The value of seasonal energy storage is realized through storage operations under limited operational flexibility. We characterize the optimal operations strategy and analyze the underlying tradeoffs. We find some counter-intuitive policies can be optimal. Based on the understanding of the optimal policy, we design a method to improve the strategy widely used in practice. We also analyze how decisions and storage value are affected by the level-dependent storing and releasing capacities.

3 - Counteracting Strategic Behavior in Commodity Storage Facilities

Alan Holland, Research Scientist, University College Cork, Dept of Computer Science, Cork, Ireland, a.holland@4c.ucc.ie, Nicola Secomandi, David Parkes

Consider a commodity storage facility that is shared by multiple firms that behave in a self-interested manner. We show how losses in overall welfare may occur in equilibrium and study the problem of counteracting strategic manipulation via the design of alternative economic mechanisms. We present novel algorithms for computing efficiency-maximizing flow plans and conduct an empirical analysis of a natural gas storage facility.

4 - An Approximate DP Approach to Benchmark Practice-based Heuristics for Natural Gas Storage Valuation

Guoming Lai, Assistant Professor, McCombs School of Business, University of Texas at Austin, Austin, TX, 78712, United States of America, Guoming.Lai@mccombs.utexas.edu, Nicola Secomandi, Francois Margot

The valuation of the real option to store natural gas is a practically important problem. Traders value this option heuristically because its exact valuation is at odds with the high-dimensional price evolution models that they use. We develop a novel and tractable approximate dynamic programming method that coupled with Monte Carlo simulation computes lower and upper bounds on the value of storage. We use these bounds to benchmark heuristics used in practice

■ MD03

C - Ballroom D3, Level 4

Forestry IV: Fire Prevention and Management

Sponsor: Energy, Natural Resources and the Environment//Forestry
Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Avenue, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Forecasting Arson with Temporal Clusters

Douglas Thomas, National Institute of Standards and Technology, Gaithersburg, MD, United States of America, douglas.thomas@nist.gov, David Butry, Jeffrey Prestemon

A significant number of arson incidents cluster in time. We characterize temporal arson patterns across the U.S., and use these patterns to develop a forecast model for arson in Detroit. Using a four-equation Poisson model, we are able to generate predictions of the presence or absence of arson in 12-hour increments (half-days) and test the model using an out-of-sample forecast of arson.

2 - Letting Wildfires Burn

Claire Montgomery, Dept Forest Engineering, Resources and Management, Oregon State University, Corvallis, OR, United States of America, claire.montgomery@oregonstate.edu, Rachel Houtman, Alan Ager

We develop a decision rule indicating when it may be optimal to let a wildfire burn as a function of ignition location and timing, weather, and spatial configuration of fuel around the ignition. We use an optimization method known as approximate policy iteration with policy roll-out. We estimate expected loss plus cost with and without suppression using Monte Carlo simulations of fire trajectories and develop a decision rule using iterative binary choice regression on the simulation outcomes.

3 - Evaluating Forest and Wildland Fire Detection Systems

David Martell, Faculty of Forestry, University of Toronto, Canada, martell@smokey.forestry.utoronto.ca

Forest and wildland fire managers often assess detection system performance in terms of detection size but detection size alone ignores many factors that influence initial attack success. We describe the development and use of a new integrated detection/initial attack detection system performance measure that accounts for initial attack system capacity.

4 - Wildfire Suppression with Imperfect Information

Matthew Thompson, U.S. Forest Service, Rocky Mountain Research Station, Missoula, MT, United States of America, mpthompson02@fs.fed.us

Detection and control of wildland fires is subject to uncertainty regarding fire occurrence and spread, the geospatial distribution of resources that may be exposed to fire, the effects of fire on resources, and the relative value of market and non-market resources. Given imperfect information about the level of risk (quantified in the actuarial sense), we investigate the applicability of Partially Observable Markov Decision Processes (POMDP) to inform suppression decision-making.

■ MD04

C - Ballroom D4, Level 4

Sustained, Energy-Efficient Operation in Large Commercial Buildings and Industrial Plants

Cluster: Electrical Energy Systems
Invited Session

Chair: Carl Schweiger, Senior Research Scientist, Rockwell Software, 9500 Arboretum Blvd., Austin, TX, 78759, United States of America, caschweiger@ra.rockwell.com

1 - Globally Optimal Electric Chiller Selection Utilizing Hybrid Models Contained in a Mixed-Integer

Alexander Smith, Research Scientist, Rockwell Software, 9500 Arboretum Blvd., Austin, TX, 78759, United States of America, asmith@pavtech.com, Carl Schweiger, Bijan Sayyar-Rodsari

Electric chillers represent an integral component in the vast majority of HVAC systems; however,the coefficient of performance, COP, varies significantly over the feasible range of ordinary operating conditions. In a situation for which cooling load must be met through selection of a subset of chillers, computational advisement is often required to optimize electricity use. This paper presents a technique for globally optimal chiller selection, based on a case study at the University of Iowa.

2 - Optimization of HVAC Energy with a Computational Intelligence Approach

Andrew Kusiak, Professor, The University of Iowa, Mechanical and Industrial Engineering, Iowa City, IA, 52242, United States of America, andrew-kusiak@uiowa.edu

A computational intelligence approach for optimization of a heating, ventilation, and air conditioning (HVAC) system is presented. A predictive model of the HVAC system is derived by data-mining algorithms based on a data set collected from an experiment conducted at an energy research facility. The set points of the control system are optimized for energy savings using an evolutionary computation algorithm.

3 - Sensitivity Analysis in the Minimization of Energy Cost using an Efficient Photovoltaic System

Mayra Méndez-Piñero, Assistant Professor, University of Puerto Rico - Mayaguez, Call Box 9000, Industrial Engineering Department, Mayaguez, 00680, Puerto Rico, mayra.mendez@upr.edu, Melitza Colón-Vàzquez

Currently, government and industries are seeking for solutions to global warming and petroleum shortages. Reduction in energy consumption and renewable energy systems appear to be the most commonly analyzed alternatives to solve these problems. However, many industries do not implement them due to their high costs. The challenge of this research is to develop an optimization model combining options using cost effective photovoltaic systems as feasible solutions to generate energy in industries.

4 - Plant-wide Optimization of an Ethanol Plant using Parametric Hybrid Models

Carl Schweiger, Senior Research Scientist, Rockwell Software, 9500 Arboretum Blvd., Austin, TX, 78759, United States of America, caschweiger@ra.rockwell.com, Bijan Sayyar-Rodsari

The optimal operation of ethanol plants is achieved by accurately modeling the integrated nature of the plant components. This involves a compromise between model accuracy and computational efficiency. A parametric hybrid modeling framework is used to represent process units with shortcut models whose parameters are empirically modeled based on actual plant data. The approach is demonstrated using actual ethanol plant data to determine the optimal operation under different economic conditions.

■ MD05

C - Ballroom D5, Level 4

Auctions/Mechanism Design II

Contributed Session

Chair: Rafael Olarte, PhD Candidate, University of Maryland, College Park, 4103 Metzerott Rd, College Park, MD, 20740, United States of America, olarte@umd.edu

1 - Stackelberg Voting Games: Computational Aspects and Paradoxes

Lirong Xia, Duke University, Department of Computer Science, Durham, 27705, United States of America, lxia@cs.duke.edu, Vincent Conitzer

We consider settings in which voters vote in sequence, each voter knows the votes of the earlier voters and the preferences of the later voters, and voters are strategic. We propose a dynamic-programming algorithm for finding the backward-induction outcome for any such game. Our main theoretical results are several general paradoxes for many common voting rules. These paradoxes state that the backward-induction outcomes are sometimes extremely undesirable.

2 - Investigating Negotiauctions: Auctions or Negotiations?

Long Pham, PhD Student (ABD) in operation management, New Mexico State University, 2308 Cole Village, Las Cruces, OK, 88001, United States of America, longpham@nmsu.edu, Jeffrey Teich

We discuss the NegotiAuction website that combines characteristics of both negotiation and auction with different auction mechanisms. These characteristics along with the pricing out technique are designed to overcome limitations in online reverse auctions. We plan to test economic performance of the system.

3 - Bidding Strategies for Real-life Small Loan Auctions

Jyrki Wallenius, Professor, Aalto University, Runeberginkatu 22-24, Helsinki, 00100, Finland, jyrki.wallenius@hse.fi, Hannele Wallenius, Jeffrey Teich, Lauri Puro

We define and identify bidding strategies in real-life small loan auctions (Prosper.com). In this auction, lenders bid for borrowers' loan listings and the winners get to fund the loan at an interest rate determined by the auction. The exceptionally large empirical database provided by Prosper.com offers a unique opportunity to test and further develop the theory of online auctions.

4 - Formulation and Analysis of an Auction-based Congestion Pricing Problem

Rafael Olarte, PhD Candidate, University of Maryland, College Park, 4103 Metzerott Rd, College Park, MD, 20740, United States of America, olarte@umd.edu, Nikola Markovic, Ali Haghani

An auction mechanism for allocating time slots to vehicle users who need to enter a congested area presents advantages as well as challenges. One main challenge is to establish a bidding process that is effortless to users. We propose an auction-based congestion pricing problem with a bidding language that facilitates users the submission of large number of bids but adds difficulty to an already NP-hard problem. We also explore the empirical hardness of solving this problem.

■ MD06

C - Ballroom E, Level 4

Tutorial: The Separation, and Separation-deviation Methodology for Group Decision Making and Aggregate Ranking

Cluster: Tutorials
Invited Session

Chair: Dorit Hochbaum, University of California-Berkeley, Department of IE and OR, Berkeley, CA, United States of America, hochbaum@ieor.berkeley.edu

1 - The Separation, and Separation-deviation Methodology for Group Decision Making and Aggregate Ranking

Dorit Hochbaum, University of California-Berkeley, Department of IE and OR, Berkeley, CA, United States of America, hochbaum@ieor.berkeley.edu

The aggregate ranking problem is to obtain a ranking that is fair and representative of the individual decision makers' rankings. We argue here that using cardinal pairwise comparisons provides several advantages over score-wise or ordinal models. The aggregate group ranking problem is formalized as the separation model and separation-deviation model and linked to the inverse equal paths problem. The application of these models is described for scenarios including sports competitions, NSF review panels, choosing winning projects, determining countries credit risk, customer segmentation, web pages rankings and ranking academic papers in terms of citations. We compare and contrast the separation approach with PageRank and the principal eigenvector methods as well as other commonly used methods.

■ MD07

C - Ballroom F & G, Level 4

Tutorial: Meaningless Statements in Epidemiology

Cluster: Tutorials
Invited Session

Chair: Fred Roberts, Professor, Rutgers University, 96 Frelinghuysen Road, New Brunswick, NJ, 08854, United States of America, froberts@dimacs.rutgers.edu

1 - Meaningless Statements in Epidemiology

Fred Roberts, Professor, Rutgers University, 96 Frelinghuysen Road, New Brunswick, NJ, 08854, United States of America, froberts@dimacs.rutgers.edu

A statement involving scales of measurement is called meaningless if its truth or falsity can depend on the particular versions of scales that are used in the statement. Using examples from the study of diseases such as HIV, malaria, and tuberculosis, we will give a variety of examples of meaningless and meaningful statements. We will briefly discuss the mathematical foundations of the theory of meaningfulness, discuss ways to average scores that lead to meaningful statements, and, time permitting, discuss the meaningfulness of statistical tests. Some of the specific topics to be discussed are: Averaging judgments of cough severity or fatigue, finding a combined index of air pollution, evaluating alternative HIV treatments using averages of normalized scores, meaaningfulness of solutions to optimization problems in epidemiology, and behavioral responses to health events.

■ MD08

C - Room 11A, Level 4

Public Sector Location Modeling 1

Sponsor: Location Analysis
Sponsored Session

Chair: Mark Daskin, Professor, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, msdaskin@umich.edu

Co-Chair: Alan Murray, Professor, Arizona State University, Geographical Sciences and Urban Planning, Tempe, AZ, 85287, United States of America, atmurray@asu.edu

1 - Optimizing Essential Air Service (EAS) Airport Locations

Tony Grubesic, Associate Professor, Drexel University, Information Science and Technology, Philadelphia, PA, 19104, United States of America, tony.grubesic@gmail.com, Alan Murray, Timothy Matisziw

Essential Air Service is a federal program that helps provide a minimum level of air transport service to/from remote communities in the U.S. While critics cite underutilized routes as indicators of wasteful public spending, recent work suggests that the spatial configuration of EAS subsidized airports may also contribute to systemic inefficiencies. This paper explores the benefits associated with alternative allocations of EAS funds through the spatial optimization of airport locations.

2 - The Flow-Refueling Location Model for Alternative-Fuel Stations: An Efficient Formulation

Ismail Capar, Assistant Professor, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, capar@tamu.edu, Michael Kuby, Brijesh Rao

The Flow-Refueling Location Model (FRLM) locates a given number of refueling stations on a network to maximize the flow among origin-destination pairs that can be refueled given the driving range of vehicles. We present a radically different MIP formulation for FRLM that, unlike previous formulations, does not use combinations of facilities as input. Although the new formulation creates a much larger MIP, it solves the FRLM to optimality as fast or faster than the published heuristic algorithms.

3 - Prepositioning of Supply Points in Preparation for a Foreseeable Disaster: A Case Study

Gina Galindo, Graduate Student, University at Buffalo (SUNY), 438 Bell Hall, Department of Industrial & Systems Engg, Buffalo, NY, 14260, United States of America, ggalindo@buffalo.edu, Rajan Batta

This research presents a case study for an optimization model developed to preposition supplies under a foreseeable disaster setting. The model minimizes the total expected cost while meeting demand and capacity constraints as well as some restrictions in the number of units to preposition. The scenario to be analyzed is defined by the forecasts of hurricane Katrina. Based on those forecasts, data is analyzed and transformed as needed in order to be able to apply the optimization model.

4 - Locating Fire-stations: An Integrated Approach for Belgium

Philippe Chevalier, Professor, CORE, Université catholique de Louvain, Voie du Roman Pays 34, Louvain-la-Neuve, 1348, Belgium, Philippe.Chevalier@uclouvain.be, Isabelle Thomas

This paper demonstrates the potential of a decision-support system developed for Belgium by a consortium of universities and a private firm, in the framework of a public call by the Ministry of the Interior. The system is designed to provide the Belgian emergency management admini-stration with a complete decision-aid tool for the location of fire-stations.

■ MD09

C - Room 11B, Level 4

Production/Inventory Systems with Disruptions

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa, AL, United States of America, bkeskin@cba.ua.edu

1 - Decision Support Models for Design of Reliable Distribution Networks

Qingwei Li, RA, University of South Florida, 6821 waterton dr, riverview, fl, 33578, United States of America, qli4@mail.usf.edu, Alex Savachkin, Bo Zeng

Disruptions in lean distribution networks, triggered by forces of nature and human malignant attacks, can entail staggering economic ramifications. We examine a derivative of the p-median uncapacitated distribution network design problem with a finite fortification budget. We demonstrate that the problem is NP-hard and hard to solve even for smaller size networks. To achieve computational tractability of the model, we develop an efficient Lagrangian relaxation-based algorithm.

2 - Inventory Management Under Supply Disruptions, Demand Substitution and Market Size Dynamics

Tianhu Deng, PhD Student, UC, Berkeley, IEOR Department, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, United States of America, tianhu_deng@berkeley.edu, Z. Max Shen, Simin Huang

We consider an inventory system with N competing retailers, with supply disruptions and demand substitution. We consider two settings vary only in the exogenous demand process (dynamic and stationary). The retailers compete by selecting their service levels. We show that the retailer risk information is much more valuable in the dynamic demand setting than in the stationary demand setting.

3 - Game Theoretic Analysis of an Inventory Problem with Substitution, Random Demand and Yield

Burak Eksioglu, Associate Professor, Mississippi State University, P.O. Box 9542, Mississippi State, MS, 39762, United States of America, beksioglu@ise.msstate.edu, Tugce Martagan

A game theoretic approach is used to analyze an inventory problem with two products. Both retailers face stochastic demand for a single product and replenish from an outside supplier who provides a random fraction of the quantity requested. A given percentage of customers with unmet demand substitute the other product. The single period expected profit of a player depends on the decisions of both players. Thus, game theory is used to find the order quantities assuming they are rational players.

4 - Analysis of a Production-inventory System with Unreliable Supplier

Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa, AL, United States of America, bkeskin@cba.ua.edu, Jeffrey Kharoufeh, Sharif Melouk

We consider a production-inventory system with a single retailer that uses a base-stock policy and a single, unreliable supplier who experiences disruptions at random intervals. We model the system as an unreliable inventory-queue to obtain the supplier's mean workload and jointly optimize the retailer's base-stock level and the supplier's recovery capacity level.

■ MD10

C - Room 12A, Level 4

Supply Chain Management and Healthcare/Pharmaceutical Industries

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Yao Zhao, Rutgers University, 1 Washington St, Newark, United States of America, yaozhao@andromeda.rutgers.edu

1 - Resell versus Direct Models in Brand Drug Distribution
Kathleen Martino, Rutgers University, 1 Washington Park, Newark, NJ, 07102, United States of America, martinok2@gmail.com, Yao Zhao

We present a mathematical model to compare the asset-based fee-for-service (FFS) contract and a non-asset based contract, Direct-to-Pharmacy (DTP), for brand drug distribution. We show that the DTP contract eliminates forward-buying and achieves optimality for the entire supply chain. Indeed, for any FFS contract, one can always find a DTP contract that improves the profitability for all parties involved. We discuss the broader business implications of DTP through a real world application.

2 - Inventory Positioning in Global Clinical Trial Supply Chains
Adam Fleischhacker, Assistant Professor, University of Delaware, 222 Alfred Lerner Hall, Newark, DE, 19716, United States of America, ajf@udel.edu, Anh Ninh, Yao Zhao

To speed recruitment, clinical trials are going global to find patients willing to participate in studies of new drugs. While this benefits recruitment efforts, the supply chain is challenged to maintain available drug supply at globally scattered testing sites; especially when considering a clinical trial's goal to recruit a fixed patient horizon as quickly as possible. To address this unique challenge of a clinical trial supply chain, we provide a new class of multi-echelon inventory models.

3 - The Unexpected Impact of Information-Sharing on US Pharmaceutical Supply-Chains
Hui Zhao, Purdue University, 403 W. State Street, West Lafayette, IN, United States of America, zhaoh@purdue.edu, Leroy Schwarz

This paper examines the introduction of information-sharing (from distributor to manufacturer) into the pharmaceutical supply chains in the United States. This introduction was unusual because it was catalyzed from outside the industry and was initiated to keep distributor inventory low! We find that although its effect on pharmaceutical distributors has been profound, evidence indicates that information-sharing has had no impact on pharmaceutical manufacturers' inventory-management practices.

4 - Manufacturer's Promotional Support in a Dynamic Retail Duopoly
Xiuli He, Assistant Professor, University of North Carolina-Charlotte, 9201 University City Blvd, BISOM Dept, Charlotte, NC, 28213, United States of America, xhe8@uncc.edu, Ashutosh Prasad, Anand Krishnamoorthy, Suresh Sethi

We consider a dynamic distribution channel consisting of a manufacturer and two competing retailers engaged in promoting the manufacturer's product to be sold through one or both of the two retailers. The manufacturer decides on its support for the retailers' advertising activities by announcing cooperative advertising subsidies called "participation rates."

■ MD11

C - Room 12B, Level 4

Patient Flow Models: Within Hospitals and Beyond

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Sarang Deo, Assistant Professor, Northwestern University - Kellogg School of Management, Evanston, IL, United States of America, s-deo@kellogg.northwestern.edu

1 - Empirical Adventures in Hospitals
Galit Yom-Tov, Technion, Haifa, Israel, gality@techunix.technion.ac.il, Mor Armony, Avishai Mandelbaum, Yariv N. Marmor, Yulia Tseytlin

We investigate empirical aspects of patient's flow in hospitals. We focus on operational characteristics of this flow, such as length of stay, blocking and returns of patients. We demonstrate how different operational schemes manifest themselves in our data. Our empirical research raises new operational questions, which motivates theoretical research. One such example call for (first modeling then) enforcing "justice" in the allocations of patients to wards.

2 - Patient Flow in a Hospital ICU
Carri Chan, Columbia University, 3022 Broadway, Uris Hall, Room 410, New York, NY, 10027, United States of America, cwchan@columbia.edu

Hospital Intensive Care Units are reserved for the most critical patients and they are generally operated at or above capacity. As such, the ICU often presents a significant bottleneck in providing timely and necessary care to the most critical patients. In this work, we consider how the timing of intensive care admission can affect patient outcomes and focus on how to incorporate this information into improving patient flow through the ICU.

3 - The Effect of Universal Healthcare on Emergency Department Operations
Diwas Kc, Emory University, 1300 Clifton Road, Atlanta, GA, 30322, United States of America, Diwas_KC@bus.emory.edu, Sriram Venkataraman

Relatively scant attention has been paid to the impact of universal healthcare coverage on hospital emergency departments. We explore the effect of the passage of universal healthcare coverage in Massachusetts on the operational performance of hospitals in that state. In particular, we examine the impact on patient volume, capacity utilization, quality of care and service times in emergency departments. We also explore the role of capacity amongst competing EDs in influencing patient choice.

4 - Centralized vs. Decentralized Ambulance Diversion: A Network Perspective
Sarang Deo, Assistant Professor, Northwestern University - Kellogg School of Management, Evanston, IL, United States of America, s-deo@kellogg.northwestern.edu, Itai Gurvich

Ambulance diversion can provide pooling benefits in a network of emergency departments (EDs) and reduce waiting times. However, recent evidence suggests that this benefit is not often realized in practice. Using a stylized analytical model of a network with two EDs, we find that decentralized decision making provides one potential explanation for this effect. We also propose an alternative solution that captures most benefits of the social optimum and is potentially much easier to implement.

■ MD12

C - Room 13A, Level 4

Editor's Favorites: IIE Transactions Scheduling and Logistics

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Candace A. Yano, Professor, University of California, Haas School of Business, IEOR Department, Berkeley, CA, 94720, United States of America, yano@ieor.berkeley.edu

1 - Quantity Commitment, Production and Subcontracting with Bargaining
Dimitris Kostamis, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, dimitris_kostamis@unc.edu, Izak Duenyas

We consider a buyer that can produce in-house but also can purchase from a supplier. The buyer contracts to buy a guaranteed minimum quantity from the supplier; the supplier and the buyer then establish their respective production quantities. Once the buyer realizes its demand, it may contact the supplier for more units, and a renegotiation ensues. We show that high bargaining power may actually hurt the buyer as it may lead the supplier to underproduce.

2 - An Analysis of Manufacturer Benefits Under Vendor-Managed Systems
Nesim Erkip, Prof., Bilkent University, Department of IE, Ankara, 06800, Turkey, nesim@bilkent.edu.tr, Secil Savasaneril

Vendor managed systems has attracted a lot of attention due to its benefits. We analyze the benefits beyond information sharing and assess the motivation for the manufacturer behind joining such a program. We show that vendor-managed systems provide increased flexibility in manufacturer's operations and bring additional benefits. We analyze how the system parameters affect the profitability and determine the conditions that make the vendor-managed system a viable strategy.

3 - Logistics Network Design with Inventory Stocking for Low-demand Parts: Modeling and Optimization

Erhan Kutanoglu, University of Texas, Austin, TX, United States of America, erhank@mail.utexas.edu, Vishv Jeet, Amit Partani

We model, analyze and develop solution techniques for a network design and inventory stocking problem, capturing features of service part logistics systems: time-based service levels, and stochastic demands, facilities operating one-for-one replenishment policy. Along with location and allocation decisions, the model decides stock levels and fill rates, varying them across facilities to achieve system-wide service levels. Computational results show the effectiveness of the approach.

4 - Buffer Location and Sizing to Optimize Cost and Quality in Semi-Continuous Manufacturing Processes

Kumar Rajaram, Professor, UCLA Anderson School, 110 Westwood Plaza, Suite B 410, Los Angeles, CA, 91403, United States of America, krajaram@anderson.ucla.edu, Zhili Tian

We formulate the problem of optimizing the location and size of buffers in semi-continuous manufacturing processes as a non-linear integer program. This determines the optimal buffer size for individual stages and allocates tanks to those stages in order to minimize total tank inclusion, holding, quality, process overshoot and undershoot costs. This method is implemented at a large food processing company and has resulted in total annual cost savings of around 6.4% or $9 million.

■ MD13

C - Room 13B, Level 4

Industrial Scheduling

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Rasaratnam Logendran, Professor, Oregon State University, School of Mech., Indust. & Mfgr. Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, Logen.Logendran@oregonstate.edu

1 - Flow Shop Supply Chain Scheduling

Yasaman Mehravaran, PhD Student, Oregon State University, School of Mech., Indust., & Mfgr. Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, mehravay@onid.orst.edu, Rasaratnam Logendran

We propose a model capable of finding the optimal schedule of jobs in a flow shop with sequence-dependent setup times, machine skipping, and dynamic job release/machine availability in order to benefit the producer and customers in a supply chain. The objective is to minimize the work-in-process inventory while maximizing customer service level. A tabu search based algorithm is developed to find the best solution and a small example is used to demonstrate the applicability of the algorithm.

2 - Minimization of Makespan and Total Tardiness in a Manufacturing Cell

Hadi Panahi, PhD Student, Oregon State University, School of Mech., Indust. & Mfgr. Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, panahih@onid.orst.edu, Rasaratnam Logendran

We consider the problem of simultaneously minimizing makespan and total tardiness in a flow shop manufacturing cell with sequence-dependent family setup times. In each cell, the sequence of part families and the sequence of jobs in each part family are determined. A novel mathematical model is developed for this problem. A Pareto based multi objective simulated annealing (MOSA) algorithm is developed and results are compared with the results of the mathematical model implemented in CPLEX.

3 - Dual Resource Scheduling on a Two-stage Unrelated Parallel Machine

Yasaman Mehravaran, PhD Student, Oregon State University, School of Mech., Indust., & Mfgr. Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, mehravay@onid.orst.edu, Rasaratnam Logendran

We develop a methodology to find the best schedule of a two stage flow shop when machines and manpower are constrained. Each stage consists of a set of unrelated parallel machines and different manpower skills exist. The skill level required to perform the setup could be different from the one needed to perform the run. Stage skipping and reentries are allowed. A tabu search based heuristic is developed to find the best sequence of jobs that minimizes the sum of completion time and tardiness.

4 - A Three Stage Flexible Flow Shop with Batching and Discrete Machines and a Blocking Constraint

Hadi Panahi, PhD Student, Oregon State University, School of Mech., Indust. & Mfgr. Engr., 204 Rogers Hall, Corvallis, OR, 97331-6001, United States of America, panahih@onid.orst.edu, Rasaratnam Logendran

We consider the minimization of maximum weighted completion times in a three stage flexible flow shop problem. There are unrelated machines in the 1st stage, identical batching machines in the 2nd stage, which are bounded by a blocking constraint from its downstream stage, comprised of unrelated furnaces. Each furnace requires a setup based on the number of jobs processed and the previously loaded jobs. A heuristic algorithm based on tabu search has been developed and tested on sample problems.

■ MD14

C - Room 14, Level 4

Supply Chain Management IV

Contributed Session

Chair: Neda Ebrahimy, PhD Student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, neda@u.northwestern.edu

1 - Location Routing Problem Taking Joint Economic Lot Size into Consideration

Wenyih Lee, Assistant Professor, Chang Gung University, 259 Wenhua 1st Rd., Kweishan, Taoyuan, 333, Taiwan - ROC, leewe@mail.cgu.edu.tw

A location routing problem (LRP) taking joint economic lot size (JELS) issue into consideration is investigated. To minimize the system total cost, the proposed model simultaneously determines how many warehouses are needed and where they are, the vehicle routings, and the inventory lot size decisions. We applied the genetic algorithm to solve the model. Numerical illustrations show that jointly solving the LRP and JELS results in better solution than that when solving them in sequence.

2 - Optimal Sourcing 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 an assemble-to-order system that faces supply uncertainty where the actual available quantity is equal to a random fraction of the order quantity. After the supply realization but before the demand realization, the assembler has the option to order from the backup suppliers. We analyze how the backup suppliers affect the threshold price of the final product and the order quantities of all components, and under what conditions the assembler should order from the backup suppliers.

3 - Promise or Requirement? Quality-based Supplier Selection

Xinghao Yan, Richard Ivey School of Business, 1151 Richmond St., London, ON, N5X4P6, Canada, xyan@ivey.uwo.ca, Hui Zhao, Kwei Tang

We explore quality-based supplier selection with quality improvement, quality uncertainty, and information asymmetry. To hedge against quality uncertainty, we consider quality requirement approach and quality promise approach. We find that these two different approaches affect suppliers'/ buyer's quality improvement efforts, their costs, and the social welfare differently w/o information asymmetry.

4 - Capacity Contracts for Horizontal Capacity Coordination with Semiconductor Industry Applications

Xiaole Wu, Washington University in St. Louis, Olin Business School, Campus Box 1133, St. Louis, MO, 63130, United States of America, x.wu@wustl.edu, Panos Kouvelis, Hirofumi Matsuo

Within the semiconductor industry, foundries are dedicated to device manufacturing, while IDM integrates both device design and manufacturing functions. The IDM makes decisions on whether to manufacture internally, sub-contract to foundries, or both. This paper studies two types of contracts between the IDM and foundry: alpha-contract and reservation contract, from both the IDM's perspective and as a Nash Bargaining equilibrium.

5 - The Role of Salesperson with Demand Information in a Supply Chain: Wholesale vs. Retail Salesperson

Neda Ebrahimy, PhD Student, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, neda@u.northwestern.edu, Seyed Iravani, Hyoduk Shin

We study the impact of a salesperson who promotes consumer demand in a supply chain with one manufacturer and one retailer. The salesperson or the retailer may have superior demand information than the manufacturer, and either the manufacturer or the retailer can hire the salesperson. We show that retailer's superior demand information can hurt himself when the manufacturer hires the salesperson. We also identify factors that affect our assessment as to who should hire the salesperson.

■ MD15

C - Room 15, Level 4

Productivity, Labour and Contract Simplification

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Ken Schultz, Associate Professor of Operations Management, University of Alberta, School of Business Building, Edmonton, AB, T6G2R6, Canada, Ken.Schultz@ualberta.ca

1 - Correlation of Worker Processing Times
Ken Schultz, Associate Professor of Operations Management, University of Alberta, School of Business Building, Edmonton, AB, T6G2R6, Canada, Ken.Schultz@ualberta.ca

Models and understanding of line design depend on accurate assessments of the effects of design parameters on human actions. We us archival data from a manufacturing line to show that workers react to the speed of their coworkers. We model an optimal and a heuristic rearrangement of workers and suggest a modified heuristic that performs well for increasing throughput. Our methodology combines empirical approaches, analytical modeling, and Monte Carlo simulation.

2 - The Task and Temporal Microstructure of Learning: Evidence From Japanese Financial Services
Bradley Staats, Assistant Professor, UNC - Chapel Hill, Campus Box 3490, McColl Building 4702, Chapel Hill, NC, 27599-3490, United States of America, bstaats@unc.edu, Francesca Gino

We investigate how individual learning varies within task and within time. We also examine the concept of a restart effect - task and temporal disruptions that stimulate worker productivity - as a mechanism to address the motivational challenges of repetitive work. We use three years of transaction data from a Japanese bank's home loan application processing line. Our results offer insight into how learning takes place and suggest new ways to improve system-wide productivity.

3 - The Labor Illusion: How Operational Transparency Increases Perceived Value
Ryan Buell, Doctoral Candidate, Harvard Business School, Morgan Hall 480, Boston, MA, 02163, United States of America, rbuell@hbs.edu, Michael Norton

While conventional wisdom and operations theory suggests that the longer people wait, the less satisfied they become, we demonstrate that when websites engage in operational transparency - signaling the work they are performing - people not only mind the wait less, but also value the service more. Due to what we term the labor illusion, people can prefer websites with longer waits to those that return identical instantaneous results, if the website provides evidence of the effort being exerted.

4 - Contract Complexity and Performance Under Asymmetric Demand Information
Basak Kalkanci, Stanford University, Stanford, CA, United States of America, kalkanci@stanford.edu, Feryal Erhun, Kay-Yut Chen

Exploring the tension between theory and practice regarding complexity and performance in contract design is especially relevant today. This paper studies why simpler contracts may commonly be preferred in practice despite being theoretically suboptimal. In addition to observations with human experiments, we provide an experience-weighted attraction learning model to demonstrate that simpler contracts would be sufficient for a supplier designing contracts under asymmetric demand information.

■ MD16

C - Room 16A, Level 4

Production and Scheduling II

Contributed Session

Chair: Joao Moccellin, Professor, University of São Paulo, Av. Trabalhador São-carlense, 400, São Carlos, SP, 13566-590, Brazil, jvmoccel@sc.usp.br

1 - Tabu Search Approach to Resource Planning for a Make-to-order Environment
Wassama Sangplung, Graduate Assistant, University of Oklahoma, 202 W.Boyd St., Room 124, Norman, OK, 73019, United States of America, wassama@ou.edu, Scott A. Moses

We present a tabu search approach to resource planning for a make-to-order environment that uses the ideal (infinite capacity) plan for a job to focus the search. Experiments investigate the impact of system variability on scalability and performance. Results for small instances are compared to those from an optimization model.

2 - Modeling of Uncertainty in Manufacturing Systems for Rolling Schedule Based Production Planning
Michiel Jansen, Eindhoven University of Technology, School of Industrial Engineering, Postbus 513, Eindhoven, 5600 MB, Netherlands, m.jansen@tue.nl

The Supply Chain Operations Planning function is responsible for timing the release of materials and resources in a network of Production Units. Essential to proper decision making at the SCOP level is the anticipation model which predicts the PU response to the release decision. We study three types of information aggregation typically found in anticipation models: aggregation of time, aggregation jobs, and aggregation resources.

3 - Rule Generation for Scheduling Cross Training with a Heterogeneous Workforce
Sungsu Kim, Pennsylvania State University, Department of Industrial & Manufacturing Eng., University Park, PA, 16802, United States of America, sungsu@psu.edu, David Nembhard

This talk presents an association rule mining based framework for workforce scheduling in order to assist a manager with robust real-time assignment decisions with the least computational effort. We assume heterogeneous workers in terms of productivity and learning and forgetting behaviors. We consider three cases of a managerial constraint such as the baseline, setting the maximum allowable individual cross-training level, and balancing workloads among workers.

4 - Simulation-based NDP Approximation for the CRL Scheduling Problem by using Selected Features
Jin Young Choi, Professor, Ajou University, San 5, Woncheon-dong, Yeongtong-gu, Suwon, 443-749, Korea, Republic of, choijy@ajou.ac.kr

We present an initial result of research on a simulation-based neuro-dynamic programming approximation method for capacitated re-entrant line scheduling problem, especially for cluster tools with chamber revisiting. In particular, the basic idea and framework of the considered method are discussed, while suggesting a good set of feature functions by using some example capacitated re-entrant lines.

5 - Minimizing Makespan in No-wait Flow Shop Sequencing
Joao Moccellin, Professor, University of São Paulo, Av. Trabalhador São-carlense, 400, São Carlos, SP, 13566-590, Brazil, jvmoccel@sc.usp.br, Fabio Branco, Marcelo Nagano

This paper deals with the no-wait Flow Shop Sequencing in order to minimize makespan. It is introduced a constructive heuristic which uses an appropriate combination of both shift and interchange job-sequence neighborhoods. Experimental results show that the proposed heuristic provides better solutions than those from the best three existing ones.

■ MD17

C - Room 16B, Level 4

Edelman Finalist Presentations

Cluster: Practice of OR/MS
Invited Session

Chair: Graham Rand, Lancaster University, Department of Management Science, Lancaster University Management School, Lancaster, LA1 4YX, United Kingdom, g.rand@lancaster.ac.uk

1 - Innovative Decision Support in a Petrochemical Production Environment
Michele Fisher, Senior Operations Researcher, Sasol, P.O. Box 1, Sasolburg, 1947, South Africa, michele.fisher@sasol.com, Marlize Meyer

Historically, the petrochemical industry based decisions on averages. Sasol, major producer of fuels and chemicals based in South Africa, critically needed to include variability and dynamics. The company's MOSS methodology was used to build three discrete event simulations spanning Sasol's unique coal-to-liquids value chain. The models have repeatedly proven their value in enhancing insights, enabling more effective collaboration, ensuring efficient production and improving the bottom-line.

2 - Managing Global Brand Investments at DHL
Marc Fischer, Professor of Marketing and Services, University of Passau, Innstr. 27, Passau, Germany, marc.fischer@uni-passau.de, Wolfgang Giehl, Tjark Freundt

We present the customer-insight-based approach that has been adopted by Deutsche Post DHL (more than 500,000 employees) to improve its global express delivery business. It supports local brand managers in allocating marketing resources to activities that grow the global brand in the right direction in their country market. Its application in more than 20 countries lead to an estimated increase in brand value of USD 1.32 bn over 5 years.

■ MD18

C - Room 17A, Level 4

Modeling Languages II

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Robert Fourer, AMPL Optimization, 900 Sierra Place SE, Albuquerque, NM, 87108, United States of America, 4er@ampl.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Why is Maximal Software Now Giving Away Free Development Copies of the MPL Modeling System?

Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

In today's challenging economy, many are now looking for ways to save on their IT budget, including when purchasing optimization software. We at Maximal have now decided to fundamentally change how we sell our software, by greatly reducing how much you pay for development copies of MPL, in many cases bringing the actual cost down to zero. We will explain several new programs: "Pay Maintenance Only, "Subscription-Based Pricing," "Free Development Copies of MPL" and "Free Software for Academics.

2 - New Directions in Development of the AMPL Modeling Language and System

Robert Fourer, AMPL Optimization, 900 Sierra Place SE, Albuquerque, NM, 87108, United States of America, 4er@ampl.com, David M. Gay

We summarize current and planned projects to extend and enhance AMPL, with the aim of facilitating both formulation and implementation of optimization models. Extensions to AMPL's language are designed to allow for more natural description of discrete models and stochastic data. New solver interfaces will make nontraditional solvers more accessible for practical modeling. A new callable interface to the AMPL system will facilitate business deployment.

3 - AIMMS Optimization Modeling Platform - Transformation of OR to Business Value

Gertjan de Lange, Product Strategy, AIMMS (Paragon), Schipholweg 1, Haarlem, 2034LS, Netherlands, G.de.Lange@aimms.com

To be able to transform OR technology to business value, you need a tool that is powerful during prototyping & development (were the value is defined) and flexible in deployment (where the value is captured). We will discuss how AIMMS enables such value creation illustrated by latest advances such as Robust Optimization support, Dynamic model editing, and Application Publishing & Remote Optimization.

■ MD19

C - Room 17B, Level 4

Empirical Studies of Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, serguei.netessine@insead.edu

1 - Effects of Alliances on Airline Entry Strategy and Capacity Planning

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

Alliances may impose changes on airline entry strategy and capacity planning. We examine this trend using historical airline industry data from 1998 to 2008. We adopt the difference-in-difference approach to provide evidence on the following specific question: Do airlines strategically seek or avoid route overlapping with their partners from the same alliance? What are the underlying reasons for the observed behavior?

2 - Determining Competitive Sets: An Empirical Study of Hotel Data

Roger Lederman, Columbia University, New York, NY, United States of America, rlederman13@gsb.columbia.edu, Garrett Van Ryzin, Marcelo Olivares

We present an empirical approach to estimating the closest competitors of a given hotel. The approach uses a latent segment choice model and is developed and tested using a unique industry data source. To account for the time-varying composition of hotel demand, latent class size estimates are tied to data on events in the study area. We discuss the model specification and estimation method, and provide initial results.

3 - Choice-based and EMSR-based Revenue Management Models for Multi-resource Industries

Jeffrey Newman, Georgia Institute of Technology, Dept of Civil and Environmental Engr, Atlanta, United States of America, jeff@newman.me, Mark Ferguson, Laurie Garrow

Existing revenue management methodology cannot be directly applied to multi-resource industries such as hotels with different room types. We develop several new methodologies and extensions to the single-product capacity allocation problem and compare the performance of these extensions against traditional revenue management techniques using actual hotel industry data from a publicly available data source.

4 - Setting Prices for Theater Seats Based on Consumer Choice Behavior

Senthil Veeraraghavan, Assistant Professor, Wharton School of Business, University of Pennsylvania, 3730 Walnut Street, Jon M. Huntsman Hall, Suite 500, Philadelphia, PA, 19104, United States of America, Senthilv@wharton.upenn.edu, Necati Tereyagoglu

Using ticket sales and seat pricing data from an arts organization, we construct a structural model to estimate the factors that influence consumers' seat choice and ticket purchase time decision. Using these estimates, we suggest a new pricing policy that factors in strategic consumer purchase behavior, and investigate the effects and implication of the pricing scheme.

■ MD20

C - Room 18A, Level 4

New Directions in Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Omar Besbes, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, ob2105@columbia.edu

1 - Noncooperative Network Revenue Management

Xing Hu, New York University, 44 West Fourth Street, New York, United States of America, xhu@stern.nyu.edu, Gustavo Vulcano, Rene Caldentey

We investigate contractual agreements between multiple airlines operating within a network alliance. We study contracts that specify how revenue should be split among the carriers. We propose a two-step hierarchical approach. First, we formulate a static problem in which airlines select partitioned allocations and show that a simple transfer price mechanism achieves first best. Then, we study the dynamic problem and prove that the static transfer prices are asymptotically optimal.

2 - The Hcμ-rule for Congestion-Based Leadtime Quotation with Heterogenous Customers

Mustafa Akan, Assistant Professor, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, akan@andrew.cmu.edu, Tava Olsen, Baris Ata

We consider welfare maximization in a congestible system serving multiple classes of customers who differ in their valuations and delay sensitivities captured by convex-concave delay cost functions. System manager dynamically offers a menu of leadtimes and prices to arriving customers, who choose the pair that maximizes their net utility. Formulating a novel fluid model we show that the Hcμ-policy (based on the convex hulls of the delay cost functions) is optimal and incentive compatible.

3 - Dynamic Price Competition with Fixed Capacities

Victor Martinez de Albeniz, Associate Professor, IESE Business School, Av. Pearson 21, Barcelona, Spain, valbeniz@iese.edu, Kalyan Talluri

We study dynamic price competition in an oligopoly, where each of the sellers has a fixed number of units available for sale over a fixed number of periods. Demand is stochastic. We prove existence of a unique subgame-perfect equilibrium. In each state, sellers engage in Bertrand competition and the seller with the lowest (equilibrium) reservation value, the one with the lowest capacity, sells a unit at a price equal to the second-lowest reservation value.

4 - Product Assortment and Price Competition Under Multinomial Logit Demand

Denis Saure, Columbia University, 2960 Broadway, New York, United States of America, dsaure05@gsb.columbia.edu, Omar Besbes

We study product assortment and pricing competition for a duopoly of retailers with limited display capacity. In particular, we analyze, through a unified framework, equilibrium behavior for both the settings of assortment-only and joint assortment and pricing competition

■ MD21

C - Room 18B, Level 4

Carbon Emission Analysis in Energy Industry

Sponsor: Service Science
Sponsored Session

Chair: Yidong Zhang, PhD Candidate, University at Buffalo, 308A Bell Hall, Amherst, NY, 14226, United States of America, yz46@buffalo.edu

1 - Decomposition of Energy-related CO2 Emission in China: 1997-2004

Yong Xue, School of Management, Xi'an Jiaotong University, Mailbox 1889, No.28 Xianning West Road, Xi'an, Shaanxi, 710049, China, xueyong08@gmail.com, Lei Meng, Ju'e Guo

This paper undertakes a structural decomposition analysis of the historical change in energy-related CO2 emission in China during the period 1997 -2004.The result shows that, to harmonize the economic growth and CO2 emission reduction, it is important to enhance energy efficiency and further enforce policies on structural change of final demand and renewable energy substitution.

2 - Smart Grids and Wind Integration: Evaluating Impacts on Emissions and Costs

Subhamoy Ganguly, Doctoral Student, Leeds School of Business, University of Colorado at Boulder, UCB 419, Boulder, CO, 80309, United States of America, Subhamoy.Ganguly@colorado.edu, Stephen Lawrence

This paper evaluates the interplay of smart grids and wind-energy penetration on carbon emissions and generating costs. A mixed-integer linear program is used to model the generator dispatch decisions of a utility. Our analysis shows that at low wind penetration, advanced grid capabilities will result in modest cost savings, while emissions may in fact increase. However, at higher penetrations of wind, advanced grid capabilities will enable significant reductions in both emissions and costs.

3 - Analysis of Carbon Capture in Industrial Clusters

Vibeke S. Nörstebö, Research scientist, SINTEF Applied Economics, S.P. Andersen 5, Trondeheim, 7465, Norway, vibeke.s.norstebo@sintef.no, Kjetil Midthun, Thor Björkvoll

We present an analysis of investment and operation of a carbon capture plant capturing CO2 from multiple sources in an industrial cluster. The cluster uses natural gas for power production and as raw material in industrial processes. Exhaust gas from the processes has different CO2 concentration and optimal investment and operation of a carbon capture plant depend on both exhaust volume and CO2 concentration. The basis for the analysis is a technical economic modeling of the cluster processes.

4 - Long Term CO2 Sequestration System Modeling

Yidong Zhang, PhD Candidate, University at Buffalo, 308A Bell Hall, Amherst, NY, 14226, United States of America, yz46@buffalo.edu, Mark H. Karwan

In this study, a comprehensive mathematical programming model is proposed to evaluate the full economic impact of a regional carbon capture and storage system integrated with the electricity production from coal-based plants. Computational experiments for different scenarios are used to validate this model necessitating algorithmic development for large-scale cases.

■ MD22

C - Room 18C, Level 4

Supply Chain/Electronic Hub and Outsourcing Services

Sponsor: Service Science
Sponsored Session

Chair: Gene Hahn, Assoc. Professor, Salisbury University, 1101 Camden Ave, Salisbury, MD, 21801, United States of America, edhahn@salisbury.edu

1 - A Comparative Analysis of Supply Chain/Electronic Hubs

Amer Karim, Northwestern University, McCormick School of Engineering, Evanston, IL, United States of America, akarim@u.northwestern.edu, Ahmad Karim

Effective organization of a company's supply chain is one of the most important factors in succeeding in the global economy. In recent years, electronic hubs have received great attention, providing buyers and suppliers laike with a mean of structuring and streamlining their supply chains in order to create maximum efficiency. In the near future, online marketplaces are expected to rapidly move toward becoming ful service providrs, letting e-commerce take over the entire supply chain.

2 - Reverse Offshoring of Services: The New Wave of Emerging Offshorers

Gene Hahn, Assoc. Professor, Salisbury University, 1101 Camden Ave, Salisbury, MD, 21801, United States of America, edhahn@salisbury.edu, Kraiwinee Bunyaratavej

Offshore outsourcing of services accelerated at the end of 1990s in developed countries. Recently, developing countries have begun to increasingly offshore services, both to developed countries and to other developing countries. Yet, to date little attention has been paid to the emergence of this reverse offshoring. The focus of this research is on the determinants of reverse offshoring of services and we investigate what drives firms from developing countries to offshore services.

3 - Switching Costs and Information Technology: The Case of IT Outsourcing

Christian Peukert, Ulm University, Helmholtzstr. 20, Ulm, 89081, Germany, christian.peukert@uni-ulm.de

Micro data from US credit unions for 1999 to 2009 reveals that with more than 98 percent, outsourcing has been by far the preferred mode of IT provision. However, the average credit union only sticks with the same vendor for 4 years. This paper empirically investigates determinants of the decision to switch suppliers. Moreover we provide evidence for the existence and magnitude of switching costs. The estimates suggest that average switching costs account for 3 percent of annual expense.

■ MD23

C - Room 18D, Level 4

Business Performance Management and Services Science

Sponsor: Service Science
Sponsored Session

Chair: Ko-Yang Wang, kyw@us.ibm.com

1 - Improving Business Performance and Business Agility with BPM Technology

Ko-Yang Wang, kyw@us.ibm.com

In this talk, we will describe the recent advances in Business Process Management (BPM) technology in Services Science and how they are used to improve the business performance and business agility by enabling actionable, adaptive business processes and rules.

2 - Human Centric Business Process Management

Alan Godfrey, IBM, United States of America, alan.godfrey@us.ibm.com

Human-centric business process activities which enables business to handle exceptions to predefined business rules or unexpected events and support decision making are critical to the business performance. In this talk, we will discuss the human centric business process management and some techniques to quickly model and visualize the process activities in easy to understand graphical models, identify and add performance monitoring check-points, enable the run-time environment for executing the process and monitoring the performance, and then use the performance results to rapidly improve the processes.

3 - Best Practices in BPM for Business Agility

Leah Pope, IBM, United States of America, leah.pope@us.ibm.com

Modern Business Process Automation tools can be used to enable Rapid Process Development and Automation, thereby enabling organizations to respond to environmental and business changes much quicker and in ways that are more scalable. We will discuss some BPM use cases and best practices and describe how they help to improve an organization's performance and agility.

4 - Business Rules Management

Alessandro Campioli, IBM, United States of America, ale.campioli@us.ibm.com

With the rapidly changing business conditioners, many companies found that their IT are too inflexible to keep up with their rapidly changing business needs. Well designed Business Rules Management Systems (BRMS) can support the business people and application designers to centrally define and manage sophisticated rule sets that control key aspects of the business outside the IT applications but interacting with them to support efficient rules execution. It also provides support for testing and impact assessment of rule changes thereby enables business people to manage and update the business rules without the need to go through time consuming IT application release process.

■ MD24

C - Room 19A, Level 4

Operations Research and Homeland Security

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Jeffrey Herrmann, University of Maryland, Department of Mechanical Eng., Institute for Systems Research, College Park, 20742, United States of America, jwh2@umd.edu

1 - Models for Public Health Crisis Management During a Pandemic
Diana Prieto, Doctoral student, University of South Florida, 4202 E. Fowler Avenue ENB118, Tampa, FL, 33620, United States of America, dprieto@mail.usf.edu, Tapas K. Das, Alfredo Santana-Reynoso, Sharad Malavade, Alex Savachkin

This research addresses the need for models that can be used to develop and evaluate real-time strategies supporting pandemic preparedness. We demonstrate how a simulation model can be used to assess the epidemiological parameters in the early stages of an outbreak and to use those parameters in reducing the risk of overresponse or underresponse. Results of the model implementation on a sample problem are presented.

2 - Model to Analyze Possible Disruptions to a Food Item's Supply Chain Due to a Pandemic Influenza
Carlo Davila Payan, PhD Student, Georgia Tech, 765 Ferst Dr, Atlanta, GA, 30322, United States of America, carlo.davila@gatech.edu, Julie Swann

We built a food item's supply chain model to analyze the consequences of tactical disruptions to its operations. These disruptions are sudden, unexpected, and temporary, such as the absenteeism caused by a pandemic influenza, and cause a partial loss of capacity on different nodes and arcs of the supply network. We will present some preliminary results and discuss on findings and research directions.

3 - A Column Generation Approach to Emergency Medication Distribution
Adam Montjoy, University of Maryland, Institute for Systems Research, College Park, MD, 20742, United States of America, adam.montjoy@gmail.com, Jeffrey Herrmann

A bioterrorist attack will prompt rapid distribution of medication from a central depot, where it becomes increasingly available over time. Finding the best distribution strategy requires solving a unique capacitated vehicle routing problem. The objective is to maximize delivery slack as a hedge against uncertainty. We tested a column generation approach, a search algorithm, and a heuristic that separates the problem into routing and scheduling and applied them to real-world instances.

4 - Medical Resource Allocation in the Aftermath of a Natural Disaster
Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu, Yisha Xiang

We study a novel medical resource allocation model to better serve the victims in deteriorating health conditions in the aftermath of a disaster. We consider three levels of health conditions and allow transitions from less into more severe levels. We study the performance measure in such a system and formulate a resource allocation model to improve the rescue operations under resource constraints.

■ MD25

C - Room 19B, Level 4

OR For the Public Interest - Security and Infrastructure

Cluster: Public Policy
Invited Session

Chair: Michael Atkinson, Naval Post Graduate School, United States of America

1 - When a Bit More is Too Much: The Cascading Effect of Insurgency Actions on Popular Attitudes
Michael Atkinson, Naval Post Graduate School, United States of America, Roberto Szechtman, Moshe Kress

Insurgents need popular support to thrive and achieve their goals. People support the insurgents only if they are better off with the insurgents than they would be with the government in place. We examine the effect of insurgents' actions on popular support using a model rooted in rational choice theory.

2 - Safe Dike Heights at Minimal Costs: The Homogeneous Case
Dick den Hertog, Tilburg University, P.O. Box 90153, 5000 LE Tilburg, Netherlands, d.denhertog@uvt.nl, Carel Eijgenraam, Ruud Brekelmans

We address the question of when and how much to invest in dikes. The cost-benefit analysis by Van Dantzig (1956), which balances the investment costs against the expected benefit of avoiding damage by flooding, is extended with sea level rising and economic growth.

3 - Safe Dike Heights at Minimal Costs: The Non-Homogeneous Case
Dick den Hertog, Tilburg University, P.O. Box 90153, 5000 LE Tilburg, Netherlands, d.denhertog@uvt.nl, Carel Eijgenraam, Ruud Brekelmans

We address the question of when and how much to invest in non-homogeneous dike rings, i.e., dike rings that consist of different segments, each of them with different characteristics. In contrast to the homogeneous case, which can be solved by dynamic programming, this model is solved using a MINLP formulation.

4 - Strategic Planning for Disaster Recovery with Stochastic Last Mile Distribution
Carleton Coffrin, PhD Student, Brown University, 115 Waterman Street, Box 1910, Province, RI, 02906, United States of America, cjc@cs.brown.edu, Pascal Van Hentenryyck, Russell Bent

We consider the single commodity allocation problem (SCAP) for disaster recovery. SCAPs are stochastic optimization problems that combine resource allocation and warehouse routing. This work formalizes the specification of SCAPs and presents a multi-stage hybrid-optimization algorithm that utilizes the strengths of mixed integer programming, constraint programming, and large neighborhood search.

5 - On Conducting Route Clearance to Protect Convoys against Improvised Explosive Devices
Peter Kolesar, Professor Emeritus, Columbia University, 314 Uris Hall, 3022 Broadway, New York, NY, 10027, United States of America, pjk4@columbia.edu, Kellen Leister, Daniel Stimpson, Ronald Woodaman

We study the coordination of a single route clearance team (RCT) and convoy on a road where IEDs are a non-homogenous Poisson process and IED clearance is Bernoulli. The enemy reseeds IEDs after the RCT sweep. Risk is the expected number of IED attacks. The spatial distribution of IEDs and speed of reseeding dictate the optimal schedule. An inferior RCT technology can dominate a superior technology by superior scheduling.

■ MD26

C - Room 4A, Level 3

Tutorial: System Monitoring and Diagnosis with Supervised Learning

Sponsor: Data Mining
Sponsored Session

Chair: George Runger, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, United States of America, George.Runger@asu.edu

1 - System Monitoring and Diagnosis with Supervised Learning
George Runger, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, United States of America, George.Runger@asu.edu, Houtao Deng, Eugene Tuv

Traditional monitoring methods are challenged by modern data sets such as non-standard distributions, high dimensions, mixed variables, missing values, scaling, etc.. This tutorial presents alternative transforms of monitoring to supervised learning based on the computational capabilities to be leveraged. The diagnosis of features that contribute to a signal is an important capability. Performance is compared to traditional monitoring methods and to contributor diagnostics such as PLS.

■ MD27

C - Room 4B, Level 3

Organizational Processes and Decision-Making

Sponsor: Organization Science
Sponsored Session

Chair: Joseph Broschak, Associate Professor, Management/Organizations, University of Arizona, McClelland Hall 405, Tucson, AZ, United States of America, broschak@email.arizona.edu

1 - Cognitive Underpinnings of Managerial Actions: Does the Framing of Environmental Demands Matter?
Elizabeth George, Hong Kong University of Science & Technology, Department of Management, Clear Water Bay, Hong Kong - PRC, egeorge@ust.hk, Prithviraj Chattopadhyay, Gilad Feldman

We test hypotheses contrasting the predictions of prospect theory with those of the threat-rigidity hypothesis. We found that individuals respond to potential losses of resources by taking more risky actions and to potential gains of resources with risk-averse actions. In contrast, those facing potential loss of control took risk-averse actions and risk seeking actions when facing potential gain of control. We then look at how the framing affects the spread of practices within an industry.

2 - Learning From Operational Problems: Managers Workers to Contribute Process Improvement Ideas

Michael Toffel, Assistant Professor, Harvard Business School, Morgan Hall 497, Boston, MA, 02163, United States of America, mtoffel@hbs.edu, Julia Adler-Milstein, Sara Singer

How can managers encourage employees to voice concerns and offer ideas to improve operating processes? We examine managerial information campaigns and managers' personally engaging in problem solving. Analyzing 7500 accidents and incidents reported to a hospital incident reporting system, we find both management approaches lead employees to speak up and voice process improvement suggestions, and reveal tradeoffs between these approaches.

3 - The Creativity Cycle and the Possibility of Producing Creative Ideas Efficiently

Jeffrey Loewenstein, Assistant Professor, University of Texas at Austin, Department of Management, Austin, TX, United States of America, Jeffrey.Loewenstein@mccombs.utexas.edu, Matthew Cronin

Inspired by an analogy between organizational routines and biological pathways, we propose a new process model of how organizational actors generate new ideas, and relate it to a model of how people generate new products. Unlike the dominant organizational models, our model predicts ways to change the likelihood that people generate useful new ideas. We test part of the model, and provide support for it by showing the value of representational design for efficiently generating ideas.

4 - Mindful Organizing and Adaptive Performance

Kathleen Sutcliffe, Professor of Management and Organizations, University of Michigan, Ross School of Business, 701 Tappan, Ann Arbor, MI, 48109, United States of America, ksutclif@umich.edu

Mindful organizing is an adaptive form for unpredictable environments. Mindfulness facilitates discovery and correction of ill-structured contingencies facilitating adaptations as action unfolds. Drawing on qualitative and quantitative data gathered from wildland firefighters we find that mindfulness is positively associated with positive outcomes when contextual uncertainty is high. We end by examining mechanisms through which mindfulness is generated.

■ MD28

C - Room 4C, Level 3

Design and Analysis of Experiments

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: William Brenneman, Procter & Gamble Company, 11511 Reed Hartman Highway, Cincinnati, OH, 45241, United States of America, brenneman.wa@pg.com

1 - Bayesian Analysis of Split-Plot Experiments for Evaluating Non-Standard Performance Criteria

Christine Anderson-Cook, Research Scientist, Los Alamos National Laboratory, Statistical Science Group, P.O. Box 1663 MS F600, Los Alamos, NM, 87545, United States of America, c-and-cook@lanl.gov, Timothy Robinson

Many experiments contain difficult to change factors, resulting in a split-plot randomization structure. For valid statistical inferences, it is important to account for the correlation induced by the restricted randomization. We demonstrate the usefulness and flexibility of Bayesian methods for various functions of the response distribution, such as specific percentiles. Beyond examining just the mean and variance, these summaries may more accurately reflect the characteristic of interest.

2 - Robust Design of Meaasurement Systems

Tirthankar Dasgupta, Assistant Professor, Harvard University, Science Center, 1 Oxford Street, Cambridge, MA, United States of America, dasgupta@stat.harvard.edu, Arden Miller, Jeff Wu

An integrated experimental approach for estimation and reduction of measurement variation (and its components) in systems with linear signal-response relationship is developed. The noise factors are classified into a few distinct categories based on their impact on the measurement system. A random coefficients model that accounts for the effect of control factors and each category of noise factors on the signal-response relationship is proposed.

3 - Quadratic Loss Criteria and Credible Intervals for Robust Design with Gaussian Process Models

Jeff Wu, Professor, Department of Industrial and Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, jeffwu@isye.gatech.edu, Matthias H Tan

We develop a general expected quadratic loss criterion and methods for constructing credible intervals for the loss for computer-experiment-based robust design. Our methods are based on posterior predictive processes for Gaussian process models, which includes linear models. The Lugannani-Rice saddlepoint approximation and moment-matching techniques are used to construct credible intervals. The criterion accounts for response surface uncertainty, and the credible intervals are accurate.

4 - A New Modeling Approach for Mixture-of-Mixtures Experiments

William Brenneman, Procter & Gamble Company, 11511 Reed Hartman Highway, Cincinnati, OH, 45241, United States of America, brenneman.wa@pg.com, Lulu Kang, Roshan Vengazhiyil

The special structure of the mixture-of-mixtures experiment makes the design and modeling approaches different from a typical mixture experiment. We propose a new model called the major-minor model to overcome some of the limitations of the commonly used multiple-Scheffe model. We also provide a strategy for designing experiments that are much smaller in size than those based on the existing methods.

■ MD29

C - Room 5A, Level 3

Industrial Statistics in Asia

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Peter Qian, University of Wisconsin-Madison, 1300 University Ave, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

1 - A Variable-Selection-based Multivariate EWMA Chart for Process Monitoring and Diagnosis

Kaibo Wang, Associate Professor, Tsinghua University, Department Industrial Engineering, Tsinghua University, Beijing, China, kbwang@tsinghua.edu.cn, Jiang Wei, Fugee Tsung

Fault detection and root cause identification are two equally important tasks in MSPC. This paper proposes a combined procedure for multivariate process monitoring and fault diagnosis by utilizing dimension reduction techniques. It first finds potentially out-of-control variables via variable selection and then deploys such information in the monitoring statistics. A real example from a footwear manufacturing process is used to illustrate the applicability of the proposed MSPC chart.

2 - Impact of Six Sigma on Statistical Paradigm for Quality

Thong Goh, Professor, National University of Singapore, ISE Dept, Faculty of Engineering, 10 Kent Ridge Crescent, Singapore, 119260, Singapore, isegohtn@nus.edu.sg

Six Sigma is a Statistics-based framework. Since its emergence at Motorola in the 1980s, it has gained widespread acceptance though academics tend to point out that there is "nothing new" in it. In this presentation it is discussed how, with globalization as the backdrop, the advent of Six Sigma has changed the paradigm in quality in industry, in terms of using statistical tools and the adoption of statistical thinking. Such a paradigm shift is a significant one in the quality profession.

3 - A Critical Review of Six Sigma in Practice

Thong Goh, Professor, National University of Singapore, ISE Dept, Faculty of Engineering, 10 Kent Ridge Crescent, Singapore 119260, Singapore, isegohtn@nus.edu.sg

Six Sigma as a quality and business competitiveness improvement framework has taken industry by storm for a quarter of a century, with extensions and derivatives such as Design for Six Sigma and Lean Six Sigma. While Six Sigma has its inherent merits, there are also unrealistic expectations and unproductive practices in its promotion and deployment. In this presentation, it is pointed out that there are practice that should not be allowed to cloud the effectiveness of Six Sigma in industry.

■ MD30

C - Room 5B, Level 3

Bayesian Methods in Engineering and the Physical Sciences

Cluster: Bayesian Models
Invited Session

Chair: Paul Damien, University of Texas at Austin, Austin, TX, United States of America, Paul.Damien@mccombs.utexas.edu

1 - A Stochastic Newton Method for Large-scale Statistical Inverse Problems

Omar Ghattas, Professor, University of Texas in Austin, 1 University station C0200, Austin, 78712, United States of America, omar@ices.utexas.edu, Carsten Burstedde, James Martin, Georg Stadler, Lucas Wilcox, Tan Bui

We are interested in the solution of several inverse problems in solid earth geophysics, including the inference of mantle constitutive parameters from observed plate motions, earth seismic velocities from surface seismograms, and polar ice sheet basal friction from satellite observations. Each of these inverse problems is most naturally cast as a large-scale statistical inverse problem in the framework of Bayesian inference: given observations and their uncertainty, the governing PDEs and their uncertainty, and a prior model of the parameter field and its corresponding uncertainty, find the posterior probability density of the parameters. Here, we present a Langevin-accelerated MCMC method for sampling high-dimensional, expensive-to-evaluate probability densities. The method builds on previous work in Metropolized Langevin dynamics, which uses gradient information to guide the sampling in useful directions, improving acceptance probabilities and convergence rates. We extend the Langevin idea to exploit local Hessian information, leading to what is effectively a stochastic version of Newton's method. We apply the method to the Bayesian solution of a seismic inverse problem, for which we observe several orders of magnitude faster convergence over a reference blackbox MCMC method.

2 - Formulation and Application for Departure Time Choice

Jason Lemp, Dr., University of Texas in Austin, lemp5000@yahoo.com, Kara Kockelman, Paul Damien

Discrete choice models, like the multinomial logit (MNL), have long been recognized for their ability to capture a wide array of transport-related choice phenomena. However, a number of choices are continuous response variables (e.g., location choice, departure time choice, activity duration, and vehicle usage). In this paper, the continuous cross-nested logit (CCNL) model is introduced. The CCNL model results from generalizing the discrete cross-nested logit (CNL) model for a continuous response variable, much like the continuous logit model emerges by generalizing the MNL. The model is formulated and shown to come from the generalized extreme value (GEV) class of models. Using an example utility formulation, the model's behavior is demonstrated and compared to continuous logit model results. The model's parameters are estimated for a work-tour departure time context using Bayesian estimation techniques and San Francisco Bay Area data. Empirical results suggest the model performs similarly to the continuous logit model in out-of-sample prediction with these data, but allows a more flexible choice behavior to emerge. Finally, a simple welfare example is illustrated and a number of model extensions are presented.

3 - Decision Dependent Stochastic Processes

Thomas Kirschenmann, Graduate Researcher, thk3421@gmail.com, Elmira Popova, Paul Damien, Timothy Hanson

Managers often make decisions affecting a stochastic process with incomplete knowledge of their impact on the process. We present a new Bayesian estimation technique to form an estimate of the decision dependency leading to better informed decisions. Our technique, available in both parametric and nonparametric form, is applied using an MCMC method to obtain estimates of the dependency on maintenance decisions for a system at a nuclear power plant. We report evidence of decision dependence in the failure time distribution, and use these estimates as inputs to a dynamic programming algorithm leading to large financial savings.

4 - Modeling and Preventive Maintenance Optimization of Items with Increasing and Bathtub Failure Rates

Dmitriy Belyi, Graduate Researcher, all_hail_dima@hotmail.com, Paul Damien, David Morton, Elmira Popova

We present a new technique for fitting a Weibull distribution to a set of failure data. This technique overcomes difficulties associated with large sets of observations, which negatively affect other Weibull fitting methods such as maximum likelihood estimation. We use previously derived optimization methods coupled with this modeling technique to compute optimal maintenance schedules for real items. Additionally, we show a new optimization algorithm for items with a bathtub failure rate. We demonstrate this algorithm on real data sets from the South Texas Project Nuclear Operating Company.

■ MD31

C - Room 5C, Level 3

Joint Session DM/ MIF: Statistical Approaches in Data Mining

Sponsor: Data Mining/ Minority Issues
Sponsored Session

Chair: Kobi Abayomi, Assistant Professor, Georgia Institute of Technology, 765 Ferst Dr., 444 Groseclose, Atlanta, GA, 30332, United States of America, kabayomi3@isye.gatech.edu

1 - Discovery of Hidden Subclasses: An Example of Wikipedia Vandalism Detection

Si-Chi Chin, The University of Iowa, LIB 3087, Iowa City, IA, 52242, United States of America, si-chi-chin@uiowa.edu, Nick Street

While classification algorithms learn a single function to separate positive from negative cases, binary labels may contain multiple unknown subclasses. Positive instances of Wikipedia vandalism are heterogeneous, so we detect them by learning multiple subclasses. We perform clustering to identify latent subclasses of labeled instances and analyze the heterogeneity of positive cases. Then we construct an ensemble model to classify each subclass individually and combine the results.

2 - Sorting for Multivariate Prognostic Data

Ping-Han Wu, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30318, United States of America, phwu@gatech.edu, Kobi Abayomi, Nagi Gabraeel

Multivariate prognostic data - time to failure, say, for m components in the ith of n machines - can be used in sorting/scheduling algorithms. We demonstrate two approaches - top k and minimal probing - under various assumptions on observable multivariate prognostics.

3 - Bayesian Multivariate Extreme Value Thresholding for Environmental Hazards

Drew Lupton, Georgia Institute of Technology, Atlanta GA, United States of America, drew.lupton@gatech.edu, Kobi Abayomi, Matthew Lacer

Extreme Value Thresholding, for multivariate data, partitions data by goodness of fit to extreme value distribution. A minimal Pickand's distance is common for the univariate case. Estimation of this distance is non-trivial in the multivariate generalization. We explore the multivariate version of Pickand's distance and consider a log-ratio CUSUM type alternative, via the copula. We illustrate the methodology on environmental hazard data used in the World Bank's 2005 "Hotspots" report.

4 - Statistical Issues for Re-identification in Networked Data

Justin Vastola, Georgia Institute of Technology, Atlanta GA, United States of America, jvastola@gatech.edu, Shawndra Hill, Kobi Abayomi

Models for network data - data represented as a graph with nodes and edges - are often statistically indeterminate. We explore statistical model specification and parameter estimation for three popular network models - Erdos-Renyi, Small World, and Scale Free.

■ MD32

C - Room 6A, Level 3

Computational Linear and Integer Programming

Sponsor: Computing Society
Sponsored Session

Chair: Yan Xu, Analytical Solutions Manager, SAS Institute Inc., SAS Campus Dr, Cary, 27513, United States of America, Yan.Xu@sas.com

1 - SAS MILP Solver Developments

Amar Narisetty, SAS Institute, 100 SAS Campus Drive, Cary, NC, 27513, United States of America, Amar.Narisetty@sas.com, Philipp Christophel, 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 that are incorporated in the SAS MILP solver. These improvements are in search, heuristics, presolve and cuts. We present computational results to demonstrate the effectiveness of these improvements.

2 - Recent Improvements in IBM ILOG CPLEX Optimization Studio

Tobias Achterberg, CPLEX Developer, IBM, Zuse Institute Berlin, Takustr. 7, Berlin, 14195, Germany, achterberg@de.ibm.com

We present new features that have been added to IBM ILOG CPLEX Optimization Studio and give detailed benchmarking results that demonstrate the performance improvements in CPLEX 12.2.

3 - MIP Domination

Zonghao Gu, CTO, Gurobi Optimization, 3733-1 Westheimer Road, Houston, 77027, United States of America, gu@gurobi.com, Robert Bixby, Ed Rothberg

This talk considers the identification and use of domination information in MIP models. This information can be used to simplify a model in presolve, and to avoid unnecessary search in the branch-and-bound algorithm. We discuss different MIP domination techniques, such as variable domination, node domination and symmetry breaking, and present computational results to show that these techniques can significantly improve the performance of a MIP solver.

■ MD33

C - Room 6B, Level 3

First-order and Stochastic Methods for Large-scale Convex Programming

Sponsor: Computing Society
Sponsored Session

Chair: Guanghui Lan, Assistant Professor, University of Florida, Department of Industrial and Systems Engineering, Gainesville, FL, United States of America, glan@ise.ufl.edu

1 - First-order Methods for Constrained Nonsmooth Optimization

Zhaosong Lu, Assistant Professor, Simon Fraser University, 8888 University Drive, Burnaby, BC, V5A 1S6, Canada, zhaosong@sfu.ca, Yong Zhang

We propose a novel augmented Lagrangian (AL) method for a class of constrained nonsmooth optimization problems. Also, we propose two nonmonotone gradient methods for solving the AL subproblems. Global and local convergence of the methods are established. Finally, we discuss the application of this method to a new formulation of sparse principal component analysis and present some computational results which substantially outperform the other existing approaches.

2 - Analysis of First Order Stochastic Methods for ell_1 Minimization Problems in Compressed Sensing

Fatma Kilinc-Karzan, PhD Student, Georgia Institute of Technology, 765 Ferst Dr NW, Atlanta, GA, 30332, United States of America, fkilinc@gatech.edu, Arkadi Nemirovski, Anatoli Juditsky

We propose a first order method with a stochastic oracle for solving bilinear saddle points problems, present its theoretical efficiency estimate and discuss a number of applications, primarily from compressed sensing. We demonstrate both theoretically and numerically, that when seeking medium-accuracy solutions of large-scale ell_1$ minimization problems, our algorithm outperforms significantly (and progressively as the sizes of the problem grow) the state-of-the art deterministic methods.

3 - Optimal Methods for Strongly Convex Stochastic Composite Optimization and Online Learning

Saeed Ghadimi, PhD Student, University of Florida, sghadimi@ufl.edu, Guanghui Lan

In this talk, we present stochastic algorithms as well as novel accurate certificates for stochastic composite optimization problems including those involving strong convexity. We show that these algorithms are (nearly) optimal in terms of expected rate of convergence, and also develop ways to improve their confidence bounds. We demonstrate the significant advantages of these algorithms applied to online learning.

■ MD34

C - Room 7, Level 3

Statistical Perspectives for Adaptive Dynamic Programming

Sponsor: Computing Society
Sponsored Session

Chair: Victoria Chen, University of Texas at Arlington, Industrial & Manuf. Sys. Engr. Department, Arlington, TX, 76019-0017, United States of America, vchen@uta.edu

1 - Semi-local Approximation for the Efficient Solution of Functional Optimization Problems

Danilo Macció, CNR - ISSIA, Via De Marini 6, Genova, 16149, Italy, ddmach@ge.issia.cnr.it, Cristiano Cervellera, Marco Muselli

In many decision problems such as managing an inventory or choosing strategies in a financial market we look for a function minimizing a cost in any point of a compact space. In this work Semi-Local Approximate Minimization (SLAM) is presented, as an efficient method to find approximate solutions characterized by moderate computational requirements. SLAM uses semi-local kernel models that, together with a smart sampling of the input space, guarantee convergence under mild regularity assumptions.

2 - Orthogonalized Dynamic Programming State Space for Efficient Value Function Approximation

Bancha Ariyajunya, University of Texas at Arlington, Industrial & Manuf. Sys. Engr. Department, Arlington, TX, 76019, United States of America, bancha.ariyajunya@mavs.uta.edu, Seoung Bum Kim, Victoria Chen

Very large-scale stochastic dynamic programming (SDP) problems can be efficiently solved by combining data mining methods with computer experiments-based SDP. However, the ideal experimental designs will not appropriately represent the state space if the state variables are highly correlated. In this study, we present data mining methods that enable the use of ideal experimental designs by orthogonalizing a DP state space. This process also reduces the dimensionality of a DP problem.

3 - Sequential Adaptive Modeling for Approximate Dynamic Programming

Victoria Chen, University of Texas at Arlington, Industrial & Manuf. Sys. Engr. Department, Arlington, TX, 76019-0017, United States of America, vchen@uta.edu, Huiyuan Fan

We present an approach that uses two sequential concepts, sequential state space exploration and adaptive value function approximation. It automatically and adaptively identifies the state space regions and approximates the future value functions. The approach is demonstrated on a nine dimensional inventory forecasting problem.

■ MD35

C - Room 8A, Level 3

Stochastic Networks

Sponsor: Applied Probability
Sponsored Session

Chair: Assaf Zeevi, Henry Kravis Professor of Business, Columbia University, Uris Hall, Room 406, Columbia University, New York, NY, 10027, United States of America, assaf@gsb.columbia.edu

1 - On Many-server Heavy Traffic Limits

Rami Atar, Technion, EE Department, Haifa, 32000, Israel, atar@ee.technion.ac.il

I will present a new heavy traffic limit theorem for a multi-server queueing model, in which the number of servers grows without bound and the limit is given by a reflected Brownian motion.

2 - Overloaded Stochastic Networks

Devavrat Shah, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 32-D670, Cambridge, MA, United States of America, devavrat@mit.edu

Performance analysis of myopic policies for stochastic processing networks has seen a terrific progress in recent years. The focus has been on underloaded (stability) or critically loaded (heavy traffic) regimes. However, in many practical scenarios, overloaded regime is more relevant. In this talk, I shall describe some surprising phenomenon observed under overloaded regime and describe an optimal myopic algorithm. Joint work with D. Wischik, UCL.

3 - Bandwidth Sharing Networks with Rate Constraints

Bert Zwart, CWI, Science Park 123, Amsterdam, Netherlands, Bert.Zwart@cwi.nl

We develop fluid and diffusion limits for an important class of networks modeling flow level behavior of communication networks. Using a novel scaling techniques we obtain tractable diffusion limits: for most parameter combinations, we obtain multivariate normal distributions, with mean and diffusion coefficients that are computable in polynomial time in the size of the network and number of classes.

4 - Optimal Admission Control for Tandem Loss Queues

Bo Zhang, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332-0205, United States of America, bozhang@gatech.edu, Hayriye Ayhan

We consider two finite-buffer single-server queues in tandem. A gatekeeper decides to accept or reject each arriving customer. An accepted customer who finds a full buffer at either station leaves the system and a station-dependent cost is incurred; a rejection incurs the same cost as a loss at station 1. We provide a complete characterization of the optimal admission control policy for minimizing the long-run average cost in some special cases, and present conjectures for the general case.

■ MD36

C - Room 8B, Level 3

Online Teaching II

Sponsor: INFORM-ED
Sponsored Session

Chair: Mike Racer, University of Memphis, 334 Fogelman, Memphis, TN, United States of America, mracer@memphis.edu

1 - Online Teaching II - The Focus of this Second Session on Online Education will be an Open Forum, Focusing on the Question of How INFORMS and INFORMed Can Play a Role in this Growing Area
John Kros, Associate Professor of Marketing and Supply Chain Management, East Carolina University, 3121 Bate Building, Greenville, NC, 27858, United States of America, krosj@ecu.edu

This session is a participative session for determining how INFORMed might play a role in assisting those who are developing their own online courses. Issues such as collaborative development, open courseware, and shared resources will be discussed.

■ MD37

C - Room 8C, Level 3

Control of Queues

Sponsor: Applied Probability
Sponsored Session

Chair: Cathy Xia, Associate Professor, The Ohio State University, 210 Baker Systems Engineering Bldg, 1971 Neil Ave, Columbus, OH, 43210, United States of America, xia.52@osu.edu

1 - Pooling Failure-prone Servers: A Cautionary Tale
Hayriye Ayhan, Professor, Georgia Institute of Technology, Atlanta, GA, United States of America, hayhan@isye.gatech.edu, Sigrun Andradottir, Douglas Down

We compare systems with unreliable resources under various degrees of pooling. We model the systems as single stage queues with servers that can fail any time. Our results show that pooling does not necessarily improve mean waiting times and tail probabilities for the waiting times in the presence of server failures.

2 - The Impact of Partial Customer Flexibility in Queuing Networks
Osman Akgun, PhD Student, University of California-Berkeley, Industrial Engineering and, Operations Research Department, Berkeley, CA, 94720, United States of America, akguno@ieor.berkeley.edu, Ronald Wolff, Rhonda Righter

We study a queuing system with arrival streams that are dedicated to particular subsets of servers, and flexible customers who have the option to choose the queue they join. We generalize earlier results on the optimality of "Join the Shortest Queue" to systems with arbitrary arrivals, multiple servers at a station, and customer abandonments. We consider two different customer abandonment models: 1) all customers might abandon and 2) only customers waiting in the queue might abandon.

3 - Stochastic Analysis and Optimization of Queueing Networks
Mark Squillante, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com, Soumyadip Ghosh

We consider a stochastic analysis of a class of queueing networks with bursty arrivals and strongly dependent service times. A stochastic optimization of resource capacity and resource allocation is then derived within the context of this class of queueing networks, where rewards are generated when performance guarantees are satisfied and penalties are incurred otherwise. The corresponding performance guarantees are based on throughput and sojourn time metrics involving tail distributions.

4 - Exact Order Asymptotic Analysis for Closed Queueing Networks
David George, PhD Student, The Ohio State University, 210 Baker Systems Engineering Bldg, Columbus, OH, 43201, United States of America, george.385@osu.edu, Cathy Xia

We present an exact order asymptotic analysis of closed queueing networks with product form as the population grows large. The study is motivated by the need to approximate system performance in large-scale queueing networks. We derive a general result that captures the asymptotic behavior of the partition function in exact order, which leads to new asymptotic approximations for various network performance measures. We demonstrate their benefit on some large-scale queueing optimization problems.

■ MD38

C - Room 9A, Level 3

Analytics Driven Best in Class e-Marketing Business Model

Contributed Session

Chair: Arnab Chakraborty, Analytics Service Delivery Leader, GBS-DSAS, Hewlett Packard, Bagmane Tech Park, CV Raman Nagar, Bangalore, 560062, India, arnab.chakraborty@hp.com

1 - Elevating the Profitability of Digital Media Investment Through Optimization Techniques
Prithvijit Roy, Senior Director, GBS-DSAS, Hewlett Packard, Bagmane Tech Park, Bangalore, India, Prithvijit.roy@hp.com

Digital Marketing allocates the investments across multiple vehicle like e-mail, search, affiliates, social media, banner ads. Due to pressure on operating margins, we need to allocate the marketing dollars effectively so that it gives maximum ROI. In this paper, the author is going to talk about the application of marketing spend optimization for various online vehicles and share the various tools and models to effectively manage demand gen budget

2 - Get the Next Billion Dollar From the Online Space by using Advanced Analytics
Arnab Chakraborty, Analytics Service Delivery Leader, GBS-DSAS, Hewlett Packard, Bagmane Tech Park, CV Raman Nagar, Bangalore, 560062, India, arnab.chakraborty@hp.com, Pritam Kanti Paul, Prithvijit Roy

Online Marketing revolves around traffic that converts into orders and having the customers coming back to the web-store for repeat purchases. The richness of the transaction data, traffic data and the customer data lends itself to very sophisticated analytics. In this paper, the author will share real life examples covering - Forecasting Traffic patterns on the web-store;Campaign targeting to enable customized offers;Increase repeat purchases by anticipating customers' needs.

3 - Analytics enabling Pro-active Customer Engagement for Effective E-marketing
Pritam Kanti Paul, Analytics Service Delivery Leader, GBS-DSAS, Hewlett Packard, Bagmane Tech Park, CV Raman Nagar, Bangalore, India, Pritam-kanti.paul@hp.com

e-Marketing business model lends itself to having direct engagement with end customers every day. This presents the opportunity to win these customers for life by having personalized and pro-active engagement and enhance the life-time value of these customers. In this paper, the author is going to share the concepts on customer segmentation and how it can be applied to enable customer profiling and targeting and giving the personalized customer experience and engagement.

■ MD39

C - Room 9B, Level 3

Advancements in Theory of Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Kiavash Kianfar, Assistant Professor, Texas A&M University, Department of Industrial and Systems Eng, Texas A&M University, College Station, TX, 77843-3131, United States of America, kianfar@iemail.tamu.edu

1 - A New Algorithm for Precedence-constrained Scheduling LPs
Mark Zuckerberg, BHP Billiton Technology, GPO Box 86A Melbourne Vic 3100 Australia, Melbourne, Australia, Mark.Zuckerberg@bhpbilliton.com, Daniel Bienstock

We present a new algorithm for solving the LP relaxation of integer programs arising in the scheduling of precedence-constrained activities subject to multiple capacity constraints. This problem arises in, among other contexts, open-pit mining. We describe theory and implementation that successfully solves very large real-world problem instances.

2 - Deterministic Lot-Sizing with Service Levels
Dinakar Gade, Graduate Fellow, The Ohio State University, 210 Baker Systems Engineering, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, gade.6@osu.edu, Simge Kucukyavuz

We study a single-item uncapacitated lot-sizing problem with a service level constraint on the number of periods one is allowed to backorder demand. We show that this problem is polynomially solvable. We develop a natural mixed-integer programming formulation and alternative extended formulations and report computational results on multi-item instances.

3 - Exploiting Special Structures in Computing Convex Hulls
Stephen Henry, Doctoral Student, Clemson University, O-05 Martin Hall, Clemson, SC, 29634, United States of America, smhenry@clemson.edu, Warren Adams

We show how a "constraint-induced" RLT automatically yields convex hull representations for specially-structured sets consisting of discrete and continuous variables. This methodology generalizes, and provides insight into, earlier RLT contributions that make use of Lagrange interpolating polynomials for the discrete case, and binary variables and their complements for the more restrictive binary case.

■ MD40

C - Room 9C, Level 3

Recent Developments in COIN-OR Projects

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: Laszlo Ladanyi, CPLEX R&D, IBM, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, ladanyi@us.ibm.com

1 - Coin Graph Classes: Creating Efficient and Extensible Graph Storage and Algorithms for C++
Philip Walton, Engineering Manager, JBHunt Transport, Inc., 411 NW A St, Bentonville, AR, 72712, United States of America, hpwalton@yahoo.com

There are many factors to take into consideration when writing a general purpose graph library. There are theoretical concerns such as complexity of search and traversals, space complexity in terms of compactness of storage and general usability. This will cover those topics and how they are accounted for in the COIN-OR Graph Classes (CGC) as well as some more practical aspects of developing such a library in C++.

2 - PFunc: Modern Task Parallelism for High Performance Computing
Anju Kambadur, IBM T J Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, pkambadu@us.ibm.com

Task parallelism is a powerful parallel programming model that allows parallelization of irregular algorithms. However, existing task parallel tools such as Cilk do not provide the flexibility required by expert programmers to exploit the power of the multi-core processors to their fullest. In this talk, we introduce PFunc, a novel library for expressing shared-memory task parallelism in C and C++ that has been designed to overcome the shortcomings of existing task parallel tools.

3 - Progress Update on COIN/DIP - Decomposition for Integer Programming
Matthew Galati, Optimization Interface Lead, SAS Institute, 1400 Morris Drive, Suite 201, Chesterbrook, PA, 19087, United States of America, matthew.galati@sas.com, Ted Ralphs

COIN/DIP (Decomposition for Integer Programming) is an open-source extensible software framework for implementing decomposition-based bounding algorithms for use in solving large-scale discrete optimization problems. We will present a progress update on the development of the application MILPBlock as a fully automated (black-box) MILP solver using branch-price-and-cut.

■ MD41

C - Room 10A, Level 3

Interior-Point Methods for Nonlinear Programming

Sponsor: Optimization/Nonlinear Programming (Joint Cluster ICS)
Sponsored Session

Chair: Hande Benson, Associate Professor, Drexel University, Department of Decision Sciences, LeBow College of Business, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu

1 - Image Reconstruction in Radio Astronomy Via SDP
Robert Vanderbei, Princeton University, 209 Sherrerd Hall, Princeton, NJ, United States of America, rvdb@Princeton.edu

New algorithms for image reconstruction in radio astronomy use a maximum likelihood technique that involves solving a block 2x2 semidefinite programming problem. We will describe the problem, the algorithm, and give some computational results involving reformulating the block 2x2 SDP as a convex optimization problem suitable for solving with a generic NLP code.

2 - A Subspace Affine-Scaling Algorithm for Nonlinear Optimization with Continuous Knapsack Constraints
Hongchao Zhang, Dr., Department of Mathematics, Louisiana State University, Baton Rogue, LA, 70808, United States of America, hozhang@math.lsu.edu

In this talk, we will introduce a subspace affine-scaling algorithm for optimization problems with a single linear equality constraint and box restrictions. Many theoretical properties of this algorithm will be discussed. Promising numerical results of this algorithm compared with other subspace algorithms for Support Vector Machine (SVM) test problems will be presented too.

3 - A Penalty-Interior-Point Method for Large-Scale Nonlinear Optimization
Frank E. Curtis, Lehigh University, 200 W. Packer Ave., Bethlehem, PA, United States of America, frank.e.curtis@gmail.com

Penalty and interior-point methods have been the most successful approaches for nonlinear optimization. Penalty methods are effective for ill-conditioned problems due to their regularization of the constraints, and interior-point methods are effective for large-scale problems. In this talk, we discuss a way to combine penalty and interior-point techniques into a single algorithm that has both of these properties, with particular focus on the updates for the penalty and interior-point parameters.

4 - Proximal-Point Nonlinear Rescaling Method for Convex Optimization
Igor Griva, Assistant Professor, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States of America, igriva@gmu.edu, Roman Polyak

We discuss a proximal-point nonlinear rescaling (PPNR) method for nonlinear convex optimization. One can view one step of the PPNR method as a primal-dual proximal point mapping. We analyzed the properties of this mapping and used them to establish convergence and estimate convergence rate of the sequence generated by the PPNR method. The introduced scheme allows analyzing a wide variety of non-quadratic augmented Lagrangian methods from unique and general point of view.

■ MD42

C - Room 10B, Level 3

Applications in Portfolio Optimization

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: John Birge, University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, jbirge@ChicagoBooth.edu

1 - Reducing Estimation Errors in Porfolio Optimization
John Birge, University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, jrbirge@uchicago.edu

Various approaches have been proposed to reduce the losses due to estimation errors in portfolio optimization. This talk will discuss the various approaches and provide computational results indicating which might be most effective in practice.

2 - Topics in Portfolio Optimization Under Asymmetric Distributions
Luis Chavez-Bedoya, Northwestern University, 1915 Maple Ave 0319, Evanston, IL, 60201, United States of America, luischavez2011@u.northwestern.edu, John Birge

We analyze the asset allocation problem under exponential utility and generalized hyperbolic distribution of returns. After finding the optimal portfolio weights, we define a more general measures of risk and return that allow the construction of an "efficient frontier" . Also, we relate our results with shrinkage estimators and three-fund rules, in the sense that they can be used to mitigate the effect of considering a Gaussian distribution of returns when the true distribution is skewed.

3 - Price of Correlations in Stochastic Optimization
Shipra Agrawal, Stanford University, Stanford, Stanford, United States of America, shipra@stanford.edu, Yichuan Ding, Amin Saberi, Yinyu Ye

In this paper, we study the robustness of the heuristic of substituting joint distribution by product distribution with given marginals through a distributionally robust stochastic programming model. We quantify the loss incurred on ignoring correlations as price of correlation (POC). We show small constant upper bounds on POC for many popular stochastic convex programs and stochastic combinatorial programs such as uncapacitated facility location, Steiner tree, and monotone submodular functions.

■ MD43

C - Room 1, Level 2- Mezzanine

Screening Policies in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: Steven Shechter, University of British Columbia, 3027 West Mall, Vancouver, BC, Canada, steven.shechter@sauder.ubc.ca

1 - Cost-Effectiveness of Screening and Treatment for Hepatitis B in China

David Hutton, Stanford University, Palo Alto, CA, United States of America, billdave@stanford.edu, Samuel So

Hepatitis B affects almost 10% of the population in China. Over the course of several decades, the disease can lead to cirrhosis and/or liver cancer. Although Hepatitis B treatment can be expensive, as the country becomes wealthier, it may become cost-effective to screen and treat individuals for Hepatitis B. We use a Markov model coupled with economic analysis to evaluate the cost-effectiveness of screening and treatment for Hepatitis B in China.

2 - A Partially Observable Markov Decision Process for Bladder Cancer Screening

Yuan Zhang, North Carolina State University, 373 Daniels Hall, 111 Lampe Drive, Raleigh, NC, 27695-7906, United States of America, yzhang13@ncsu.edu, Matthew Nielsen, Brian T. Denton

We present a new POMDP model to optimize follow-up surveillance for patients that have been previously diagnosed with bladder cancer. We describe structural properties of the optimal surveillance policy including optimal timing and sequencing of new urine based bio markers and cystoscopy procedures. We present results that incorporate personalized risk factors into screening decisions including age, gender, and the presence of co-morbidities.

3 - A POMDP Model to Optimize Colorectal Cancer Screening Decisions

Fatih Safa Erenay, PhD Candidate, University of Wisconsin-Madison, Madison, WI, United States of America, erenay@wisc.edu, Oguzhan Alagoz, Adnan Said

We develop a partially observable Markov decision process model to optimize colonoscopy screening decisions with respect to age, gender, personal history, and risk of colorectal lesion. We find a screening policy that maximizes the total expected quality adjusted lifetime using clinical data. We find that gender affects screening decisions and younger patients should be screened more aggressively. We also determine the threshold ages to stop screening based on risk of colorectal lesion.

4 - Optimal Screening Strategies of Patients on the Kidney Transplant Waiting List

Alireza Sabouri, Student, Sauder School of Business, University of British Columbia, (PhD Student) Sauder School of Business, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, alireza.sabouri@sauder.ubc.ca, Steven Shechter, 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.

■ MD44

C - Room 2, Level 2- Mezzanine

Pierskalla Finalists III

Sponsor: Health Applications
Sponsored Session

Chair: Mariel Lavieri, Assistant Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, lavieri@umich.edu

1 - Modeling the Effect of Patient Choice on the Performance of Open Access Scheduling

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

Open access scheduling is a revolutionary concept for improving healthcare access and reducing patient no-shows. A Markov chain model is presented to capture open access appointment scheduling when considering patient choice of appointments. Due to the curse of dimensionality, it is impossible to evaluate the performance of a capacity policy in a typical open access primary care clinic using the Markov chain model. Therefore, an approximate approach is proposed based on this Markov chain model.

2 - A Probabilistic Model for Predicting the Rate of No-show in Hospital Appointments

Adel Alaeddini, Wayne State University, Department of Industrial Engineering, Detroit, MI, 48202, United States of America, dz3027@wayne.edu, Kai Yang, Susan Yu

In this study we investigate factors affecting no-shows in a Veteran Affairs (VA) medical center and develop a hybrid probabilistic model based on logistic regression and Bayesian inference to predict the probability of no-shows in real time using patient general social and demographic information and their individual clinical appointments attendance records. We validate the effectiveness of the proposed approach based on a real dataset from that VA medical center.

3 - Patient Streaming as a Mechanism for Improving Responsiveness in Emergency Departments

Soroush Saghafian, PhD Candidate, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, soroush@umich.edu, Steven Kronick, Mark Van Oyen, Wallace Hopp, Jeffrey Desmond

We consider a new process and patient flow mechanism to overcome crowding in Emergency Departments (EDs). "Streaming" classifies patients based on admission to hospital. We use (1) Queueing Theory and (2) high fidelity simulation based on hospital data. We clarify the operational performance of the streaming and pooling mechanisms. We also generate insights into how EDs can improve their performance by better use of final disposition predictions.

4 - Dynamic Appointment Scheduling with Uncertain Demand

S. Ayca Erdogan, North Carolina State University, 375 Daniels Hall, Campus Box 7906, Raleigh, NC, United States of America, saerdoga@ncsu.edu, Brian T. Denton

We present two stochastic programming models to determine the optimal arrival times to a stochastic server given uncertainty in the number of customers to be scheduled. We discuss the structure of the model, methods for accelerating decomposition based solution methods and specific applications to the outpatient clinic setting. We present empirical results based on optimal scheduling of an endoscopy suite.

5 - Probability Model for Estimating Colorectal Polyp Progression Rates

Chaitra Gopalappa, PhD Student, University of South Florida, 4202 E Fowler Ave, Tampa, United States of America, chaitrag@gmail.com, Selen Cremaschi, Tapas K. Das, Seza Orcun

Developing strategies for population wide early intervention of colorectal cancer requires a systems model of the cancer care. A part of the systems model is the simulation of the natural incidence and progression of cancer. We present a probability model for estimating population-specific progression rates between disease stages.

■ MD45

C - Room 6, Level 2- Mezzanine

Capacity Planning in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: Nan Liu, Mailman School of Public Health, Columbia University, 600 W 168th ST, 6th Floor, New York, NY, 10032, United States of America, nl2320@columbia.edu

1 - On Managing No-Shows

Diwakar Gupta, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, guptad@me.umn.edu

Patients who fail to keep their appointments waste provider capacity, disrupt flow, and increase wait times for all patients. This talk will present an analysis and synthesis of literature on managing no-shows and insights from analysis of data from different types of clinics. The talk will contrast interventions that primarily change appointment scheduling with those that attempt to modify patients' behavior.

2 - Appointment Scheduling with No-shows and Service Interruptions

Jianzhe Luo, UNC Department of Statistics & Operations Research, B24 Hanes Hall CB# 3260, UNC Chapel Hill, Chapel Hill, NC, 27599, United States of America, jzluo@email.unc.edu, Vidyadhar Kulkarni, Serhan Ziya

We consider an appointments-based service system in which a finite number of customers need to be scheduled over a finite time horizon. We develop a formulation that incorporates both the customer no-shows and the service interruptions. The objective is to balance the trade-off between the customer flow times in the system and the server overtime. We also develop an algorithm to obtain the optimal scheduling numerically.

3 - Appointment Scheduling with Bounded Patient Waiting and MD Overtime: A Revenue-Maximization Approach

William Millhiser, Assistant Professor, Zicklin School of Business, Baruch College, The City University of New York, 55 Lexington Ave, Box B9-240, New York, NY, 10010, United States of America, william.millhiser@baruch.cuny.edu, Benedetto Valenti, Emre Veral

We propose an outpatient scheduling system which maximizes the scheduled number of patients based on clinicians' tolerance for overtime and targeted average (and maximum) patient waiting times, rather than balancing ambiguous costs such as patient goodwill and doctor idleness. With a numerically optimized analytical model based on transient-state D/G/1 queues, we compare various scheduling rules of heterogeneous patient classes with general service time distributions and unique no-show rates.

4 - Operational and Clinical Impact of Elective Obstetrics Procedures

Nan Liu, Mailman School of Public Health, Columbia University, 600 W 168th ST, 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 3 years of data from 44 NYC hospitals, we use statistical methods and queuing models to explore practice variation in NYC obstetrics units and analyze the impact of elective procedures on clinical outcomes, costs, and capacity needs.

■ MD46

C - Room 7, Level 2- Mezzanine

Undergraduate Research Showcase IV

Cluster: Undergraduate Operations Research Prize
Invited Session

Chair: Susan Martonosi, Assistant Professor, Harvey Mudd College, Department of Mathematics, 301 Platt Boulevard, Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu

1 - Undergraduate Research Showcase: Navigating Graduate School

Susan Martonosi, Assistant Professor, Harvey Mudd College, Department of Mathematics, 301 Platt Boulevard, Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu

In this special session geared towards undergraduates or recent graduates, current graduate students will share their experiences and advice on how to navigate graduate school, including choosing a graduate program, choosing an advisor, being a teaching assistant, being a research assistant, and managing graduate level courses. This is also an excellent opportunity for undergraduate attendees at the conference to meet each other and network.

■ MD47

C - Room 8, Level 2- Mezzanine

Making Sense of Network Structure in Complex Systems

Cluster: Complex Systems
Invited Session

Chair: David Alderson, Assistant Professor, Naval Postgraduate School, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, 93943, United States of America, dlalders@nps.edu

1 - Organized Complexity and Network Science: Making Sense of Network Data

David Alderson, Assistant Professor, Naval Postgraduate School, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, 93943, United States of America, dlalders@nps.edu, John Doyle

The view of complexity in highly organized technological and biological systems is fundamentally different from the dominant perspective in "network science," which downplays function, constraints, and tradeoffs, and tends to minimize the role of design. In this talk, I will revisit the notion of "organized complexity" and suggest that it is fundamental to what we interpret as "essential" in these network systems.

2 - How to Measure Complexity of Optimized Systems

Eugene Perevalov, Lehigh University, Department of Industrial & Systems Engineerin, Bethlehem, PA, 18017, eup2@lehigh.edu

An operational definition of system complexity is proposed. The main idea is that a system complexity can be measured by how hard it is to optimize it. This definition ties complexity directly to uncertainty. In particular, the complexity of a system (aside from purely computational complexity) whose true state is perfectly known would be close to zero. Roughly speaking, the system complexity is measured by the uncertainty of the control for the given level of suboptimality. The more suboptimality is allowed the less the control uncertainty (and the corresponding complexity) is. If the control of the system is not desired, the complexity is close zero. Efficient methods of approximate computation of the proposed operational complexity are also discussed.

■ MD48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - American Optimal Decisions - Portfolio Safeguard by AORDA

Gaia Serraino, American Optimal Decisions, 5214 SW 91 Way, Ste. #130, Gainesville, FL, 32608, United States of America, serraino@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 (linear, quadratic, maximum, StDev, variance, probability, VaR, CVaR, cardinality, fixed-charge, etc.) See real-life case studies in Windows Shell and MATLAB at www.aorda.com/aod/psg.action.

2 - Lumina Decision Systems, Inc. - Analytica: What it Does that Spreadsheets Can't

Surya Swamy, Consulting Decision Analyst, Lumina Decision Systems, Inc, 26010 Highland Way, Los Gatos, CA, 95033, United States of America, surya@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.

■ MD49

C -Room 10, Level 2- Mezzanine

Managing Technology Use

Sponsor: Information Systems
Sponsored Session

Chair: Vallabh Sambamurthy, Michigan State University, College of Business, East Lansing, India, sambamurthy@bus.msu.edu

1 - Modeling Supply-Side Dynamics of it Components, Products, and Infrastructure

Jesse Bockstedt, Assistant Professor, George Mason University, 4400 University Drive, MS5F4, Fairfax, VA, 22030, United States of America, jbockste@gmu.edu, Gedas Adomavicius, Alok Gupta

There is a growing need to understand the dynamics of supply-side forces in the introduction of new technologies. We use vector autoregression to model the co-movements of new component, product, and infrastructure introductions and provide evidence of strong Granger-causal interdependencies. We also demonstrate that substantial improvements in forecasting can be gained by incorporating these cross-level effects into models of technological change

2 - Optimal Software Free Trial Strategy: The Impact of Network Externalities and Consumer Uncertainty

Hsing Kenneth Cheng, University of Florida, Department of ISOM, Gainesville, FL, 32611, United States of America, hkcheng@ufl.edu, Yipeng Liu

Many software firms offer a fully functional version of their products free of charge, for a limited trial time, to help the diffusion of their new product. This paper uncovers the condition under which software firms should introduce the time-locked free trial software, finds the optimal free trial time, and develops a unified framework for deciding which free trial strategy,time-locked or limited version,is preferred in the presence of network externalities and consumer uncertainty.

3 - Contractual and Information Structures of Business Process Outsourcing Relationships

Deepa Mani, Indian School of Business, ISB, Gachibowli, Hyderabad, India, deepa_mani@isb.edu, Anitesh Barua, Andrew Whinston

Contracts facilitate cooperation while information structures facilitate coordination in information intensive business process outsourcing (BPO) relationships. Our study develops and tests the theoretical argument that the extent of use and performance effects of the information structure of BPO relationships are greater in time and materials BPO contracts than in fixed price contracts. The results have implications for theories of organization and value creation in complex BPO arrangements.

■ MD50

C -Room 11, Level 2- Mezzanine

Power Management in Server Farms

Cluster: Cloud Computing
Invited Session

Chair: Mor Harchol-Balter, Associate Professor, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, harchol@cs.cmu.edu

1 - Energy-efficient Dynamic Capacity Provisioning in Server Farms
Varun Gupta, Computer Science Department, Carnegie Mellon University, Pittsburgh, United States of America, varung@cmu.edu, Anshul Gandhi, Mor Harchol-Balter, Michael Kozuch

A key question in designing server farms is how to efficiently provision the number of servers to handle unpredictable demand patterns. In this work, we analyze server farm management policies, and prove that it suffices to consider a small, natural class of policies to guarantee near-optimal behavior. We also consider time-varying demand patterns and propose a robust, traffic-oblivious server farm management policy which we prove to be asymptotically optimal as the load becomes large.

2 - Decomposition Results for an M/M/k with Staggered Setup
Mor Harchol-Balter, Associate Professor, Carnegie Mellon University, 5000 Forbes Ave., Pittsburgh, PA, 15213, United States of America, harchol@cs.cmu.edu, Anshul Gandhi, Ivo Adan

In this talk, we consider an M/M/k queueing system with setup costs, where servers are turned off when there is no work to do, but turning on an off server incurs a setup cost. In the staggered setup model, at most one server can be in setup at any time. We provide the first analytical closed-form expressions for this system, and prove that its response time is equal, in distribution, to the sum of response time for an M/M/k system without setup, and the setup time.

3 - Optimal Sleeping: A Way to Exploit Underutilization of Data Centers
Lachlan Andrew, Swinburne Univ of Technology, Melbourne, Australia, Melbourne, Australia, landrew@swin.edu.au, Sangtae Ha, Minghong Lin, Ioannis Kamitsos, Hongseok Kim, Mung Chiang, Adam Wierman, Eno Thereska

In this talk we focus on optimal sleep patterns for servers under dynamic load. We show analytical results on the structure of the optimal turn ON/OFF policy for a single CPU taking into account the energy penalty for entering and leaving sleep mode,and assuming a Markovian workload. Simulation results demonstrate significant energy savings, especially under low load.Finally, we extend to multicore servers and compare their optimal sleeping policy with the one obtained in the single core case.

■ MD51

C -Room 12, Level 2- Mezzanine

Modeling for Defense Analysis I

Sponsor: Military Applications
Sponsored Session

Chair: Bill Fox, Professor, Naval Postgraduate School, Monterey, CA, 93943, United States of America, wpfox@nps.edu

1 - Modeling and Methodology for Detecting Suicide Bombers
Bill Fox, Professor, Naval Postgraduate School, 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 models and a methodology that examine current technologies to increase the probability of identifying a suicide bomber.

2 - Modeling the Complexity of the Terrorism/Counter-Terrorism Struggle: Mathematics of the "Hearts and Minds"
Chris Arney, United States Military Academy, Dept of Math, West Point, NY, 10996, United States of America, david.arney@usma.edu, Zachary Silvis, Matthew Thielen, Jeff Yao

The US military is considered the world's most powerful force. But, in insurgencies, asymmetric warfare (terrorism) wreaks havoc on the less flexible. To be effective, the US military must improve its CT flexibility. We model the struggle with a system of first-order differential equations and include analysis of flexibility in leadership, promotion, recruitment, resources, operational techniques, cooperation, intelligence, science, and psychology.

3 - Docking Two Models of Insurgency Growth
Michael Jaye, Associate Professor, Naval Postgraduate School, Monterey, CA, 93943, United States of America, mjjaye@nps.edu, Robert Burks

Both mathematical theories and agent based models (ABM) have the power to provide insight into phenomenon of interest. In this work, we "dock", to use Steven Epstein's phrase, the mathematical results of the SIRS model of infectious diseases applied to civil violence with an ABM extension of Steven Epstein's model for civil violence using Netlogo. In addition, we demonstrate the power of ABM by presenting results not attainable from ordinary differential equations.

4 - Application of Novel Reinforcement Learning Agents to Represent Threat Networks in Social Simulation
Francisco Baez, Naval Postgraduate School, 700 Dyer Rd, Monterey, CA, United States of America, jkalt@nps.edu, Sotiris Papadopolis, Christian Darken, Jonathan Alt

Agent models designed to represent societies and threat networks typically employ relatively simple reflex agents and have yet to fully explore the application of more sophisticated learning agents in these domains. This research describes the application of novel reinforcement learning based agents to this domain.

■ MD52

C -Room 13, Level 2- Mezzanine

Infectious Disease Modeling and Control I

Cluster: Homeland Security and Defense
Invited Session

Chair: Nedialko Dimitrov, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States of America, ned@alumni.cs.utexas.edu

1 - Optimizing Influenza Vaccine Allocation
Jan Medlock, Assistant Professor, Clemson University, Box 340975, Clemson, SC, 29634, United States of America, medlock@clemson.edu, Alison Galvani, Lauren Meyers

The recent emergence of the 2009 H1N1 influenza A strain and delays in production of vaccine against it illustrate the importance of optimizing vaccine allocation. Using a computational model, we determined optimal vaccination strategies with regard to multiple objective functions: e.g. deaths, years of life lost, economic costs. We explored the balance between vaccinating children who transmit most and those individuals at greatest risk of mortality.

2 - Geographic Optimization of Influenza Surveillance Networks
Samuel Scarpino, The University of Texas at Austin, 1 University Station C0930, Section of Integrative Biology, Austin, TX, United States of America, sscarpin@mail.utexas.edu, Lauren Meyers, Alison Galvani, Nedialko Dimitrov

In collaboration with the Texas Department of State Health Services, we assessed the ability of Texas' Influenza-Like-Illness Network to predict hospitalizations and deaths due to influenza. Then, using geographically coded data on influenza hospitalizations we implemented subset-selection algorithm to determine optimal networks of health care providers for capturing the pattern of influenza transmission in different geographic regions, socioeconomic groups, and age-classes.

3 - Trans-seasonal Dynamics of Influenza Epidemics
Thomas Hladish, University of Texas at Austin, 1 University Station C0930, Austin, TX, 78753, United States of America, tjhladish@mail.utexas.edu, Lauren Meyers, Ruben Kubiak

Predicting the size of flu epidemics is a major public health problem, in part because of the complex effects of the human immune system on population-level dynamics. Using a contact network population model with waning long-term immunity, we describe some of the interesting epidemic dynamics that arise. We find that it may be possible to make good predictions about the likelihood and severity of next year's flu epidemic given good information about recent annual epidemics.

■ MD53

C -Room 14, Level 2- Mezzanine

Mobile Ad-hoc Network Simulation and Protocol Development

Sponsor: Telecommunications
Sponsored Session

Chair: Aaron Phillips, Texas Tech University, 2500 Broadway, Lubbock, TX, 79409, United States of America, aaron.phillips@ttu.edu

1 - Mobility Awareness Protocol Considerations
Ivan Guardiola, Assistant Professor, Missouri University of Science and Technology, Department Of Engineering Management & System, Rolla, MO, 65409, United States of America, guardiolai@mst.edu, Kirthana Akunuri

A MANET node requires establishing route on demand. Thus, RREQs are flooded exponentially through the network, which results in high control traffic overhead. Under Type I and Type II errors, network scalability in terms of RREQ flooding is limited though the existing nominal power and distance thresholds. We propose an enhanced routing scheme, Speed-Aware Routing algorithm, which establish a route. The results are elaborated by comparing the end-to-end performance of the SAR against AODVjr.

2 - Two-terminal Reliability Under the Asymptotic Random Waypoint Model's Spatial Distribution
BinChao Chen, Texas Technical Institute, Lubbock, TX, United States of America, binchao.chen@gmail.com, Aaron Phillips, Timothy Matis

The research in this paper seeks to investigate the characteristics involved in using the common Random Waypoint Model to create node movements and simulate mobile ad hoc networks (MANETs). The RWPM's possible effects in computing two-terminal reliability are taken into consideration. This paper then proceeds to provide a method through which two-terminal reliability can be calculated using the understood asymptotic spatial node distribution.

3 - ALACS: A Self-Aware, Adaptive Mobile Ad hoc Routing Protocol
Aaron Phillips, Texas Tech University, 2500 Broadway, Lubbock, TX, 79409, United States of America, aaron.phillips@ttu.edu

In a mobile ad hoc network, the routing protocol serves as the crucial instrument in sustaining communication amongst on-the-go users and their mobile devices. While many common protocols use "blanket rules" for all nodes to follow, ALACS seeks to utilize environmental and self awareness in an effort to avoid unreasonable expectations being placed on any one node. A device being able to make decisions based on its own status may offer benefits not seen by one-size-fits-all routing protocols.

4 - A Fundamental Approach to Wireless Networks
Timothy Matis, Associate Professor, Texas Tech University, Box 43061, Lubbock, TX, 79409-3061, United States of America, timothy.matis@ttu.edu

The OR community has developed several models related to optimizing the QoS of wireless networks over the past several years. Notwithstanding, many of these ignore fundamental axioms related to the physical transmission of a wireless signal. In this presentation, we consider several of these axioms, and comment on how several OR models could be improved to increase fidelity.

■ MD54

C -Room 15, Level 2- Mezzanine

Technology Management Section 2010 Distinguished Speaker

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: David Moore, klicnet.org, 16312 SE 4th Street, Bellevue, WA, 98008, United States of America, dmoore@klicnet.org

1 - Innovation Streams, Paradoxical Organization Architectures, and Organizational Evolution
Michael Tushman, Professor, HBS, mtushman@hbs.edu

Focusing on dynamic capabilities at the business unit and corporate levels of analysis, I link dynamic capabilities to the firm's ability to simultaneously explore and exploit. The firm's architecture, senior team, and ability to manage incremental as well as punctuated change are linked. I discuss characteristics of firms and their senior teams that can host paradoxical strategies, and the nature of collaborative relations with firms that enable research that is both rigorous and relevant.

■ MD55

C -Room 16, Level 2- Mezzanine

Technology Management

Contributed Session

Chair: Yuri Yatsenko, Professor, Houston Baptist University, 7502 Fondren Rd, Houston, TX, 77074, United States of America, yyatsenko@hbu.edu

1 - Estimation of Econometric Models for University-based Technology Transfer Offices in the US
Mehmet Serdar Kilinc, University of Arkansas, 72701, Fayetteville, AR, United States of America, serdarmehmet@gmail.com, Alp Ustundag, Erkan Isikli

In our study, the main objective is to provide econometric models that take long term effects of licensing activities of universities in the US. We use data from the AUTM Licensing Survey covering an eight-year-period. There have been researches focused on determinants of licensing activities and efficiency of research institutes in technology transfer. However, so few researchers have used econometric models and focused on long-term effects of technology transfer.

2 - Measuring Biomedical R&D Productivity: The Probability that a Patent is Utilized in Drug Development
Alexandra Stone, Doctoral Candidate, LBJ School of Public Affairs, University of Texas at Austin, P. O. Box Y, Austin, TX, 78713, United States of America, astone@mail.utexas.edu, Kenneth Flamm

This paper presents a novel approach to measure the productivity of federally-funded biomedical R&D by measuring the utilization of R&D outputs by firms. Productivity of R&D performed at universities is measured as the likelihood that a patent will be licensed by a firm to develop a pharmaceutical. The probability is measured conditional on the experience of the university technology transfer office.

3 - Strategic Motives and Patenting Behaviors in China: The Role of Institutional Support
Qin Wang, Xian Jiaotong University, Post 1875#, No.28, Xianning West Road, Xian City, 710049, China, wangqinxjtu@gmail.com, Min Zhang, Shanxing Gao

Against the background of the patent upsurge in China, we examine the role of strategic motives to patent under a relatively weaker legal system. Based on survey data collected from China, we highlight the significant influence of the strategic motives, especially reputation motives on patenting, considering sector and regional effects. Besides, government based institutional support can substitute for institutional infrastructure. Implications for future research and policy are discussed.

4 - Economic Life Asset Replacement Under Improving Technology
Yuri Yatsenko, Professor, Houston Baptist University, 7502 Fondren Rd, Houston, TX, 77074, United States of America, yyatsenko@hbu.edu, Natali Hritonenko

The economic life (EL) method of asset replacement is analyzed under improving technology that impacts the maintenance cost, new asset cost, and salvage value. In particular, we prove that the asset EL is constant when all these costs decrease with the same rate. We also introduce a modified EL method that minimizes the annual cost over two future replacement cycles and considers technological change. A systematic numeric simulation demonstrates practical applicability of the modified method.

■ MD56

C - Room 1, Level 1

Simulation Applications

Sponsor: Simulation Society
Sponsored Session

Chair: David Muñoz, Head, Dept Industrial Engineering, Instituto Tecnológico Autónomo de México, Rio Hondo # 1, Colonia Progreso Tizapan, Mexico City, DF, 01080, Mexico, davidm@itam.mx

1 - Inventory Management of Spare Parts using Simulation
Luis César Castañeda, Engineer, Instituto Tecnológico Autónomo de México, Rio Hondo # 1, Mexico City, DF, 01080, Mexico, lccvz@hotmail.com, David Muñoz

The erratic demand patterns of service parts for which demand commonly is intermittent represent a challenge in providing a good service. We discuss the application of a model based on Bayesian estimation to forecast intermittent demand that considers data on order sizes and time between order arrivals. Since it does not allow us to obtain simple analytical expressions for the parameters needed for inventory management, we illustrate the use of simulation to estimate the parameters.

2 - Economic Analysis of Different Therapies using Simulation
Norman Navarrete, Mr., Instituto Tecnológico Autónomo de México, Rancho Cocuite 106. Campestre Coyoacàn, Rìo Hondo #1. Progreso Tizapàn, Mexico City, DF, 04890, Mexico, mxnorman@hotmail.com, David Muñoz

The effects on patients' relief of different therapies for long-term illness (e.g., diabetes) are usually monitored and recorded in large databases. We discuss the challenges and opportunities that a modeler faces when trying to incorporate available data into a simulation model in order to perform a cost-utility analysis of different therapies. We illustrate these challenges for the particular case of different therapies for treatment of diabetes mellitus.

3 - Algorithms for the Generalized Weighted Frequency Assignment Problem
Francisco Sànchez, Research Assistant, ITAM, Rio Hondo # 1, Colonia Progreso Tizapan, Mexico City, DF, 01080, Mexico, fsancheza@comunidad.itam.mx, Diego Muñoz, David Muñoz

The performance of fifteen construction heuristics, and seven search algorithms to solve a frequency assignment problem. Different algorithms were tested on two sets of problems. The first one corresponds to the Philadelphia problems, and the second one to FM frequencies assigned in Mexico. Results show that the construction heuristics that consider weights perform better. Seven search algorithms (heuristics) were tested.

4 - A Spatio-Temporal GIS Approach for Agent-Based Pandemic Model
Shengpeng Jin, PhD Student, University of Louisville, Department of Industrial Engineering, 203A J.B. Speed Bldg, University of Louisville, Louisville, KY, 40217, United States of America, jinshengpeng@gmail.com

When pandemics and the emergency cases happen, the EMS stations are supposed to send their ambulances to the patients. There are 26 EMS (Emergency Medical Service) Stations in Jefferson County, Kentucky. Our objective is to figure out whether the distributions of these EMS stations are reasonable for each one to cover a relatively large population by using GIS simulation model so that the sent ambulances are able to arrive at the patients in a required period of time.

■ MD57

C - Room 2, Level 1

Financial Services Tutorials

Sponsor: Financial Services Section
Sponsored Session

Chair: Aparna Gupta, Rensselaer Polytechnic Institute, Lally School of Mgmt, Troy, NY, 12180, United States of America, guptaa@rpi.edu

1 - Financial Engineering for Corporate Treasuries
Alan King, IBM Research, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, kingaj@us.ibm.com

Corporate Treasuries are responsible for funding operational and investment activities. They are like a bank but their time horizons and risk spaces are different. In this tutorial we will discuss opportunities for OR in financial engineering for Treasury applications such as liquidity planning, investment valuation, and risk management.

2 - Consumer Credit and Credit Scoring
Lyn Thomas, Professor, University of Southampton, United Kingdom, L.Thomas@soton.ac.uk

Credit scoring has been the most successful application of Operations Research in consumer Finance in the last 50 years and is one of the first application of data mining techniques. We review how scorecards are built , how one measures how good they are and when they need replacing, and look at the decisions for which they are used. We review how they performed in the global financial crisis and the new challenges they face, in terms of new applications and more sophisticated modelling.

■ MD58

C - Room 3, Level 1

Stochastic Models in Finance

Cluster: Quantitative Finance
Invited Session

Chair: Vadim Linetsky, Professor, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60208, United States of America, linetsky@iems.northwestern.edu

1 - Inverting Analytic Characteristic Functions and Financial Applications
Liming Feng, UIUC, University of Illinois at Urbana-Champaign, 117 Transportation Building MC-238, 104 S Mathews Avenue, Urbana, IL 61801, United States of America, fenglm@illinois.edu, Xiong Lin

In this talk, we present Hilbert transform representations for some useful expectations, including the cumulative distribution function, of a random variable with known analytic characteristic function. The Hilbert transform can be approximated highly accurately and fast using a simple scheme. Numerical results on options pricing and monte carlo simulation will be presented.

2 - Asset-backed Financing with Credit Risk
Steven Golbeck, PhD Student, Northwestern University, IEMS Department, 2145 Sheridan Road Room C210, Evanston, IL, 60201, United States of America, stevengolbeck2008@u.northwestern.edu, Vadim Linetsky

We develop an 2-factor stochastic model for assets of depreciating value that generate a service flow over the course of a finite useful lifetime. We give particular attention to financial transactions which are collateralized by aircraft, and calibrate the stochastic model to a time series of aircraft current market value appraisals.

3 - Discrete Time Optimal Stopping and Early Exercise of Options Under Subordinated Diffusion Models
Lingfei Li, PhD Candidate, Northwestern University, 2145 Sheridan Road Room C217, Evanston, IL, 60208, United States of America, lingfeili2012@u.northwestern.edu, Vadim Linetsky

We consider the discrete time optimal stopping problem for subordinated diffusions with square-integrable reward functions. Assuming the spectrum of the transition semigroup is discrete and using backward induction, we express the value function in terms of eigenfunction expansion. As an example, we consider the pricing of standard Bermudan style put and call option for commodity futures under the subordinated Ornstein-Uhlenbeck model introduced in Li and Linetsky (2009).

4 - Multivariate Time Changes of Markov Processes with Applications to Modeling Dependent Jumps
Vadim Linetsky, Professor, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60208, United States of America, linetsky@iems.northwestern.edu

We show how to construct multi-dimensional Markov processes with dependent jumps via multivariate time changes, how to solve the resulting models via the spectral method, and discuss a range of applications in mathematical finance.

■ MD59

H - Salon A, 4th Floor

Panel Discussion: The Industry Job Search

Cluster: Job Placement Services
Invited Session

Moderator: Bala Shetty, Professor, Texas A & M University, 8413 Wildewood Circle, College Station, TX, 77845, United States of America, BShetty@mays.tamu.edu

1 - Panel Discussion: The Industry Job Search

Panelists: Andrew Boyd, Consultant, 4104 Amherst Street, Houston TX 77005, United States of America, e.a.boyd@earthlink.net, Hossam Zaki, Vice President, Zilliant, 3815 South Capital of Texas Highway, Austin TX 78704, United States of America, hossam_zaki@yahoo.com, Bruce Patty, Vice President, Pacer Stacktrain, 2300 Clayton Road, Concord CA 94520, United States of America, bwpatty@attglobal.net

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.

■ MD60

H - Salon B, 4th Floor

Decision Analysis Society Awards

Sponsor: Decision Analysis
Sponsored Session

Chair: Jim Smith, Duke University, Fuqua School of Business, Durham, NC, 27708, jes9@duke.edu

1 - Student Paper Award

Erin Baker, Associate Professor, University of Massachusetts Amherst, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu, Karen Jenni

The Student Paper Award is given annually to the best decision analysis paper by a student author, as judged by a panel of the Decision Analysis Society of INFORMS. We will recognize the finalists, and the winning paper will be presented.

2 - DA Practice Award

Eric Bickel, Assistant Professor, The University of Texas at Austin, Operations Research / Industrial Engineering, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, ebickel@mail.utexas.edu

The DAS Practice Award is given annually to the best application of decision analysis, as judged by a panel of decision analysis academics and practitioners. We will recognize the finalists and the winner.

3 - DA Publication Award

Rakesh Sarin, UCLA, The Anderson School, Los Angeles, CA, United States of America, rakesh.sarin@anderson.ucla.edu, George Wu, Alex Markle

This award is given annually to the best decision analysis article or book published in the second preceding calendar year (i.e., calendar year 2008 for consideration in 2010). The intent of the award is to recognize the best publication in "decision analysis, broadly defined." This year's winner is George Wu and Alex Markle, "An Empirical Test of Gain-Loss Separability in Prospect Theory," Management Science, vol. 54, no. 7, July 2008.

4 - Frank P. Ramsey Medal

Robert Winkler, Duke University, Fuqua School of Business, Durham, NC, 27708-0120, United States of America, rwinkler@duke.edu, Elisabeth Pate-Cornell

The Frank P. Ramsey Medal is the highest award of the Decision Analysis Society, and it recognizes distinguished contributions to the field of decision analysis. The medal is named in honor of Frank Plumpton Ramsey, a Cambridge University mathematician who was one of the pioneers of decision theory in the 20th century. This year's winner is Elisabeth Pate-Cornell, of Stanford University. Professor Pate-Cornell will give a presentation.

■ MD63

H - Room 404, 4th Floor

Decision Analysis I

Contributed Session

Chair: Raquel Muñoz, Teacher, Tecnológico de Estudios Superiores de Coacalco, Av. 16 de septiembre # 54 Coacalco de Be, Estado de Mexico, 55700, Mexico, jael2222@hotmail.com

1 - The Analysis of Team Decision Procedural Justice and Decision Quality

Ronghui Pang, NanKai University, No. 94, WeiJin Road, Tianjin, China, nextqianlong@yahoo.com.cn

In this paper, the Zhejiang private enterprise was used as the study sample. then we analyzed 143 valid questionnaires and established a model of the relation among decision procedural justice, Team trust and Decision quality. Finally, we tested the relational model. The results show that decision quality was improved by meliorating team decision procedural justice and team trust serves as partially mediating variable between decision procedural justice and decision quality.

2 - Sensitivity Analysis in Decision Analysis using Decision Circuits

Debarun Bhattacharjya, Research Staff Member, IBM T.J. Watson Research Center, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States of America, debarunb@us.ibm.com, Ross Shachter

Decision circuits are graphical representations for efficient decision analysis computation and they are particularly beneficial for real-time decision making. In this talk we explain how the decision analyst can use the partial derivatives that are readily available in decision circuits to efficiently perform sensitivity analysis for a decision situation that is represented as an influence diagram.

3 - A Model for Building Effective Teams

Baichun Feng, University of Wisconsin-Milwaukee, 4510 N Wilson Dr., Apt 1, Shorewood, WI, 53211, United States of America, fengb@psu.edu, Hong Ren

Forming a team that can function effectively over time to sustain high-level team performance is a difficult task. Sometimes, it takes a long time for diverse team members to build a cohesive team. This research analyzes how a firm should group employee to promote the group performance of its employee.

4 - Information Richness and Advice Giving and Taking

Davide Secchi, Assistant Professor of Org. Beh., University of Wisconsin, 1725 State Street, La Crosse, WI, 54601, United States of America, secchi.davi@uwlax.edu

It was 1987 when Daft et al. introduced the information richness (IR) scale, i.e. the capacity of a medium to "facilitate shared meaning." Drawing on studies on advice giving/taking (Bonaccio and Dalal, 2006) it is hard to understand how richness levels can be associated to any mediums independent of other conditions. The paper presents a model of IR "fit" based on: (a) decision maker's needs; (b) adviser's expectations; (c) cognitive efforts necessary to code and de-code information.

5 - Innovation in Business Incubator Project Selection

Raquel Muñoz, Teacher, Tecnológico de Estudios Superiores de Coacalco, Av. 16 de septiembre # 54 Coacalco de Be, Estado de Mexico, 55700, Mexico, jael2222@hotmail.com, Francisco Quiroz

High Technology Business incubators provide advice to entrepreneurs in order to create solid and profitable companies. A good selection of technological projects in the first stage is extremely important to avoid wasting resources. This article proposes a Reusable Decision Model that integrates the elements, including uncertainty, in the selection of innovation and technological projects, making significant savings in the incubation process, where the current incubation models are deterministic.

■ MD68

H - Room 415, 4th Floor

Analytics: The Future of INFORMS

Contributed Session

Chair: Anne Robinson, Director, Information & Data Strategy, Cisco Systems, Inc., 170 W. Tasman Drive, San Jose, CA, 95134, United States of America, annerobi@cisco.com

Co-Chair: Jack Levis, Director of Process Management, United Parcel Service, 2311 York Road, Timonium, MD, United States of America, jlevis@ups.com

1 - Analytics: The Future of INFORMS?

Anne Robinson, Director, Information & Data Strategy, Cisco Systems, Inc., 170 W. Tasman Drive, San Jose, CA, 95134, United States of America, annerobi@cisco.com, Jack Levis

Please join Anne Robinson, VP of Marketing, Communications, and Outreach, Jack Levis, VP of Practice, along with other INFORMS Leaders to hear the results of the recent Analytics Market Study, and discuss how this relates to the future of INFORMS.

■ MD69

H - Salon F, 6th Floor

Railroad OR Models

Sponsor: Railway Applications
Sponsored Session

Chair: Clark Cheng, Director Operations Research, Norfolk Southern Corp, 1200 Peachtree St NE, Box 117, Atlanta, GA, 30309, United States of America, clark.cheng@nscorp.com

1 - Simplified and Integrated Decision Support System for Real-time Train Traffic Management

Michael Swindler, BNSF Railway, 2400 Western Center Blvd., Fort Worth, TX, 76131, United States of America, Michael.Swindler@bnsf.com, Homarjun Agrahari

Real time traffic management involves coordination of several resources to ensure safe and efficient operation of trains. This requires information gathering, decision making, communication of decisions to individuals and entry into systems. BNSF has developed a decision support tool that simplifies decision making and presents an integrated platform for information. We present experimental results on how such a tool can help maximize the median efficiency of train dispatching personnel.

2 - Algorithms for Scheduling Freight Trains Over a Complex Rail Network

Pavan Murali, Doctoral Candidate, USC, 3715 McClintock Ave., GER 240, Los Angeles, CA, 90089, United States of America, pmurali@usc.edu, Maged Dessouky

We briefly describe an integer programming-based capacity management planning model that schedules trains and dispatches them along routes with the least expected delay. The talk will mainly focus on approximation schemes that were developed to solve the planning model for real-world rail networks. We compare the performance of these schemes to the current delays. Results from sensitivity analysis tests will be presented to show the impact of the approximation procedures on the delay values.

3 - A Heuristic Approach to a Classification Yard's Scheduling Problem

Shuangjun Xia, Georgia Institute of Technology, Atlanta GA, United States of America, shuangjun.xia@gatech.edu, Edward Lin

The connection ratio of a classification yard is a widely used measure of operation efficiency and reliability. The problem of scheduling the classification sequence of incoming traffic, assigning cars to tracks, and the train assembly sequence to maximize connection ratio is often very complex. We take a heuristic approach to break the problem down and solve three sub-problems individually. The heuristic is applied to a major classification yard of a Class I rail road, and results presented.

■ MD70

H - Salon G, 6th Floor

Joint Session AAS/ TSL: Tradeoffs in Delay Mitigation: Incorporating Network Effects, Competition and Emissions

Sponsor: Aviation Applications/ Transportation Science and Logistics Society
Sponsored Session

Chair: Vikrant Vaze, Massachusetts Institute of Technology, 77, Massachusetts Avenue, 1-245, Cambridge, MA, 02139, United States of America, vikrantv@mit.edu

1 - Planned and Actual Performance of an Airline Schedule

Amy Cohn, Associate Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, amycohn@umich.edu, Peter Belobaba, Gerasimos Sklatsas

We provide an empirical study of how airlines plan their schedules, in particular with respect to the amount of buffer time used to account for variation in departure, taxi out, flight, and taxi in time. We also discuss the connection between planned buffer and other metrics such as crew costs, aircraft and gate utilization, etc.

2 - Mitigation of Passenger Delays by Integrating Disruption Management and Flight Planning

Lavanya Marla, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 1-245, Cambridge, MA, 02139, United States of America, lavanya@mit.edu, Bo Vaaben, Cynthia Barnhart

This work examines operational measures of managing airline delays and disruptions by integrating two areas of airline operations thus far separate - disruption management and flight planning. We present models for aircraft and passenger recovery combined with flight planning, which optimize the trade-off between fuel costs and passenger delay costs. Our computational experiments on data provided by a European airline show a decrease in passenger disruptions on the order of 47.2%-53.3%.

3 - Routing and Scheduling of Aircraft on Airport Surface with Environmental Considerations

Babak Khorrami, Metron Aviation Inc, 45300 Catalina Court, Suite 101, Dulles, VA, 20166, United States of America, khorrami@metronaviation.com, Vivek Kumar, Terence Thompson

We develop an Integer Program for routing and scheduling of aircraft taxiing from gate to runway and vice-versa on the airport surface. The objective is to mitigate the environmental effects of aircraft taxiing process while conforming to operational constraints of the airports. We limit the movement of every aircraft to the first K-shortest paths between the origin and destination points. Finally we test our model on flight data for DFW airport.

4 - Models of Airline Frequency Competition for Airport Congestion Mitigation

Vikrant Vaze, Massachusetts Institute of Technology, 77 Massachusetts Avenue, 1-245, Cambridge, MA, 02139, United States of America, vikrantv@MIT.EDU, Cynthia Barnhart

Competition influences the capacity allocation decisions in airline markets and has important implications to airport congestion and airline profitability. We model the airline frequency competition as a game and solve using the Nash equilibrium solution concept. We provide a learning-based as well as an empirical justification of the Nash equilibrium outcome. Using these models, we evaluate the impact of strategic slot allocation schemes for congestion mitigation on different stakeholders.

■ MD71

H - Salon H, 6th Floor

Scale and Scope Economies in DEA

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Ole Bent Olesen, University of Southern Denmark, Denmark, ole@sam.sdu.dk

1 - Statistical Tests of Returns to Scale using DEA

Rajiv Banker, Temple University, Philadelphia, PA, United States of America, banker@TEMPLE.EDU, Hsihui Chang, Shih-Chi Chang

Using experimentally designed simulations, this paper evaluates the relative performance of various statistics for testing hypotheses of returns to scale using DEA. Simulation results indicate that DEA-based tests proposed by Banker (1993, 1996) perform much better than Bootstrap-based tests proposed by Simar and Wilson (2002) in terms of the occurrence of Type I errors and is comparable for Type II errors suggesting that Simar and Wilson misreport the results of DEA-based statistics regarding tests of hypotheses of returns to scale when the null hypothesis is true. The simulation results also indicate that the performance of Bootstrap-based statistics is very sensitive to the two different decision rules suggested by Simar and Wilson to evaluate the null hypothesis of constant returns to scale. Further, DEA-based statistics have an advantage of using only a very small fraction of the CPU time required by the Bootstrap-based tests. Taking together, our simulation results suggest that there is no need for empirical research to use the Bootstrap-based test procedures in testing returns to scale in DEA.

2 - Non-parametric Methods for Assessing Scope Properties

Brandon Pope, Texas A&M University, 234F Zachry, College Station, United States of America, brandon_pope@tamu.edu, Andrew Johnson

Two major characteristics of interest of the production function are the scale and scope properties. Knowledge of these can provide insight for policy makers considering industry structure, and also for analysts determining which tools are appropriate. In this research, a new property is introduced, returns to scope, which has several appealing features from an analytical as well as a policy maker's perspective. Two non-parametric methods for the assessment of returns to scope are presented.

3 - Estimation of Economies of Scope in DEA

Ole Bent Olesen, University of Southern Denmark, Denmark, ole@sam.sdu.dk, Niels Christian Petersen

Focus is on scope properties in DEA. DEA in combination with S-shaped production frontiers for fixed input and output mixes facilitate quantification of economies of scope using the notion of product specific returns to scale (Baumol et al. (1982)). An estimation of the minimum proportional increase in observed inputs compared to a splintered production scheme provides an alternative measure of the degree of economies of scope. Upper and lower bounds of scope will be validated using Monte Carlo studies.

■ MD72

H - Salon J, 6th Floor

Public Transit III

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Rahul Nair, Graduate Research Assistant, University of Maryland, Civil & Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu

1 - A Structured Flexible Transit System for Low Density Demand
Seyed Mohammad Nourbakhsh, PhD Student, UIUC, B-156 Newmark Civil Engineering Lab, MC-250, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, nourbak1@illinois.edu, Yanfeng Ouyang

This research proposes a flexible transit route network in a hybrid network structure that is the combination of a grid network and a hub-and-spoke network. The proposed model determines the structure of the network as well as headway of buses for different transportation mode. The case studies shows that under low-to-moderate demand levels, the proposed flexible-route system has the lowest system cost compare to fixed route and taxi.

2 - A Bilevel Network Design Problem for Shared-vehicle Systems
Rahul Nair, Graduate Research Assistant, University of Maryland, Civil & Environmental Engineering, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, rahul@umd.edu, Elise Miller-Hooks

A shared vehicle system involves a vehicle fleet located across a network from which users are free to check out vehicles and return them to a station close to their destinations. A bilevel model is formulated to determine the optimal configuration (locations, capacities) to provide value-added, transit-based, intermodal trips for users.

3 - An Urban Transportation Service - Bringing You and Your Vehicle Home
Johan Oppen, Molde University College, Molde N-6402 Norway, Johan.Oppen@himolde.no

A company offers a transportation service to bring people and their vehicles home, meaning that a driver will come and drive your vehicle to your home with you as a passenger. Typically, some of the transportation tasks are ordered early and thus known when the daily operations are planned, but additional tasks will be called in while the plan is being executed. The company may choose between several modes of transportation to bring a driver to the pickup location of the next task. The associated planning problem can thus be modelled as a dynamic and stochastic Vehicle Routing Problem with multiple transportation modes. We present models and discuss solution methods, both for the simpli?ed version where all demand is known in advance, and for the real-world version where replanning has to be done as new orders arrive.

■ MD73

H - Salon K, 6th Floor

Consolidation and Network Design III: Studies of Consolidation

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Yue Geng, Northwestern University, 2145 Sheridan Road Room C223, Evanston, IL, United States of America, yue-geng@northwestern.edu

1 - Freight Consolidation Strategy in an International Supply Chain
Wooseung Jang, University of Missouri - Columbia, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America, jangw@missouri.edu, Na Deng

We present frequent order consolidation strategies in an international supply chain. Our study shows how companies should effectively plan their cargo loading, delivery mode and route selection to minimize total logistics cost. A mixed integer linear programming model is developed and the solution is applied to a real case.

2 - When Does Shipment Consolidation Make Sense?
M. Ali Ulkü, Assistant Professor of Operations Management, School of Business, Capital University, 1 College and Main, Columbus, OH, 43209, aulku@capital.edu

Depending on the operating environment of the supply chain and the nature of the orders for small shipments, a freight consolidation program may not be at all beneficial to the shipper or the carrier, especially when the orders are very time sensitive or the products are fast-perishable. We investigate the conditions under which shipment consolidation would enable savings both for the cases of private and common carriage. Some managerial insights are offered by furnishing numerical analyses.

3 - Consolidation on a Single Lane
Yue Geng, Northwestern University, 2145 Sheridan Road, Room C223, Evanston, IL, United States of America, yue-geng@northwestern.edu, Diego Klabjan

We consider single-lane transportation problems where cost savings can be achieved by consolidating shipments and thus moving from less-than-truckload to full truckload operations. Through mathematical programming we study optimal and approximate policies. We also take into account the different lead times offered by these two operational strategies.

4 - Impact of Consistency of Care on Home Healthcare Routing
Mike Hewitt, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, mrheie@rit.edu, Maciek Nowak, Ashlea Bennett

For some organizations, cost is one of many factors used to measure the quality of a route. In home health care, consistency with respect to the nurse that visits a patient or the time of day a patient is visited can be just as important. Also, advances in information technology devices provide a new method for providing care. We present an integer programming model with multiple objectives to study these conjoined factors and the impact devices have on the ability to achieve them.

■ MD74

H - Room 602, 6th Floor

Sustainabile Transportation Networks

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Srinivas Peeta, Professor of Civil Engineering, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States of America, peeta@purdue.edu

1 - A Sustainable Policy Decision Approach for Emissions and Travel Time Tradeoff for Large Urban Transportation Networks
Sushant Sharma, Research Associate, Purdue University, B100, 2700 Kent Avenue, West Lafayette, IN, 47906, United States of America, sharma57@purdue.edu, Srinivas Peeta

This study addresses the transportation network design problem arising from the planner's objective to minimize vehicular emissions, in addition to the system travel time, while seeking capacity expansions to the road network. A bi-level optimization model is used to solve the problem. Results and insights are illustrated for an urban (city) network.

2 - Enhancing Energy Consumption Efficiency in Multimodal Transportation Networks
Lili Du, NEXTRANS Center, Purdue University, 2700 Kent Avenue, West Lafayette, IN, 47906, United States of America, ldu@purdue.edu, Denfeng Sun, Peng Wei, Srinivas Peeta

This study proposes a bi-level optimization model which aims to enhance the energy consumption efficiency in multimodal transportation networks. The interaction between the multimodal transportation networks (supplier) and intermodal trips (demand) is considered in the model development. The solution methodology and the sensitivity analysis for the key factors are discussed.

3 - Prepositioning Supplies in Preparation for Disasters
Ann Campbell, Associate Professor, University of Iowa, Management Sciences Department, Iowa City, IA, 52242-1994, United States of America, ann-campbell@uiowa.edu, Phil Jones

We examine the decision of where to preposition supplies in preparation for a disaster, such as a hurricane or terrorist attack, and how much to preposition at a location. Our cost model considers the tradeoff between risk and delivery time and can be used to select the best supply point(s) from a discrete set of choices.

Tuesday, 8:00am - 9:30am

■ TA01

C - Ballroom D1, Level 4

Optimization and Equilibrium Modeling for Energy Markets - II

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Steve Gabriel, Associate Professor, University of Maryland, 1143 Martin Hall, Department of Civil & Env. Engineering, College Park, MD, 20742, United States of America, sgabriel@umd.edu

1 - Solving a Linearly Constrained Equilibrium Problem using Schur's Theorem and SOS2 Variables

Sauleh Siddiqui, PhD Student, University of Maryland, College Park, MD, 20742, United States of America, siddiqui@umd.edu, Hakob Avetisyan, Steve Gabriel

In a Linearly Constrained Equilibrium Problem (LC-EP), approximating the solution set of a linear or quadratic program or a linear complementarity problem requires the approximation of non-separable terms. We first use Schur's decomposition followed by SOS2 variables to approximate the non-separable terms. We then apply this to an example of a two-level problem, specifically, the entrance of a shale producing firm in the natural gas producing market in the United States.

2 - Market Based Decision-making for New Pipeline Construction for Natural Gas Supply

Hakob Avetisyan, PhD Student, University of Maryland, College Park, MD, United States of America, havetisy@umd.edu, Sauleh Siddiqui, Steve Gabriel

Natural gas is expanding its share in the energy market due to new plentiful resources such as shale gas. In this presentation, we present an MPEC wherein the upper-level corresponds to building gas pipelines to exploit new resources and the lower level represents the rest of the gas market.

3 - A Fast Heuristic for Optimal Transmission Switching

David Fuller, Prof., University of Waterloo, Department of Management Sciences, 200 University Ave. West, Waterloo, ON, N2L 3G1, Canada, dfuller@engmail.uwaterloo.ca

Other researchers have shown that large reductions in generation cost can be achieved by switching some transmission lines out of service. A MIP, based on the DC load flow LP, calculates near-optimal switching. However, MIP solution times are very long. My talk presents a heuristic that solves the DC load flow LP repeatedly with a line removed at each step as indicated by dual information. Tests show huge reductions in computational time with no sacrifice in solution quality.

4 - COALMOD-World: Modeling the International Coal Markets Until 2030

Clemens Haftendorn, PhD Student, DIW Berlin, Mohrenstrafle 58, Berlin, 10117, Germany, chaftendorn@diw.de, Franziska Holz

Coal continues to play an important role in the global energy sector. In order to analyze future trade flows we developed a multi-period model of the global coal market with endogenous investments. The main specificity of our model is that it is based on energy and mass values and simulates decoupled domestic markets to see the interaction of domestic markets with the world market. We also model different market power scenarios to assess the effect of increasing concentration on the supply side.

■ TA02

C - Ballroom D2, Level 4

Energy Procurement and Contracting

Cluster: Energy: Modeling the Interface Between Markets and Operations

Invited Session

Chair: Sam Aflaki, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, sam.aflaki@insead.edu

1 - Integrated Spot, Forward and Options Procurement Policies in Presence of Logistical Costs

Ankur Goel, Case Western Reserve University, 10900 Euclid Avenue, 324 Peter B Lewis Bldg., Cleveland, OH, 44113, United States of America, axg312@case.edu, Fehmi Tanrisever

In this research we develop the optimal spot, forward and options procurement policies when demand and prices are uncertain and logistical costs are present. Demand is price dependent and follows a linear downward sloping curve. The optimal procurement quantity has a newsvendor like structure. We also develop insights on the effect of demand and price volatility on the optimal procurement policy. We further extend our model to optimize the portfolio of options with different strike prices.

2 - Procurement Risk Management: A Case in Turkish Energy Industry

Cagri Haksoz, Assistant Professor of Operations Management, Sabanci University, Faculty of Management, Orhanli, Tuzla, Istanbul, 34956, Turkey, cagrihaksoz@sabanciUniversityedu, Ozgur Arslan

We present the procurement risk management practice of Enerjisa, a major energy company in Turkey. We provide results of a survey and interview conducted at Enerjisa, which illuminates the current perception of the critical procurement risks and how they are being managed effectively. We shed light on the procurement risk perception, critical drivers of procurement risks, risk assessment strategies, and operational and financial hedging of procurement risks.

3 - Technology Choice and Capacity Investment Under Carbon Regulation

David Drake, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, david.drake@insead.edu, Paul R. Kleindorfer, Luk Van Wassenhove

Under carbon regulation, a firm's investment decision not only determines its capacity and traditional operating cost profiles; it also determines the firm's exposure to emissions-related costs. We explore the impact of this additional cost by studying normative technology choice and capacity decisions under both carbon cap-and-trade and carbon tax regimes. We compare technology shares across these two regimes, as well as the resulting expected profit, service level and emissions performance.

4 - Strategic Investment in Renewable Energy Sources

Sam Aflaki, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, sam.aflaki@insead.edu, Serguei Netessine

We model the contracts between a grid operator, responsible to meet the uncertain electricity demand, and two types of generators: the green and the black. The green generator has an intermittent supply but relatively low unit operational and emissions costs. The black generator is more reliable, but with higher variable and emission costs. Besides analyzing the optimal contracts, we characterize and compare the optimal capacities under first-best and game settings.

■ TA03

C - Ballroom D3, Level 4

Forestry V: Ecosystem Services

Sponsor: Energy, Natural Resources and the Environment//Forestry Sponsored Session

Chair: Robert Haight, US Forest Service Northern Research Station, 1992 Folwell Avenue, St. Paul, MN, 55108, United States of America, rhaight@fs.fed.us

1 - Bundling Water Quality and Native Forest Restoration Services in a New Zealand Pine Plantation

Svetlana Kushch, School of Forest Resources, University of Washington, Seattle, WA, United States of America, kushch@uw.edu, Sergey Rabotyagov, James Turner, Sandor Toth

ECOSEL is a market mechanism that combines multi-criteria optimization and auction theory to match willing sellers and buyers of forest ecosystem services. We present a case study where the method is used to analyze land management options in a forested catchment in New Zealand under two regulatory regimes. We find that while current regulations warrant minimal nitrogen emissions in the catchment, evidence from mock auctions suggest that ECOSEL might be useful where these regulations are absent.

2 - Optimizing the Energy Savings From Shade Tree Location

David Butry, National Institute of Standards and Technology, Gaithersburg, MD, United States of America, david.butry@nist.gov, Joshua Kneifel, Geoffrey Donovan

Research has shown that shade trees can generate similar reductions in residential cooling cost as more conventional energy-efficient technologies (e.g., windows, insulation, HVAC replacement). We use EnergyPlus to estimate the impact a new shade tree planting has on annual residential energy costs, while varying its location. We map energy saving zones around a prototypical house, identifying the optimal location of a new planting.

3 - Stochastic Approaches to Address Wildfire Risk: Maritime Pine and Eucalypt Stands in Portugal

Jordi Garcia-Gonzalo, Dept Forest Engineering, Technical University of Lisbon, Lisbon, Portugal, Jordigarcia@isa.utl.pt, Liliana Ferreira, José Guilherme Borges, Miguel Constantino, Timo Pukkala

We review research to address wildfire risk in stand-level management and discuss the application of stochastic dynamic programming and non-linear programming to three applications of pine and eucalypt management in Portugal. Two components of wildfire risk-occurrence and damage-are considered in all applications. Both sources of risk were treated as endogenous factors depending on stand features (e.g. basal area) that may be impacted by management.

4 - Issues in the Formulation and Solution of a SDP Approach to Optimal Stand Level Forest Management
Eldon Gunn, Department of Industrial Engineering, Dalhousie University, Halifax, NS, Canada, eldon.gunn@Dal.Ca

This paper reports on a stochastic dynamic programming approach where complex, continuous-valued state information is necessary to adequately represent growth and yield for multi-species stands. The approach allows us to deal with uncertainties on market prices, regeneration, and disturbances. The paper reports on the formulation and approximation issues and on some of the insights from the computed policies.

■ TA04

C - Ballroom D4, Level 4

Power System Impacts of Electrified Transportation

Cluster: Electrical Energy Systems
Invited Session

Chair: Ramteen Sioshansi, Assistant Professor, The Ohio State University, 240 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43215, United States of America, sioshansi.1@osu.edu

1 - Analyzing the Co-Benefits of Solar Photovoltaics and Plug-in Hybrid Electric Vehicles
Paul Denholm, Senior Energy Analyst, National Renewable Energy Laboratory, 1617 Cole Blvd, Golden, CO, 80401, United States of America, paul_denholm@nrel.gov

Plug-in hybrid electric vehicles (PHEVs) offer an option for electrification of the transportation sector. This work simulates the energy balance of a system with large amounts of both solar photovoltaics (PV) and PHEVs to examine the potential co-benefits of these technologies. Mid-day charging increases the economic performance PHEVs, reducing petroleum use while increasing the useful penetration of PV by providing a use for electricity during non-peak periods of solar output.

2 - Will Greenhouse Gas Emission Reductions From Plug-in Vehicles Be Worth the Cost?
Jeremy Michalek, Associate Professor, Carnegie Mellon University, Scaife Hall 324, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, jmichalek@cmu.edu

We identify vehicle design and allocation for minimum life cycle cost and GHG emissions in the US. We find a mix of PHEVs sized for 25-40 miles of electric travel minimizes daily GHG emissions. Larger battery packs result in greater emissions due to production and weight. GHG emission reductions from PHEVs make marginal impact on cost-minimizing solutions even when GHGs are priced at $100/tonne. To be cost effective GHG reducers, PHEV life cycle costs must already be competitive with HEVs.

3 - Optimal Management of Disused PHEV Batteries as Distribution-Level Storage Devices
Vincenzo Marano, Senior Research Associate, The Ohio State University, 930 Kinnear Road, Columbus, OH, 43212, United States of America, marano.8@osu.edu, Xiaomin Xi, Ramteen Sioshansi

This paper presents models to optimize the usage of disused PHEV batteries as energy storage devices and to value these secondary uses of PHEV batteries. The optimization of PHEV battery use is an inherently complex, both due to the multiple potential uses of a battery and the effect of battery usage on future cycling capabilities of the battery.

■ TA05

C - Ballroom D5, Level 4

Game Theory I

Contributed Session

Chair: Dongbin Huang, ETH Zurich, Department of Environmental Sciences, Universitaetstrasse 16, Zurich, 8092, Switzerland, dongbin.huang@env.ethz.ch

1 - Direct Reciprocity in Finite Populations
Jinyan Shao, IBM Research - China, Diamond Building, ZGC Software Park, Beijing, China, shaojiny@cn.ibm.com, Wenjun Yin, Jin Dong, Ming Xie, Wei Zhao

Direct reciprocity is one of the most significant mechanisms for the emergence of cooperation. In this paper, we investigate the finite population dynamics with AllC, AllD and TFT. This evolutionary dynamics we considered can be characterized by a Markov chain and can be further formulated into a system of linear equations. In addition, we find two essential variables, the global fixation probability and the partial fixation probability, to depict the evolutionary process.

2 - Computing Equilibria by Incorporating Qualitative Models
Sam Ganzfried, Carnegie Mellon University, 5000 Forbes Avenue Computer Science, Department, Pittsburgh, PA, 15213, United States of America, sganzfri@cs.cmu.edu, Tuomas Sandholm

We present a new approach for solving large (even infinite) multiplayer games of imperfect information. The key idea behind our approach is that we include additional inputs in the form of qualitative models of equilibrium strategies (how the signal space should be qualitatively partitioned into action regions). We demonstrate that our main algorithm can be used to improve play in two-player limit Texas Hold'em — the most studied imperfect-information game in computer science.

3 - Asymmetric Spite in Auctions
Ankit Sharma, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ankits@cs.cmu.edu, Tuomas Sandholm

Spiteful bidding in auctions stems from long-term benefits from making competitors worse off or from inherent psychological effects. Prior analyses assumed equally spiteful bidders. We find game-theoretic equilibria of the common auction mechanisms in the more realistic setting where bidders are asymmetrically spiteful. Even with two bidders, important properties of symmetric-spite settings cease to hold: the allocation can be inefficient and second-price auction is no longer best in revenue.

4 - An Adaptive Online Ad Auction Scoring Algorithm for Revenue Maximization
Chenyang Li, University of Virginia, 112 Chelsea Drive, Apt.B, Charlottesville, VA, 22903, United States of America, cl2ha@virginia.edu, Mingyi Hong, Alfredo Garcia, Rany Cogill

This paper studies the search engine scoring strategy for online ad auction revenue maximization. It shows a specific scoring rule that extracts the full surplus of the advertisers in an NE of the complete information game. An adaptive heuristic is also described for the incomplete information game where the search engine is informed by total revenue to optimize advertiser ordering. The results can be used to analyze how a monopoly search engine may abuse its power during revenue maximization.

5 - Collective Lunch: An Empirical Test of Fair and Efficient Equilibrium
Dongbin Huang, ETH Zurich, Department of Environmental Sciences, Universitaetstrasse 16, Zurich, 8092, Switzerland, dongbin.huang@env.ethz.ch, Hans Rudolf Heinimann

A fair and efficient equilibrium is unambiguous. It can be used as a proposal for solving a collective action problem. This paper presents a collective lunch experiment to validate the mechanism for achieving such an equilibrium.

■ TA06

C - Ballroom E, Level 4

Tutorial: Dynamic Optimization with Applications to Dynamic Rate Queues

Cluster: Tutorials
Invited Session

Chair: William A. Massey, Princeton University, ORFE Department, Princeton, NJ, United States of America, wmassey@princeton.edu

1 - A Tutorial on Dynamic Optimization with Applications to Dynamic Rate Queues
William A. Massey, Princeton University, ORFE Department, Princeton, NJ, United States of America, wmassey@princeton.edu, Robert Hampshire

This tutorial presents recent developments in the dynamic optimization of dynamic rate queues. These problems are motivated by the management of communications services and apply broadly to services involving the leasing of shared resources. First, we show how the time evolution of many fundamental dynamic rate queueing models are well approximated by low-dimensional dynamical systems. We then discuss the variational calculus methods for Lagrangians, Hamiltonians, and Bellman value functions that give us a three century perspective on the dynamic optimization of dynamical systems. Finally, we apply these techniques to examples of dynamic rate queues that yield approximate policies for profit-optimal design, pricing, or staffing.

■ TA07

C - Ballroom F & G, Level 4

Joint Session JFIG/ HAS/ SPPSN: Pandemic Planning and Modeling

Sponsor: Junior Faculty Interest Group/ Health Applications/ Public Programs, Service and Needs
Sponsored Session

Chair: Dionne Aleman, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, aleman@mie.utoronto.ca

1 - Incorporating Healthcare into Non-homogeneous Pandemic Disease Spread Models
Dionne Aleman, University of Toronto, 5 King's College Road, Toronto, ON, M5S3G8, Canada, aleman@mie.utoronto.ca, Brian Schwartz, Natalia Lizon

In modeling the spread of pandemic disease, homogeneous mixing models are common, but make simplistic assumptions that call into question their accuracy. Non-homogeneous models, though, require large amounts of data to be accurate. We examine our agent-based non-homogeneous simulation of an outbreak in the Greater Toronto Area to assess the impact of public healthcare. We show that the omission of public healthcare in non-homogeneous models leads to massive underestimates of disease spread.

2 - Estimating Work Absenteeism During an Influenza Pandemic
Ali Ekici, Assistant Professor, University of Houston, Department of Industrial Engineering, E221A Engineering Building 2, Houston, TX, 77204, United States of America, aekici@Central.UH.EDU, Julie Swann, Pinar Keskinocak

Many experts believe that an influenza pandemic has been imminent given the flu cases that happened in the last few years. The U.S. Department of Health & Human Services estimates that in the next pandemic 20% of working adults may become ill, and there may be a 40% workforce loss during the pandemic peak. Using a disease spread model, we investigate the effect of influenza pandemic and the intervention strategies such as voluntary quarantine and school closure on the active workforce.

3 - Modeling Vaccine Distribution Decisions for Pandemic Response
Ozgur Araz, Postdoctoral Fellow, University of Texas at Austin, Patterson Lab 628, Austin, TX, 78712, United States of America, oaraz@mail.utexas.edu, John Fowler, Lauren Meyers, Alison Galvani

In this paper, we evaluate the vaccination strategies for influenza pandemic through an age structured geospatial disease spread model and present a decision making framework for vaccine distributions by taking the demographic structures of communities into policy considerations.

■ TA08

C - Room 11A, Level 4

Location Analysis

Sponsor: Location Analysis
Sponsored Session

Chair: Zvi Drezner, Professor, California State University - Fullerton, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu

1 - Modeling Lost Demand in Competitive Facility Location
Tammy Drezner, Professor, California State University, Fullerton, 800 State College Blvd., Fullerton, CA, 92834, United States of America, tdrezner@Exchange.FULLERTON.EDU, Zvi Drezner

We propose a simple new approach to model lost demand (also referred to as elastic demand) in competitive facility location. A "dummy" competing facility that attracts the lost demand is added to the list of competing facilities. All competitive facility location models can be modified to include lost demand and be solved by the same algorithms designed for standard models once the dummy facility is added to the data as an additional competitor.

2 - Design of Reliable Hub-spoke Network
Bo Zeng, Assistant Professor, University of South Florida, Department of IMSE, Tampa, FL, 33620, United States of America, bzeng@usf.edu, Yu An, Yu Zhang

In this talk, we present our research on designing hub-spoke network with consideration of hub disruptions. For both single allocation (SA) and multiple allocation (MA) models, mixed integer programming models are constructed. Given those models are large-scale, Lagrangian relaxation algorithms are developed and their computational performance are presented.

3 - Improved Algorithm for Network Partitioning Into p Equal Size Sub-networks
Atsuo Suzuki, Professor, Nanzan University, 27 Seirei-cho, Seto, 489-0863, Japan, atsuo@nanzan-u.ac.jp, Takehiro Furuta, Atsuyuki Okabe

We provide an improved method for the network partitioning into equal size sub-networks. In the problem, a given network is divided into p connected sub-networks, where the total edge length of each sub-network is equal to those of other sub-networks. This problem is useful for network analysis such as a network version of the cell count method. Tabu search and non-linear programming methods are used for the solution. We apply our method to actual road networks and show the effectiveness.

4 - Location of a Distribution Center for a Perishable Product
Zvi Drezner, Professor, California State University - Fullerton, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu, Carlton Scott

A model that combines an inventory and location decision is presented, analyzed and solved. We consider a distribution center location that serves a finite number of sales outlets for a perishable product. The total cost to be minimized , consists of the transportation costs from the distribution center to the sales outlets as well as the inventory related costs at the sales outlets.

■ TA09

C - Room 11B, Level 4

Economics of Service Quality Provision

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Senthil Veeraraghavan, Assistant Professor, Wharton School of Business, University of Pennsylvania, 3730 Walnut Street, Jon M. Huntsman Hall, Suite 500, Philadelphia, PA, 19104, United States of America, Senthilv@wharton.upenn.edu

1 - Speed Quality Trade-offs in a Dynamic Model
Raj Rajagopalan, Univ. of Southern California, Marshall School of Business, Los Angeles, United States of America, raj@marshall.usc.edu, Vasiliki Kostami

An important tradeoff organizations face in many environments is one between quality and speed. The speed at which some services are performed can be varied with a resultant impact on quality. Working faster may result in greater output and less delay but may result in lower quality and dissatisfied customers. We consider dynamic models in a monopoly setting to explore this tradeoff between quality and speed. We also allow the price of the product/service to be a lever in determining demand.

2 - 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.

3 - The Impact of Size and Occupancy of Hospital on Ambulance Diversion: Theory and Evidence
Sarang Deo, Assistant Professor, Northwestern University - Kellogg School of Management, Evanston, IL, United States of America, s-deo@kellogg.northwestern.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. We test the key insights from these using cross-sectional data from California and find that heavy traffic approximation provides better explanation of our data.

4 - Quality Speed Conundrum: Tradeoffs in Customer-Intensive Services

Senthil Veeraraghavan, Assistant Professor, Wharton School of Business, University of Pennsylvania, 3730 Walnut Street, Jon M. Huntsman Hall, Suite 500, Philadelphia, PA, 19104, United States of America, Senthilv@wharton.upenn.edu, Mehmet Fazil Pac, Krishnan Anand

We model a service system where the expected service quality changes with service speed. Increasing the service rate reduces the waiting costs, but also reduces the expected service quality, so slow service might provide better service. Consumers decide to join a service based on its value, the speed of service and their expected waiting costs. We find that, in equilibrium, firms prefer partial market coverage and charge higher prices in competition.

■ TA10

C - Room 12A, Level 4

Behavior in Pricing Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Ozalp Ozer, Associate Professor, School of Management, The University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, oozer@utdallas.edu

Co-Chair: Yanchong Karen Zheng, PhD Candidate, Stanford University, Huang Engineering Center 338C, 475 Via Ortega, Stanford, CA, 94305, United States of America, yczheng@stanford.edu

1 - Joint Inventory and Cash Management in Micro-Retailing

Margaret Pierson, Harvard Business School, Morgan Hall, Boston, MA, United States of America, mpp2002@columbia.edu, Garrett Van Ryzin

We survey the micro-retailer business environment and the operational challenges faced by micro-retailers in developing economies. We then discuss research results on one problem faced by micro retailers, namely jointly managing cash and inventory. We provide initial inventory management results in this setting and discuss extensions to settings with customers who wish to make purchases on credit (i.e., without paying at the time of purchase).

2 - The Value of Product Variety When Selling to Strategic Customers

Ali Parlakturk, Assistant Professor, University of North Carolina at Chapel Hill, Chapel Hill, United States of America, pturk@unc.edu

We consider a firm that sells two vertically (quality) differentiated products to strategic consumers over two periods setting the prices dynamically in each period. The consumers are heterogeneous in their evaluations of quality and they are strategic in that they decide not only whether and which product variant to buy, but also when to buy choosing the option that maximizes their utility. We derive the equilibrium of the pricing-purchasing game between the firm and the consumers.

3 - Pricing for Generations

Yanchong Karen Zheng, PhD Candidate, Stanford University, Huang Engineering Center 338C, 475 Via Ortega, Stanford, CA, 94305, United States of America, yczheng@stanford.edu, Ozalp Ozer

When successive generations of popular products are introduced to market within months of each other, consumers often make purchase decisions based on the price and performance of the current generation and the anticipated price and performance of the next generation. Firms should take into account this consumer behavior when pricing different generations. We demonstrate that the consequence of ignoring consumer's purchase timing decision can be substantial to a firm.

■ TA11

C - Room 12B, Level 4

Procurement Design Strategies Under Supply Uncertainty

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Yimin Wang, Arizona State University, W. P. Carey School of Business, Tempe, AZ, United States of America, Yimin_Wang@asu.edu

1 - Managing Supplier Product Adulteration: Deferred Payments, Inspection, and Combined Mechanisms

Volodymyr Babich, Georgetown University, McDonough School of Business, Washington, DC, United States of America, vob2@georgetown.edu, Christopher Tang

We study deferred payment, inspection, and combined mechanisms for deterring suppliers from adulterating products. We find the optimal contracts for each mechanism, and describe the Nash equilibria of inspection sub-games. The inspection mechanism cannot completely deter the suppliers from product adulteration, but the deferred payment mechanism can. The combined mechanism is redundant. We identify four factors that determine the dominance of deferred payment over the inspection mechanism.

2 - Supply Disruptions in Serial Supply Chains

Zumbul Atan, Assistant Professor, Technical University of Eindhoven, Paviljoen A06, Eindhoven, Netherlands, zub205@lehigh.edu, Lawrence V. Snyder, Ying Rong

We consider a two-echelon serial system subject to supply disruptions. We show that the optimal policy for the well-known Clark-Scarf system with Bernoulli disruptions is an echelon base-stock policy. For the same system but with disruptions that are governed by a DTMC, we prove that the optimal base-stock level of a node depends on the state of the disruption process at the node itself and all the remaining downstream locations.

3 - Disruption Risk Information and Flexible Backup Suppliers

Soroush Saghafian, PhD Candidate, University of Michigan, 1205 Beal Ave., Ann Arbor, MI, 48109, United States of America, soroush@umich.edu, Mark Van Oyen

We provide insight into two effective remedies to increase supply chain resilience: (1) contracting with a backup flexible supplier, and (2) monitoring suppliers to obtain disruption risk information. We characterize the firm's jointly optimal behavior regarding (a) the capacity investment level with a backup flexible supplier, and (b) the inventory ordering policy. We also derive measures for (a) the value of a flexible supplier, and (b) the value of disruption risk information.

4 - Supplier Improvement Under Competition and Knowledge Spillover

Nan Yang, Assistant Professor, Washington University in St. Louis, Campus Box 1133, St. Louis, MO, 63130, United States of America, yangn@wustl.edu, Yimin Wang

We consider a model with two manufacturers that source a common component from an unreliable supplier, and compete in their consumer market by selecting a service level and other product-related factors. The demand process is given by a stochastic version of the general attraction model. The manufacturer can make an investment to improve supplier reliability, and we examine how supplier improvement effort is influenced by the potential knowledge spillover and the competitiveness of the market.

■ TA12

C - Room 13A, Level 4

Strategic Issues in Supply Chain Management

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Jan Fransoo, Eindhoven University of Technology, School of Industrial Engineering, Eindhoven, Netherlands, J.C.Fransoo@tue.nl

Co-Chair: Sila Cetinkaya, Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States of America, sila@tamu.edu

1 - Adoption and Diffusion of New Technology in a Two-level Supply Chain

Daeheon Choi, PhD Student, University of Washington, ISOM Department Mackenzie 370, Box 353200, Seattle, WA, 98195, United States of America, dhchoi@uw.edu, Apurva Jain

We study the adoption of a new technology like RFID in a two-level manufacturers-retailers supply chain. We optimize an individual firm's adoption decision in a dynamic model that captures the effect of other retailers/manufacturers' adoptions on the firm's probabilistic belief about the technology's benefits and costs. We then aggregate individual decisions to track the diffusion of adoption across the two populations and develop insights into factors that influence this diffusion in practice.

2 - Quantifying the Impact of Supply Chain Fit on Firm Performance

Feryal Erhun, Stanford University, 380 Panama St, Stanford, CA, 94305, United States of America, ferhun@stanford.edu, Stephan Wagner, Pan Grosse-Ruyken

Magnitude of the impact of supply chain management on a firm's financial performance has not been documented so far. Using a sample of 259 U.S. and European manufacturing firms, we empirically document that supply chain fit has a direct, significant, and positive impact on a firm's financial success. Firms with supply chain fit achieve on average 4% [5%] higher ROA, 12% [16%] higher ROCE, 4% [4%] higher sales growth rate, and 4% [2%] higher EBIT margin for their functional [innovative] products.

3 - Product Ramp-ups in Consumer Electronics

Jan Fransoo, Eindhoven University of Technology, School of Industrial Engineering, Eindhoven, Netherlands, J.C.Fransoo@tue.nl, Ad de Jong, Andreas Pufall, Ton de Kok

Product ramp-ups are crucial because short product life cycles prevail and profit margins diminish rapidly over time. The ramp-up process is however still largely unexplored. We use data from the cell phone industry and identify the key product characteristics that affect ramp-up performance. We develop a partial least squares path model and verify it empirically with operational data, and show that ramp-up performance can be largely explained by product complexity characteristics.

4 - Strategic Obfuscation of Production Capacities in Supply Chains

Elizabeth J. Durango-Cohen, Assistant Professor of Operations Management, Stuart School of Business, Illinois Institute of Technology, 3424 S. State Street, Room: 4A2-2, Chicago, IL, 60616, United States of America, durango-cohen@iit.edu

We study strategic obfuscation of perceived production capacities. In a model with two suppliers and a retailer, we show that obfuscation tacitly allows suppliers to collude and charge higher wholesale prices, thus moderating competition. As a result, obfuscation leads to increased supplier profits but decreased retailer and overall channel profit. The extent of obfuscation is limited by its cost and by the incentive of a competitor to verify capacities. We show that channel profits are higher if the retailer can verifiably disclose competitors' wholesale prices.

■ TA13

C - Room 13B, Level 4

Sourcing and Servicization

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, serguei.netessine@insead.edu

1 - Collaborate Now and Regret Later? A Role of Information Asymmetry in Product Design and Sourcing

Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, serguei.netessine@insead.edu, Sang-Hyun Kim

We investigate how information asymmetry and contracting strategies affect collaboration outcomes. We find that the manufacturer may be better off committing to a price early (before the conclusion of product development) since this promotes full collaboration. However, delaying the contract offer can also be a viable strategy if (a) collaboration leads to a large decrease of expected production cost but not of cost uncertainty, and (b) large demand uncertainty exists.

2 - Viability of a New Service Model in the Automobile Industry

Buket Avci, PhD Student, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, buket.avci@insead.edu, Serguei Netessine, Karan Girotra

We investigate the viability of a novel business model for the deployment of electric vehicles and charging infrastructure. In contrast with the traditional vehicle sales and maintenance, the electric vehicle manufacturer and charging infrastructure provider charges customers for the "service" of miles driven, as opposed to ownership of the vehicle. We investigate the impact of advances in battery technology and market structure on the viability and customer adoption of the new service model.

3 - Managing the Risks of Global Sourcing

Elena Belavina, Doctoral Candidate, INSEAD, Boulevard De Constance, Fontainebleau, France, elena.belavina@insead.edu, Karan Girotra

This study examines the sourcing practices of global sourcing firms that are simultaneously exposed to risks from changes in the exogenous business environment, and the risks of opportunistic behavior from its suppliers. We consider alternative supply chain structures and characterize the dominating strategy (supply chain performance) under different economic conditions.

4 - Incentives in Multi-Indenture Service Supply Chains

Sang-Hyun Kim, Assistant Professor, Yale University, 135 Prospect Street, New Haven, CT, 06520-8200, United States of America, sang.kim@yale.edu

We study a setting in which multiple firms providing different components of a product face investment decisions that impact after-sales service performance. In particular, each component provider can invest in either product reliability or spare parts inventory. A product-level service requirement demanded by the customer creates an externality among firms that drives strategic behavior. We contrast between the efficiencies of two commonly observed contracts under this environment.

■ TA14

C - Room 14, Level 4

Supply Chain Management V

Contributed Session

Chair: Daniel Seifert, Ecole Polytechnique Federale de Lausanne, Odyssea, Station 5, Lausanne, Switzerland, daniel.seifert@epfl.ch

1 - Capacity Transfer Rights - When do They Benefit Suppliers?

Linlin Li, Northwestern University, 2145 Sheridan Road C210, Evanston, IL, 60208, United States of America, linlinli2008@u.northwestern.edu, Izak Duenyas, Seyed Iravani

We address the question of whether and when suppliers benefit from granting capacity transfer rights to buyers who buy options to use their capacity and may not be able to use all the capacity they optioned. We analytically model three different approaches to capacity transfer rights and provide managerial insights into which one is most beneficial for the supplier under different conditions.

2 - Information Sharing in a Supply Chain with a Common Retailer

Shilu Tong, Assistant Professor, UNSW, Australian School of Business, UNSW, School of Information Systems, UNSW, Sydney, 2052, Australia, sl.tong@unsw.edu.au, Albert Ha, Weixin Shang

We consider a supply chain with two competing manufacturers selling substitutable products through a common retailer. The retailer can observe a private signal related to potential demand. Before observing the signal, the retailer commits on whether sharing the signal with any of the two manufacturers. We consider two models where the retailer or the manufacturers are the leaders in information sharing decisions and study how such leadership affects the equilibrium outcome.

3 - The Effect of Supply Chain Disruptions on Suppliers, Customers, and Rivals

Daniel Seifert, Ecole Polytechnique Federale de Lausanne, Odyssea, Station 5, Lausanne, Switzerland, daniel.seifert@epfl.ch, Ralf W Seifert, Kevin Hendricks, Vinod R Singhal

We examine the effect of supply chain disruptions on suppliers, customers, and rivals of firms that have experienced disruptions. Based on public information, we construct a sample of first tier primary suppliers and customers, and main rivals. We hypothesize that disruptions will cause negative stock market reactions at suppliers, and customers, and mixed reactions at rivals. We use event study methodology to analyze stock market effects. Preliminary findings seem to confirm our hypotheses.

■ TA15

C - Room 15, Level 4

Coordination Issues in Supply Chains and Social Networks

Sponsor: Behavioral Operations Management
Sponsored Session

Chair: Paulo Gonçalves, Associate Professor, University of Lugano, Switzerland, paulo.goncalves@usi.ch

1 - Supplier Capacity Investment Under Retailer Competition

Paulo Gonçalves, Associate Professor, University of Lugano, Switzerland, paulo.goncalves@usi.ch, Santiago Arango

In a single-supplier multi-retailer supply chain, we study the supplier's capacity investment decision when supply shortages leads to retailer order inflation. Using optimal control, we characterize the optimal supplier capacity investment trajectory. We consider the actual capacity investment trajectory of subjects taking the supplier role in an experiment with different delays between investment and capacity acquisition and different magnitude of retailer order inflation.

2 - Product Adoption with Social Network Effect: An Empirical Investigation

Yang Zhang, Penn State University, Information Sciences and Technology Building, University Park, PA 16802, yuz131@psu.edu, Gary Bolton

Products such as smart phones have network effects, in that more adopters make them more valuable to prospective customers. We study the strategic adoption of such products in a setting, where the customer's decision is affected by those of his network neighbors (e.g. his acquaintances, colleagues, etc.). Through laboratory data, we find that the density of social network, rather than the cost/benefit associated with decision making, significantly affects the product adoption.

3 - Resource Allocation Strategies in Humanitarian Relief Operations
Paulo Gonçalves, Associate Professor, University of Lugano, Switzerland, paulo.goncalves@usi.ch

Humanitarian organizations today face increased challenges to provide relief (assessing needs, tending the wounded) while trying to build capacity (training and retaining people). Capturing the tradeoff between providing relief and building capacity in a formal mathematical model, we explore the performance of two polar resource allocation strategies. A strategy that emphasizes mainly relief may lead to a better-before-worse behavior, especially when organizations face high personnel turnover.

■ TA16

C - Room 16A, Level 4

Production and Scheduling III

Contributed Session

Chair: Ali Kefeli, PhD Candidate, North Carolina State University, 2717 Brigadoon Dr., Apt 24, Raleigh, NC, 27606, United States of America, akefeli@ncsu.edu

1 - A Multi-stage Stochastic Programming Approach in Master Production Scheduling
Ersin Korpeoglu, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, ersinkorpeoglu@gmail.com, Hande Yaman, Selim Akturk

MPS is widely used in industry, especially within ERP software. The classical MPS assumes infinite capacity, fixed processing times, and a single scenario for demand forecasts. In this paper, we questioned these assumptions. We used a multi-stage stochastic programming approach given several demand scenarios. We incorporated controllability which enlarges the solution space in a capacitated environment. We proposed an effective formulation and conducted an extensive computational study.

2 - Parallel Machine Scheduling to Minimize Weighted Completion Time and Total Completion Time
Jingyang Xu, University at Buffalo (SUNY), 77 W Summerset Ln, Apt.2, Amherst, NY, 14228, United States of America, jxu7@buffalo.edu, Rakesh Nagi

We consider an identical parallel machine scheduling problem with objective to minimize summation of weighted completion time and total completion time. This problem is strongly NP-hard. Column generation is applied for solving this problem for a good solution. Computational results show that column generation is efficient on generating good solution in a short time comparing with commercial software.

3 - Optimal Placement of Passing Bays in an Underground Mine
Hamideh Anjomshoa, PhD Student, University of South Australia, School of Mathematics & Statistics, Mawson Lakes, 5095, Australia, hamideh.anjomshoa@unisa.edu.au, Amie Albrecht, David Lee, Peter Pudney

Underground mines often use a single decline for descending and ascending vehicles. Strategically placed passing bays allow opposing vehicles to pass. The number and locations of bays influences the flow of vehicles, and hence the mine productivity. We describe a simulator to predict productivity for various placements of bays, for both deterministic and stochastic scenarios. We also present an MIP to determine the optimal spacing of bays that minimises the makespan of a fixed number of trips.

4 - Decision Making for Joint Maintenance and Production Scheduling
Seungchul Lee, Graduate Student, University of Michigan, 2010 HH Dow Building, 2300 Hayward St., Ann Arbor, MI, 48109, United States of America, seunglee@umich.edu, Jun Ni

Deteriorated equipment has a significant impact on the product quality and maintenance policies. We present a decision-making architecture to determine maintenance and product dispatching policies based on condition monitoring and the relationship between machine degradation and associated product quality. We demonstrate the advantage of the proposed approach compared with traditional decision-making approaches for a semiconductor manufacturing process application.

5 - Identifying Bottlenecks and Near-bottlenecks in Congestion Prone Planning Models
Ali Kefeli, PhD Candidate, North Carolina State University, 2717 Brigadoon Dr., Apt 24, Raleigh, NC, 27606, United States of America, akefeli@ncsu.edu, Reha Uzsoy

Theory of Constraints (TOC) when used to identify bottlenecks, states that the resource with the least theoretical capacity is the bottleneck of a complex system. Clearly, when demand is under the capacity of most constrained resource, TOC will not be informative in determining the bottleneck of the system. In this presentation, we challenge TOC and, using models with clearing functions, we show that we can identify a bottleneck even under the case demand is below capacity.

■ TA17

C - Room 16B, Level 4

Optimization Applications in Energy and Power Industries

Cluster: Practice of OR/MS

Invited Session

Chair: Bex Thomas, Researcher, General Electric Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, Bex.Thomas@research.ge.com

1 - Optimal Customer Selection for Demand Response Events in Power Systems
Jason Black, Researcher, GE Global Research, 1 Research Circle, K14A64, Niskayuna, NY, 12309, United States of America, blackj@ge.com

Electric utilities offer demand response (DR) programs wherein customers receive incentives in exchange for reducing their consumption during DR events in order to reduce costs and/or maintain system stability. This talk presents a method for optimally selecting customers, along with their respective time and duration for each event. The method utilizes a knapsack algorithm to minimize costs and consumer inconvenience while meeting all physical constraints.

2 - An Options Value Approach for Utilizing Limited Demand Response Events
Rajesh Tyagi, Research Scientist, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, tyagi@ge.com, Jason Black

Many utility demand response programs limit the number of events per year. We present an option value approach that allows utilities to make the decision to invoke these events optimally based on a dynamic threshold value. This threshold is calculated daily using an options approach based on the expected value of a particular event if it is reserved for use at any future date. The utility should only invoke an event on a day when the values exceeds the expected future value.

3 - Optimizing the Design and Integration of Large Scale Photovoltaic Power Plant
Bex Thomas, Researcher, GE Global Research, 1 Research Circle, Niskayuna, NY, 12309, United States of America, thomasb@ge.com

Utilities are starting to consider photovoltaic (PV) power plant as an alternative to conventional power plants. We present an optimization based approach to find the optimal size and design given the location of the PV power plant and utility demand. This method ties design, costing and economic evaluation for optimized plant design.

■ TA18

C - Room 17A, Level 4

OR/MS Software I

Sponsor: CPMS, The Practice Section

Sponsored Session

Chair: Dave Krahl, ExtendSim, 6830 Via Del Oro, Suite 230, San Jose, CA, 95030, United States of America, davek@extendsim.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Internal Capabilities and Firm Survival: A Study of the Software Industry (1995-2005)
Shanling Li, Professor, McGill University, Desautels Faculty of Management, 1001 Sherbrooke St. (West), Montreal, QC, H3A 1G5, Canada, shanling.li@mcgill.ca, Jennifer Shang, Sandra Slaughter

We examine three internal capabilities: marketing, operations and R&D, and provide empirical evidence regarding the impact of firm internal capabilities on survivability. Drawing on RBV, we posit that internal capabilities increase firm survivability and hypothesize that in software industry, marketing and R&D capabilities are more important than operational efficiency. Finally, we postulate that employee growth and internal capabilities will further increase the likelihood of firm survival.

2 - Troubleshooting Simulation Models
Dave Krahl, ExtendSim, 6830 Via Del Oro, Suite 230, San Jose, CA, 95030, United States of America, davek@extendsim.com

The complexity of a simulation model can make it difficult to find and fix a modeling error. No matter what software is used to create the simulation, determining and locating a problem can be challenging. While the process of validating and verifying is well documented, finding and fixing model problems is not. This session will present practical advice on the tools and techniques for troubleshooting simulation models. Both new and experienced modelers will benefit from this presentation.

3 - Collaborative Forecasting with Vanguard System

Brian Lewis, Vice President, Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

Vanguard System integrates forecasting, optimization, and simulation analytics with collaboration features, interactive and dynamic reporting, and Web-based delivery. We will demo the latest collaborative forecasting features in Vanguard System and discuss the important link between forecasting and optimization.

4 - D-SIGHT: An Interactive Visual Tool for Multicriteria Decision Aid

Yves De Smet, Assistant Professor, ULB, CoDE-SMG, Bd du Triomphe CP 210-01, Bruxelles, 1050, Belgium, yves.de.smet@ulb.ac.be, Quantin Hayez

D-Sight is the third generation of PROMETHEE-GAIA based software. It helps the decision maker to structure, understand and solve multicriteria problems. D-Sight is mainly based on visual interactive tools and offers a number of crucial functions such as sensitivity and robustness analysis. In this presentation, we will illustrate its application on a practical example.

■ TA19

C - Room 17B, Level 4

Pricing in Services

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Gabriel Weintraub, Columbia Business School, New York, NY, United States of America, gyw2105@columbia.edu

Co-Chair: Nicolàs E. Stier Moses, Professor, Columbia University, 3022 Broadway, Uris Hall, Room 418, New York, NY, 10027, United States of America, ns2224@columbia.edu

1 - Would the Social Planner Let Bags Fly Free?

Martin Lariviere, Northwestern University, 2001 Sheridan Rd, Evanston, United States of America, m-lariviere@northwestern.edu, Achal Bassamboo, Gad Allon

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 - Investment in Two Sided Markets and the Network Neutrality Debate

Paul Njoroge, MIT, 77 Massachusetts Ave, Cambridge, United States of America, njoroge@mit.edu, Gabriel Weintraub, Asuman Ozdaglar, Nicolàs E. Stier Moses

Using a two-sided market framework, we investigate investment incentives of ISPs under both a neutral and non-neutral network regime. We analyze a game theoretic model of duopoly competition between two interconnected ISPs that compete over quality and prices for both CPs and consumers. Our results shed light on the hotly debated policy issue of network neutrality through formal economic analysis.

3 - Pricing of Media Service Provision Under Competition

Richard Steinberg, Chair in Operations Research, London School of Economics, Depart. of Management, NAB 3.19, Houghton Street, London, WC2A 2AE, United Kingdom, r.j.steinberg@lse.ac.uk, Peter Key

A Media Service Provider (MSP) is an ISP that offers basic Internet service plus additional media service, e.g., unlimited music file downloads. What fee should the MSP charge customers under competition? We present two models. In the first, there are two network providers, an ISP and an MSP. In the second, there is in addition an independent content provider that offers media service but relies on the ISP to provide delivery to customers.

4 - Competition and Contracting in Service Industries

Dominic DiPalantino, Stanford University, 380 Panama St., Stanford, United States of America, domdip@stanford.edu, Gabriel Weintraub, Ramesh Johari

In service industries with congestion effects, two very different contractual structures are commonly observed, depending on whether or not firms choose to offer a guaranteed service level. We analyze the impact of these choices on market outcomes in oligopolistic industries. Our results highlight how contractual agreements influence the intensity of price competition in service industries. We show that competition is often intensified when firms choose to offer service level guarantees.

■ TA20

C - Room 18A, Level 4

Managing Operations Through Promotions, Effort, and Quality

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Ozgun Caliskan Demirag, Assistant Professor of Management, Pennsylvania State University, Erie, 5101 Jordan Road, Room 259, Erie, PA, 16563, United States of America, ozc1@psu.edu

1 - Inventory Models with Partial Backordering

Matt Drake, Assistant Professor of Supply Chain Management, Duquesne University, 925 Rockwell Hall, 600 Forbes Avenue, Pittsburgh, PA, 15282, United States of America, drake987@duq.edu, David Pentico

Organizations in many industries may be able to take advantage of the fact that some customers may be willing to wait to receive an item by planning to have backordered items. We discuss a variety of inventory models under partial backordering to increase profitability including discounts offered to increase the backorder percentage and the management of component inventory under partial backordering of the parent item.

2 - Product Quality Under Demand Uncertainty

Qin Geng, Associate Professor, Kutztown University of Pennsylvania, 2A deFrancesco Building, Kutztown, PA, 19530, United States of America, geng@kutztown.edu, Nicholas Petruzzi

Price-setting newsvendor model provides a framework for understanding how uncertainty affects optimal pricing. Implicit in this framework is the assumption that product quality is held constant regardless of whether or not the seller of the product is facing uncertainty in demand. But what if the product quality question is given explicit consideration? How does this affect our understanding of how demand uncertainty affects pricing?

3 - Market Expansion Effort in Dual Exclusive Channels

Bin Liu, professor, Henan Agricultural University, Department of Management Science, Zhengzhou, 450002, China, liubhnau@163.com, George Cai

This work investigates the performance of a variety of market expansion effort structures and their impact on the supply chain in a dual-exclusive channel. We study pure supplier effort, pure retailer effort, and mixed effort, and analyze their equilibrium results. Furthermore, we explore the efficacy of cooperative expansion effort and conclude the cooperative effort is not always the optimal solution for market expansion. We also discuss overall supply chain efficiency and consumer welfare.

4 - The Compounding Effect of Coupon and Mail-in Rebate

Shilei Yang, Associate Professor, Southwestern University of Finance and Economics, School Of Business Administration, Chengdu, SC, 610074, China, syang@swufe.edu.cn, Bintong Chen, Jihua Cheung

Although in many regards, rebates and coupons are similar, one key difference is that coupons are redeemed with the purchase and provide an immediate benefit while rebates can only be redeemed after purchase. Recently, manufacturers have increasingly instituted mail-in rebate programs together with in-store coupons. Different from previous studies, which separate coupons from rebates, we identify the condition under which offering both vehicles is optimal and more profitable to the manufacturer.

5 - Retailer and Consumer Rebates Under Risk Aversion

Ozgun Caliskan Demirag, Assistant Professor of Management, Pennsylvania State University, Erie, 5101 Jordan Road Room 259, Erie, PA, 16563, United States of America, ozc1@psu.edu, Frank Chen, Jianbin Li

We investigate retailer rebates and consumer rebates in distribution channels facing stochastic and price-dependent demand. In a game theoretical framework, we incorporate the retailer's pricing and inventory decisions under risk aversion, and we derive some insights about situations where one particular rebate type outperforms the other.

■ TA21

C - Room 18B, Level 4

Energy Services

Sponsor: Service Science
Sponsored Session

Chair: Carlos Paternina-Arboleda, Associate Professor, Universidad del Norte, Km 5 via Puerto Colombia, Barranquilla, Colombia, cpaterni@uninorte.edu.co

1 - Cooperation Model in a Echelon of the Supply Chain using Game Theory

Luceny Guzman, Assistant Professor, Universidad del Norte, Km 5 via Puerto Colombia, Barranquilla, Colombia, lguzman@uninorte.edu.co, Carlos Paternina-Arboleda

This work presents a cooperative optimization model between marketers in a supply chain using a game theory approach. The goal is to determine if cooperation improves competition. Results are generated through the design and implementation of a computer tool and they are very appealing and show true practical benefits to introduce to the market.

2 - Efficient Stochastic Programming for Sensor Placement in Advanced Power Systems

Adrian Lee, Central Illinois Technology and Education Research Institute, 2312 Connie Drive, Springfield, IL, 62704, United States of America, ajlee@citeri.org, Urmila Diwekar

The problem of selecting the placement of a network of sensors in an IGCC power system, subject to budget constraints is formulated as a stochastic, nonlinear optimization problem, where variability exists in the system model and sensor measurements. Fisher information is introduced as a metric of observability to determine the optimal location of on-line sensors.

3 - Portfolio Analysis of Electricity Markets with Transmission Constraints—A Game-Theoretic Approach

Zhi Zhou, Argonne National Laboratory, 9700 South Cas Ave, Bldg 221, Argonne, IL, 60439, United States of America, zzhou@anl.gov, W. K. Victor Chan

We use an agent-based approach and a nonlinear complementarity approach to model an electricity market as a game. We investigate how the transmission capacity and portfolios of generation companies affect their bidding strategies under both monopoly and non-monopoly markets. By comparing the simulation results and the results from the theoretical mathematical model, we establish conditions for generation companies to prefer a coordination strategy over a non-coordination one.

4 - Heuristic Methods for Dynamic Economic Dispatch

Ingrida Radziukyniene, student, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, ingridar@ufl.edu, Panos Pardalos

Dynamic economic dispatch plays an important role in power system operation, which is a complicated nonlinear constrained optimization problem. Several heuristic methods are applied to solve this problem. The comparison of feasibility and effectiveness of applied approaches is presented.

■ TA22

C - Room 18C, Level 4

Models of Service Co-creation

Sponsor: Service Science
Sponsored Session

Chair: Ralph Badinelli, Professor, Virginia Tech, Department of Business Information Technology, Virginia Tech, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

1 - Scaling of Service Networks: Accumulation, Networking, and Eco-system

Cheng Hsu, Professor, Rensselaer Polytechnic Institute, Dept of Industrial and Systems Eng'g, 110 8th Street, Troy, NY, 12180-3590, United States of America, hsuc@rpi.edu, W. K. Victor Chan

Service productivity can be facilitated by resources accumulation and reuse; both of which can be considered as the goals of scaling for service. Analytically, the scale of co-creation is a function of the connections among customers, providers, and service production factors in the service network. The new hyper-networks model presented here describes the nature of such connections in especially Internet-based enterprises, and hence provide a new explanation for service scaling.

2 - Redesign of Automobile After-Sales Service Systems

Robin Qiu, Professor, Penn State University, 220 L, Main Building, The Penn State University, Malvern, PA, 19355, United States of America, robinqiu@psu.edu

Using the fundamentals of Service Science, we look into the following tasks: defining a generic computational model; identifying mechanisms for the people-centric interactions during the operations (i.e., value co-creation processes); and exploring methods to create transformative actions (i.e., redesign) for continuous service improvement.

3 - Dynamic Collaborative Processes

Morvarid Rahmani, UCLA Anderson school of management, B501 UCLA Anderson School of Management, Box 951481, Los Angeles, CA, 90095-1481, United States of America, morvarid.rahmani.2013@anderson.ucla.edu, Guillaume Roels, Uday Karmarkar

In this talk, we introduce a dynamic model for collaboration. Two agents collaborate on a project with finite deadline; at any point in time, they can decide to collaborate, work solo, or stop the project. Modeling the problem as a dynamic game, we characterize the structure of the equilibrium. We find that collaboration is absorptive and that the game dynamics lower the overall quality of the project.

4 - Models of Service Technology Functions

Ralph Badinelli, Professor, Virginia Tech, Department of Business Information Technology, Virginia Tech, Blacksburg, VA, 24061, United States of America, ralphb@vt.edu

This paper posits a framework for mathematical models of service systems. Each service process with a network of processes that make up the system is modeled in terms of a technology function. The technology function describes the integration of resource inputs and their transformation into resource outputs. Resource integration is modeled in terms of constraints that ensure the mutual adjustment of resource commitments from the agents involved in the service process.

■ TA23

C - Room 18D, Level 4

Service Innovation

Sponsor: Service Science
Sponsored Session

Chair: Jai Kim, Associate Professor, SKKU, Chongro-Gu, Seoul, 110-745, Korea, Republic of, caifave@gmail.com

1 - Service Innovation Strategy to Cope with Chasm of IPTV

Sangho Lee, Professor, Kyungsung University, Pusan, Pusan, Korea, Republic of, leeshow@empas.com, Samuel Chiu, Jai Kim, Dominique Ahn

This paper attempts to investigate the development of IPTV in Korea from high tech marketing and service innovation perspectives. Based on the IPTV subscriber data from 2007 to 2010, this paper analyzes the entrant and churn of the IPTV subscription in different phases of the development.

2 - Investment Allocation Strategies for the Implementation of a Scalable Logistics Platform

Hector Flores, Arizona State University, 699 S. Mill Avenue, Tempe, United States of America, hector.flores@asu.edu, Rene Villalobos

We introduce a methodology to find the set of investments that maximizes the probability of success of penetrating a new market. In particular, we use the case of the implementation of a logistics platform for the distribution of fresh produce, which can be as simple as a crossdock facility or as complex as multiple distribution facilities according to the market segments targeted. For each market segment there is an associated expected rate of return and a risk level.

3 - Innovation and Collaboration: Empirical Findings in German High-Tech Industries

Matthias Tyssen, EBS Business School, Rheingaustr. 1, Oestrich-Winkel, 65375, Germany, matthias.tyssen@ebs.edu, Volker Nestle, Florian Täube

To evaluate the effects of a regulatory body in clusters, I develop a framework for the integration of trust into transaction cost economics and the theory of information asymmetries. Subsequent quantitative survey has been conducted among 103 firms in a German high-tech cluster. Empirical findings show that the cluster initiative fosters sustainable collaboration-based innovation while remote companies of the same region face a higher level of competition and less collaboration activity.

4 - Modeling Trust in Risk Analysis: Incorporating the Affect Heuristic in a Decision Analysis Calculus

Michael Vedomske, University of Virginia, 151 Engineers Way, Room 112, Post Office Box 400736, Charlottesville, 22904, United States of America, mav7t@virginia.edu

Many decision models lack the affect heuristic despite its efficiency and ability to tackle complex problems. Moreover, rational decisions require a specific affect-based decision making part of the brain. Our model incorporates the affect heuristic as manifested in decision making through trust formulation, develops a trust ontology, provides metrics for trust, and forms a calculus incorporating trust in a decision analytic tool.

■ TA24

C - Room 19A, Level 4

Joint Session SPPSN/ MIF: Community-Based Operations Research

Sponsor: Public Programs, Service and Needs/ Minority Issues
Sponsored Session

Chair: Michael Johnson, Associate Professor, University of Massachusetts Boston, Department of Public Policy/Public Affairs, 100 Morrissey Blvd., Boston, MA, 02125-3393, United States of America, michael.johnson@umb.edu

1 - Decision Making for Emergency Medical Services

Hari Rajagopalan, Assistant Professor, Francis Marion University, School of Business, P.O. Box 100547, Florence, SC, 29501, United States of America, hrajagopalan@fmarion.edu, Cem Saydam, Hubert Setzler, Elizabeth Sharer

Operations of emergency response is an area of research that directly affects communities. Improving response time through forecasting ambulance demand is an important aspect of this area of research. Demand is dynamic, varying both temporally and spatially and EMS administrators need to constantly relocate their ambulances as the demand patterns change. This paper deals with the issues that arise in the day to day operations of Emergency Response systems.

2 - Educational Costs and Efficiency of Illinois Schools: A Nonparametric Analysis

John Ruggiero, Edmund B. O'Leary Professor of Economics, University of Dayton, Department of Economics and Finance, 300 College Park, Dayton, OH, 45469-2251, United States of America, John.Ruggiero@notes.udayton.edu

We employ Data Envelopment Analysis (DEA) to estimate costs and efficiency of Illinois schools. City schools have harsher environmental conditions than do wealthier suburban districts and must spend more to achieve similar outcomes. Preliminary results indicate that, on average, schools spend 28 percent above minimum costs while the bottom quartile of schools with the harshest environment are relatively more efficient than the quartile of schools with the most favorable environment.

3 - On the Modeling of Equity in Public Services

Philip Leclerc, Research Assistant, Virginia Commonwealth University, Department of Stat. Sci. and OR, 1015 Floyd Avenue, Richmond, VA, 23284-3083, United States of America, philip.leclerc@gmail.com, Laura McLay

Equity is a central concern for decision-makers determining how to allocate public resources. We discuss key issues in the modeling of equity, illustrating these ideas through examples drawn from the field of Emergency Medical Services. Novel suggestions are presented for ways in which our knowledge about how best to model equity might be improved, and pragmatic suggestions are developed concerning how the modeling of equity could be usefully standardized.

4 - Community-Based Operations Research: Decision Modeling for Local Impact and Diverse Populations

Michael Johnson, Associate Professor, University of Massachusetts Boston, Department of Public Policy/Public Affairs, 100 Morrissey Blvd., Boston, MA, 02125-3393, United States of America, michael.johnson@umb.edu

Community-based operations research aims to improve social welfare by balancing concerns of economic efficiency, social equity, and administrative burdens. Relevant problems are rooted in localized jurisdictions and often reflect concerns of underrepresented, underserved, or vulnerable populations. In this talk I review theory related to CBOR, recent contributions to this field and discuss the role CBOR may play in strengthening ties between academics and the not-for-profit sector.

■ TA25

C - Room 19B, Level 4

OR for the Public Interest - Health Care

Cluster: Public Policy
Invited Session

Chair: Oguzhan Alagoz, Assistant Professor, University of Wisconsin-Madison, 3242 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, alagoz@engr.wisc.edu

1 - Designing a New Breast Cancer Screening Program Considering Adherence

Turgay Ayer, PhD Candidate, University of Wisconsin-Madison, 1513 University Ave., 3233 ME Building, Madison, WI, 53706, United States of America, tayer@wisc.edu, Oguzhan Alagoz, Elizabeth S. Burnside, Natasha K. Stout

Mammography is the most effective modality to detect breast cancer, the leading cause of cancer deaths and by far the most frequent cancer among women. Although mammography rates are increasing, adherence to screening recommendations remain low, which is not considered by the existing guidelines. We develop a partially-observable Markov decision process (POMDP) model for optimal mammography screening decisions considering imperfect adherence. We optimally solve this POMDP using real data.

2 - Optimizing Breast Cancer Diagnosis Under Resource Constraints

Mehmet Ayvaci, PhD Candidate, University of Wisconsin Madison, 3239 Mechanical Engineering, 1513 University Ave, Madison, WI, 53706, United States of America, ayvaci@wisc.edu, Elizabeth S. Burnside, Oguzhan Alagoz

We consider the problem of optimizing diagnostic decisions after mammography from the society's perspective. We develop a constrained finite-horizon Markov decision process (MDP) model formulation that maximizes the total quality adjusted life years of a patient under budget constraints. Our modeling framework could be used for evaluating cost-effectiveness of diagnostic procedures.

3 - Influenza Vaccine Supply Chain with Multiple Agencies

Hamed Mamani, University of Washington Business School, Info Systems and Ops Management Departmen, Box 353200, Seattle, WA 98195-3200, hmamani@uw.edu, Stephen E. Chick, David Simchi-Levi

This paper illustrates how multiple governments with different sensitivities to influenza incidence can lead to suboptimal global health outcomes if each acts in its own national interest. We show how certain financial transfers can align objectives of different nations and improve vaccine coverage in regions where it is most needed.

4 - Allocating Resources for HIV Prevention and Treatment Program Scale Up

Margaret L Brandeau, Department of Managment Science, Elisa Long, Sabina Alistar

To combat the HIV epidemic, significant scale up of prevention and treatment efforts is needed. We develop a resource allocation model for use by planners that uses basic epidemic information to determine allocations. Improved resource allocation will increase access to HIV prevention and treatment programs for millions of people worldwide.

■ TA26

C - Room 4A, Level 3

Data Mining Contest

Sponsor: Data Mining
Sponsored Session

Chair: Louis Duclos-Gosselin, Applied Mathematics (Predictive Analysis, Data Mining) Consultant, Sinapse, Sinapse, 1170, Boul. Lebourgneuf, Suite 320, Quebec (Quebec), Canada, Quebec, QC, G2K 2E3, Canada, louis.gosselin@hotmail.com

Co- chair: Durai Sundaramoorthi, Assistant Professor, Missouri Western State University, 4525 Downs Drive, Saint Joseph MO 64507, United States of America, dsundaramoorthi@missouriwestern.edu

1 - INFORMS Data Mining Contest Results

Louis Duclos-Gosselin, Applied Mathematics (Predictive Analysis, Data Mining) Consultant, Sinapse, Sinapse, 1170, Boul. Lebourgneuf, Suite 320, Quebec (Quebec), Canada, Quebec, QC, G2K 2E3, Canada, louis.gosselin@hotmail.com

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. More than 809 people registered to this competition.

■ TA27

C - Room 4B, Level 3

New Firms, Populations, and Industries

Sponsor: Organization Science
Sponsored Session

Chair: Joseph Broschak, Associate Professor, Management/Organizations, University of Arizona, McClelland Hall 405, Tucson, AZ, United States of America, broschak@email.arizona.edu

1 - From Science & Technology Creation to Emergence of Dedicated Nanotechnology Population 1970-2004

Claudia Schoonhoven, Professor, University of California, Irvine, The Paul Merage School of Business, Irvine, CA, 92697, United States of America, kschoonh@uci.edu, Sang-Joon Kim

Drawing on institutional & ecological theory, we investigate the new science and human resource precursors of de novo population emergence. Data are from a larger study (Schoonhoven, 2009) of first generation dedicated nano-science firms. We found a negative effect of scientific knowledge growth on birth rates, but U-shaped effects of technology & human resource growth on birth rates. Over 75% of first generation firms were founded before the US NNI formalized the science's legitimacy.

2 - From Symbolism to Substance: A Process Model of Institutional Change

Emily Block, Assistant Professor, University of Notre Dame, esblock@gmail.com

The purpose of this paper is to understand the process through which symbolic action transforms into more substantive adoption within organizational boundaries. Using a case study of the US forest products I argue for a stage model with built-in feedback mechanisms, where symbolic adoption may be an end for some organizations but simply a step for other organizations.

3 - Discourse and Dirty Deeds in the Adoption of U.S. Wind Farms

Michael Pfarrer, Assistant Professor, University of Georgia, Terry College of Business, 430 Brooks Hall, Athens, GA, 30602, United States of America, mpfarrer@uga.edu, Rhonda Reger, Scott Benjamin

We extend the traditional sensegiving-sensemaking framework to include social desirability biases and political behaviors. Through a longitudinal examination of the U.S. wind industry, we theorize that the inclusion of competing discourses among stakeholders into the recursive sensegiving-sensemaking process can confound the adoption of viable new technology innovations.

4 - Creation and Evolution: The Contested Inclusion of Chiropractic in the Medical Field

Karen Patterson, Assistant Professor, University of New Mexico, Anderson School of Management MSC05, 1924 Las Lomas NE, Albuquerque, NM, 87131, United States of America, Patterson@mgt.unm.edu, Marvin Washington

The evolution of chiropractic medicine from "quackery" to a practice that is insurance reimbursable by sixty-five percent of all major medical insurance providers, licensed in all 50 U.S. states, and recognized as a legitimate healing practice by the federal government, is a process that has been wrought with conflict at all levels. This paper examines the emergence and acceptance of a practice and profession that, after over 100 years, remain on the periphery of the organizational field.

5 - A Study of the Nationalist Dynamics of a Dairy Cooperative's Emergence: The Case of AMUL, India

Abhijit Ghosh, PhD Candidate, McGill University, 1001 Sherbrooke St. W, Desautels Faculty of Management, Montreal, QC, H3A 1G5, Canada, abhijit.ghosh@mail.mcgill.ca

Recent scholarship underscores social movements' ability to confront institutionalized arrangements, and offer alternative organizing logics. My field study of a famous dairy coop in India suggests that, the emergence of this (co-operative) was embedded in the Patidar community at the micro level, and in their interaction with the "non-cooperative" movement led by Gandhi against the British regime. This study explores the embedded dynamics of the emergence of a socially innovative organization.

■ TA28

C - Room 4C, Level 3

Prognostics and Predictive Maintenance

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Nagi Gebraeel, Associate Professor, Georgia Tech, 765 Ferst Dr., Atlanta, United States of America, nagi.gebraeel@isye.gatech.edu

Co-Chair: Jeffrey Kharoufeh, Associate Professor, University of Pittsburgh, Department of Industrial Engineering, Pittsburgh, PA, 15261, United States of America, jkharouf@pitt.edu

1 - Residual Life Distribution of Components Degrading Under Random Time-varying Environments

Linkan Bian, Graduate Student, Georgia Tech, 755 Ferst Dr, Atlanta, GA, United States of America, linkanbian@gatech.edu, Nagi Gebraeel

This work presents a stochastic model for the degradation of components under time-varying environments, which evolve as a Markov process. We apply a two-stage method to estimate the model parameters from the historical data set; and update them with the monitored degradation signals and environments. The residual life distribution is computed and updated using a first passage time approach. The proposed methodology is applied to real world degradation signals from rotating bearings.

2 - Degradation Modeling of Complete, Sparse and Fragmented Degradation Signals

Rensheng Zhou, Georgia Institute of Technology, 765 Ferst Drive, NW, atlanta, United States of America, rzhou8@gatech.edu, Nagi Gabraeel, Nicoleta Serban

This paper presents a non-parametric degradation modeling framework for characterizing degradation processes of partially degraded engineering systems. We focus on modeling the evolution of different types of degradation signals with the goal of predicting a system's residual life distribution using real-time degradation signals. We consider degradation signals that are: (1) complete (2) sparsely observed or (3) densely observed at disjoint time intervals over the system's life cycle.

3 - Estimating a Stochastic Operating Environment via Degradation Observations

John Flory, University of Pittsburgh, Pittsburgh, PA, United States of America, jhnflory@gmail.com, Jeffrey Kharoufeh

We consider the problem of estimating the number of distinct environment states experienced by a single-unit system whose degradation is driven by an exogenous Markov chain. The environment is assumed to be unobservable, and its attributes must be discerned by observing a sequence of degradation measures. We employ a hidden Markov model to address this problem.

4 - Optimal Replacement of a System with Markov-Modulated Degradation

Yasin Ulukus, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, yasin_ulukus@yahoo.com, Jeffrey Kharoufeh, Lisa Maillart

We examine the problem of optimally maintaining a stochastically degrading system using preventive replacements. The system's rate of degradation is governed by an external environment, and the system fails once its cumulative degradation level reaches a fixed threshold. The objective is to minimize the total expected discounted cost of preventive and emergency replacements. To this end, we provide a Markov decision process model and present preliminary structural and numerical results.

■ TA29

C - Room 5A, Level 3

Optimization Methods in Quality, Statistics and Reliability

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Abhishek Shrivastava, Assistant Professor, City University of Hong Kong, 83 Tat Chee Ave, Kowloon, Hong Kong - PRC, Abhishek.Shrivastava@cityu.edu.hk

1 - Multi-step Procedure for Fitting SVM
Qiong Zhang, qzhang@stat.wisc.edu, BEN HAALAND, Peter Qian

Support vector machine (SVM) and Least squares SVM (LS-SVM) are two very useful classifcation methods, for which the problem of developing efficient algorithms is of fundamental importance, especially for fitting large scale data sets. To this end, we propose a multi-step procedure to fit SVMs on nested data structures. Simulations demonstrate that with properly tuned scale parameters, the new procedure achieves favorable performance with greater computational efficiency.

2 - Integer Programming Approach for Analyzing the Measurement Redundancy in Structured Linear Systems
Arash Pourhabib, Texas A&M University, Industrial and Systems Engineering, Texas A&M University, MS 3131, College Station, TX, 77843, United States of America, arash.pourhabib@neo.tamu.edu, Yu Ding, Kiavash Kianfar

A linear system whose model matrix is of size nxp is considered structured if some p row vectors in the model matrix are linearly dependent. Computing the degree of redundancy for structured linear systems is proven NP-hard. We present a mixed integer programming (MIP) formulation for computing the redundancy degree problem and solve it using the existing MIP solver. Our numerical studies show that the MIP approach outperforms the existing methods for many different applications.

3 - Optimal Designs for Two-level Factorial Experiments with Binary Response
Abhyuday Mandal, Department of Statistics, University of Georgia, Athens, GA 30602-1952, amandal@stat.uga.edu, Dibyen Majumdar, Jie Yang

We consider the problem of obtaining locally D-optimal designs for factorial experiments with qualitative factors at two levels each with binary response. Our focus is primarily on the 2^2 experiment. We derive analytic results for special cases and indicate how to handle the general case. The performance of the uniform design in examined and we show that this design is highly efficient in general. For the general 2^k case we show that the uniform design has a maximin property.

4 - Graph-based Method for Constructing Factorial Designs
Abhishek Shrivastava, Assistant Professor, City University of Hong Kong, 83 Tat Chee Ave, Kowloon, Hong Kong - PRC, Abhishek.Shrivastava@cityu.edu.hk

Fractional factorial designs (FFDs) are a popular choice for designing experiments. An experimenter selects a FFD by comparing statistical capabilities of a set of FFDs. Ideally all FFDs in the set will be statistically distinct. This requires that all these designs be (combinatorially) non-isomorphic to each other. We use a method based on representing FFDs as graphs for constructing catalogs of large run-size FFDs. Fractional Factorial Split-Plot designs will be considered as a case in point.

■ TA30

C - Room 5B, Level 3

Joint Session QSR/ DM: Statistical Decision Making in Health Care Applications

Sponsor: Quality, Statistics and Reliability/ Data Mining
Sponsored Session

Chair: Hui Yang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States of America, huiyang@usf.edu

Co-Chair: Jing Li, Assistant Professor, Industrial Engineering, Arizona State University, Tempe, AZ, United States of America, jing.li.8@asu.edu

1 - Integration of Similarity Measure Into QMIP for Biological Clustering
Chun-An Chou, Rutgers University, 96 Frelinghuysen Rd., Piscataway, NJ, United States of America, joechou@rci.rutgers.edu, W. Art Chaovalitwongse

We develop a quadratic mixed-integer programming (QMIP)model for clustering of sibling relationships. The QMIP model integrates combinatorial constraints with a statistical similarity (likelihood) derived from the distribution of multi-loci and co-dominated microsatellite markers. Clustering provides individuals with similar features while a reliable relationship is reconstructed based on Mendelian rules to show that they are siblings. We test the proposed approach on real biological data sets.

2 - Phase I Risk-Adjusted Control Charts for Monitoring Surgical Performance with Categorical Covariates
Kamran Paynabar, PhD Candidate, The University of Michigan, Industrial & Operations Engineering, 1205, Ann Arbor, Ann Arbor, MI, 48109-2117, United States of America, kamip@umich.edu, Arthur Yeh, Judy Jin

Existing research on risk-adjusted control charts focuses on Phase II monitoring and very little work has been done on Phase I control of surgical outcomes. In this paper, a general Phase I risk-adjusted control chart is proposed for monitoring binary surgical outcomes. Despite existing methods, this paper shows that binary surgical outcomes depend on not only the patient conditions described by the Parsonnet scores, but other categorical operational covariates, such as different surgeons.

3 - Binary Time Series Modeling with Application to Adhesion Frequency Experiments
Ying Hung, Rutgers, Camden, NJ, United States of America, yhung@stat.rutgers.edu, Jeff Wu

Repeated adhesion frequency assay is the only published method for measuring the kinetic rates of cell adhesion. Cell adhesion plays an important role in many physiological and pathological processes. Motivated by the analysis of repeated adhesion tests, a binary time series model incorporating random effects is developed. Application of the proposed methodology to real data from a T-cell experiment reveals some interesting information, including the dependency between repeated adhesion tests.

4 - Multiple Comparisons Based Structural Correlation Comparisons
Dingxi Qiu, Assistant Professor, University of Miami, 1251 Memorial Drive, Room 276, Coral Gables, FL, 33146, United States of America, dingxi@miami.edu, Lihua Bai

In genetic association studies, thousands of measurements (SNPs) need to be evaluated simultaneously regarding their contribution to the phenotype; however, these measurements are often highly positively correlated, leading to a high false discovery rate. We implemented a method based on structural correlation comparisons among measurements between cases and controls. The novelty of this method is that we examined the multifactor interactions rather than main effects or low order interactions.

■ TA31

C - Room 5C, Level 3

Data Mining I

Contributed Session

Chair: Houtao Deng, Research Associate, Arizona State University, APT 16 East Orange Street 1020, Tempe, AZ, 85281, United States of America, hdeng3@asu.edu

1 - A Neural Network Model for Executive Compensation and Firm Performance
Tawei Wang, National Taiwan University, No.85, Roosevelt Rd. Sec. 4, Taipei, 106, Taiwan - ROC, twang@ntu.edu.tw, Kuan-Lun Yu, Wenqi Shen

We use the artificial neural network to understand the association between the structure of executives' incentive plans and the firm's market- as well as accounting-based performance. The simplicity of the model overcomes the limitation in prior literature and can help firms better design the compensation package of the executives.

2 - Data Anomalies Within the Management Literature
Ray Fung, Harvard University, Morgan Hall, Boston, MA, United States of America, raymondfung@gmail.com

Various biases exist within the published literature that use econometric techniques. Publication bias and file-drawer bias serve to shift the distribution of published results. However, another type of bias - that of data dredging - has gained less play. Researchers may be dredging through their data to push p-values below levels of significance deemed necessary to publish. An analysis of a random sample of 125 papers from top management articles reveals that data dredging may be occurring.

3 - Introducing A Novel Activation Function for Back Propagation Neural Networks

Hessam Bavafa, University of Pennsylvania, 3730 Walnut ST, #500 JMHH, Philadelphia, PA, 19104, United States of America, bavafa@wharton.upenn.edu, Hamed Hasheminia

This paper introduces a novel activation function for BP NNs. The learning speed of this activation function is significantly faster than all well-known ones. To prove learning performance of this activation function a unique statistical experiment is developed. This method not only established a unique tool for measuring and comparing the learning speed of different activation functions but also showed in what order of magnitude it is faster than its well-known and wildly accepted rivals.

4 - Classifying Patients After Discharge From the Intensive Care Unit (ICU)

Yazan Roumani, PhD Student, University of Pittsburgh, 282 Mervis Hall, Pittsburgh, PA, 15260, United States of America, yfr1@pitt.edu, Jerrold May, Luis Vargas, David Strum

We applied five data mining techniques on a highly imbalanced data set, classifying patients as dead or alive upon discharge from an intensive care unit, based on residence times and complications. The relative misclassification costs are also very different in this application. The methods are compared using the F-measure, precision, recall, specificity and confusion entropy. A support vector machines had the highest specificity and lowest confusion entropy while C5 had the highest recall.

5 - Local Structure Discovery via Feature Selection

Houtao Deng, Research Associate, Arizona State University, Apt. 16 East Orange Street 1020, Tempe, AZ, 85281, United States of America, hdeng3@asu.edu, Saylisse Davila, George Runger, Eugene Tuv

Relationships between variables can be studied through Bayesian network learning. However, the learning problem can be complex and strong assumptions are made for continuous variables. We consider a minimum feature selection method to focus on local structures in the network, where variables relevant to a target variable are identified. Experiments demonstrate the advantage of our method compared to other feature selection methods and a Bayesian network local structure learning algorithm.

■ TA32

C - Room 6A, Level 3

Interfaces Between Dynamic and Stochastic Programming

Sponsor: Computing Society
Sponsored Session

Chair: Suvrajeet Sen, Professor, Ohio State University, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, sen.22@osu.edu

1 - Adversarial Markov Decision Process Design

David Morton, Engineering Foundation Professor, The University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, morton@mail.utexas.edu, Nedialko Dimitrov

We formulate an adversarial MDP design problem, using a stochastic integer program. First, with limited budget, we remove actions from an MDP to minimize the MDP's optimal value. Second, an adversary operates the MDP to maximize its value. We apply our model to interdict a smuggler of nuclear material. The smuggler operates an MDP to select a path from his origin to destination. Uncertainty in the smuggler's origin, destination, and other attributes add further stochastics to our problem.

2 - Using Machine Learning to Solve Multistage Sequential Math Programming Problems

Warren Powell, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, powell@princeton.edu, Lauren Hannah

We show how approximate dynamic programming can be used to solve high-dimensional stochastic linear and nonlinear optimization problems. We have developed approximation strategies that have worked well for resource allocation problems arising in transportation and energy systems analysis. We describe how advanced machine learning methods can be used to handle more complex state variables that arise in energy models, bridging the gap between dynamic programming and stochastic programming.

3 - Dynamic Portfolio Optimization with Transaction Costs: Heuristics and Dual Bounds

David Brown, Duke University, Fuqua School of Business, Durham, NC, 27708-0120, United States of America, dbbrown@duke.edu, Jim Smith

We study dynamic portfolio choice with transaction costs. This problem is naturally formulated as a dynamic program that is very difficult to solve when there are more than just a few assets. We explore some limited-look-ahead heuristic trading strategies and develop information-relaxation-based dual bounds that provide an upper bound on the performance of an optimal trading strategy. Extensive numerical results suggest that these easy-to-compute heuristic strategies are often nearly optimal.

■ TA33

C - Room 6B, Level 3

Stability, Sample Size, and Smoothing Techniques for Stochastic Programming

Sponsor: Computing Society
Sponsored Session

Chair: Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr, Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu

1 - Planning Work Release with Forecast Evolution to Maintain Service Levels

Reha Uzsoy, Clifton A. Anderson Distinguished Professor, North Carolina State University, 400 Daniels Hall College of Engineering, North Carolina State University, Raleigh, NC, 27695, United States of America, ruzsoy@ncsu.edu, Amirhossein Norouzi

We consider the problem of planning the release of orders into a capacitated production facility to maintain a specified service level in the face of stochastic demand. Forecast evolution is modelled explicitly to incorporate information on forecasting methods in use. We present a chance-constrained formulation for a single-stage system, and discuss computational results.

2 - Polynomial Approach for Stochastic Programming

Lijian Chen, Assistant Professor, University of Louisville, 5241 Craigs Creek Dr, Louisville, KY, 40241, United States of America, lijian.chen@louisville.edu

We present a method to solve a large scale stochastic programming by approximating its deterministic convex counterpart and solve it thereafter. The approximation is based on Bernstein polynomial and Monte Carlo sampling with common random numbers. Numerical results are presented in several commonly used stochastic programming instances.

3 - Service Center Staffing Under Joint QoS Constraints

Jing Zan, University of Texas at Austin, Graduate Program in OR/IE, Austin, TX, United States of America, jzan@mail.utexas.edu, John Hasenbein, David Morton

We analyze the problem of choosing staffing levels in a service center with multiple types of jobs, and joint quality of service constraints. We utilize many-server limits to obtain approximately optimal solutions to the staffing problem.

4 - State-of-the-Art of Statistical Techniques in Competitive Electricity Markets

Guang Li, Electric Reliability Council of Texas, 2705 West Lake Drive, Taylor, TX, 76574, United States of America, gli@ercot.com

Statistical techniques in electricity markets assist the decision making of market participants on bidding submissions, asset allocations, bilateral trades, transmission and distribution planning. This study classifies statistical techniques common in the literature based on objective, concept, time horizon, input-output specification, and level of accuracy. It facilitates validation, comparison, and improvements of specific or combined statistical techniques in competitive electricity markets.

■ TA34

C - Room 7, Level 3

Interior Point Methods and Decomposition Methods for Large Scale Optimization

Sponsor: Computing Society
Sponsored Session

Chair: Joe Naoum-Sawaya, University of Waterloo, 200 University Av W, Waterloo, Canada, jnaoumsa@engmail.uwaterloo.ca

1 - An Integrated Network Design and Scheduling Problem: Solving with Decomposition

Burak Cavdaroglu, PhD Candidate, RPI, 110 8th Street, CII Buildiing Suite 5015, Troy, 12180, United States of America, cavdab@rpi.edu, Thomas Sharkey, John Mitchell, William Wallace

We consider a new class of integrated network design and scheduling problems, with important applications in the restoration of services provided by civil infrastructure systems after an extreme event. The class of problems considered by this work focuses on a set of selected arcs to install into an existing large network and then scheduling these arcs on a set of work groups. We discuss exact methods to solve this class of large scale optimization problems by employing decomposition techniques.

2 - Dantzig-Wolfe Decomposition and Approximations for an Equilibrium Model in Electricity Markets

Emre Celebi, University of Waterloo, Department of Management Sciences, 200 University Ave. West, Waterloo, ON, N2L 3G1, Canada, ecelebi@engmail.uwaterloo.ca, David Fuller

An equilibrium model in time-of-use (TOU) electricity markets with linearized DC network constraints is examined. We have used Dantzig-Wolfe decomposition algorithm for this model and used approximations to reduce the computational effort. The algorithms and approximations are applied to a large-scale realistic model (with 66-bus network) for the Ontario electricity market.

3 - The Logistics Network Design Problem with Capacity Expansions of Existing Warehouses

Lixin Tang, Professor, Northeastern University, The Logistics Institute, Shenyang, 110004, China, lixintang@mail.neu.edu.cn, Georgios Saharidis, Wei Jiang

We investigate a practical logistics network design problem of a region where some warehouses already exist. With the increasing number and demand of customers, their capacities cannot meet the demand. The problem is to determine which warehouses are expanded or closed and where new distribution centers are located. A mixed integer program is developed and according to its structure Benders decomposition algorithm is applied and a novel acceleration method is developed for its solution.

4 - Interior-Point Methods for Integer Programming: The ACCPM Approach

Joe Naoum-Sawaya, University of Waterloo, 200 University Av W, Waterloo, Canada, jnaoumsa@engmail.uwaterloo.ca, Samir Elhedhli

This talk highlights our recent work on using interior point methods in solving integer programming through the Analytic Centre Cutting Plane Method (ACCPM). A Heuristic, a branch-and-cut method based on Benders decomposition, and new branching rules will be presented.

■ TA35

C - Room 8A, Level 3

Stochastic Network Asymptotics

Sponsor: Applied Probability
Sponsored Session

Chair: Rami Atar, Technion, EE Department, Haifa, 32000, Israel, atar@ee.technion.ac.il

1 - Controlled Stochastic Networks in Heavy Traffic: Convergence of Value Functions

Amarjit Budhiraja, Professor, University of North Carolina, 330 Hanes Hall, CB# 3260, Chapel Hill, NC, 27516, United States of America, budhiraj@email.unc.edu, Arka Ghosh

Scheduling control problems for a family of unitary networks under heavy traffic with general interarrival and service times, probabilistic routing and an infinite horizon discounted linear holding cost are studied. It is shown that, under broad conditions, the value function of the suitably scaled network control problem converges to that of the associated diffusion control problem.

2 - Null Controllability and Throughput Optimality, Revisited

Gennady Shaikhet, Assistant Professor, Carleton University, 1125 Colonel By Drive, Ottawa, ON, K1S 5B6, Canada, shaikhet@cmu.edu, Rami Atar

Throughput Sub-Optimality (TSO), in the framework of queueing networks, corresponds to existence of a resource allocation with total processing rate greater than the total arrival rate. In heavy traffic, TSO implies Weak Null Controllability (WNC) - the existence of a routing policy, under which, within any finite interval, the total 'queueing' time of the system converges to zero in probability. We continue the study of TSO and WNC and, in particular, show the converse relation between them.

3 - Dynamic Control of Parallel Server Networks Under Parameter Uncertainty

Assaf Zeevi, Henry Kravis Professor of Business, Columbia University, Uris Hall, Room 406, Columbia University, New York, NY, 10027, United States of America, assaf@gsb.columbia.edu, Ramandeep Randhawa, Achal Bassamboo

We consider a problem of dynamic control in parallel server systems, in which basic problem primitives, e.g., the arrival rates, are not known with certainty. We develop simple families of control policies and show that they perform surprisingly well in a suitable mathematical sense.

4 - The Andradottir-Ayhan Conjecture in Flexible Server Systems

John Hasenbein, Associate Professor, University of Texas at Austin, Graduate Program in OR/IE, Austin, TX, United States of America, jhas@mail.utexas.edu, Bara Kim

We prove a conjecture posed in Andradottir and Ayhan (OR, 2005), which studied a tandem queueing system with flexible server stations. We show that a service rate ratio rule maximizes throughput, for an arbitrary number of servers.

■ TA36

C - Room 8B, Level 3

Accreditation Issues in OR/MS Education

Sponsor: INFORM-ED
Sponsored Session

Chair: Eric Huggins, Associate Professor of Management, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States of America, huggins_e@fortlewis.edu

1 - Objective Evaluation, Outcome Assessment, and the Continuous Improvement Process

Jo Min, Iowa State University, IMSE Department, 3004 Black, Ames, IA, 50011, United States of America, jomin@iastate.edu, Doug Gemmill, Devna Popejoy-Sheriff, John Jackman

Program educational objectives foster accomplishments in professional careers of engineering graduates while program outcomes facilitate engineering students' systematic learning of their engineering discipline. In this paper, we first show how these objectives and outcomes can be evaluated and assessed. Next, we demonstrate the linkage between the objectives and outcomes via improvement efforts. Furthermore, a concrete framework of the continuous improvement process is provided.

2 - Evaluating the Status of OR/MS in AACSB-Accredited Undergraduate Business Programs

Susan Palocsay, Professor, Computer Information Systems & Management Science, James Madison University, 800 S. Main Street, MSC 0202, Harrisonburg, VA, 22807, United States of America, palocssw@jmu.edu, Ina Markham

In 2003, AACSB International approved a new set of standards for accreditation of business programs that include a requirement for coverage of "statistical data analysis and management science." We present preliminary results from a study to assess the current position and content of the introductory OR/MS course in undergraduate business curricula since the standards' revision. Suggested strategies for improving the prominence of this course in business schools will also be discussed.

3 - OR/MS Assessment at Small Business Schools

Eric Huggins, Associate Professor of Management, Fort Lewis College, 1000 Rim Drive, Durango, CO, 81301, United States of America, huggins_e@fortlewis.edu

How does the recent trend requiring assessment by accrediting agencies like AACSB International affect OR/MS teaching? Specifically, how does the trend affect small business schools with even smaller OR/MS departments? Does the assurance of learning requirement help students learn "The Science of Better" better? We examine the assessment process at a small business school, discuss the improvements and growing pains that are involved, and compare the process at smaller versus larger schools.

■ TA37

C - Room 8C, Level 3

Advances in Learning and Dynamic Optimization I

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, Sloan School, 50 Memorial Drive, Cambridge, MA, United States of America, vivekf@mit.edu

1 - Time-series Forecasting for Control
Yi-hao Kao, PhD candidate, Stanford University, 350 Serra Mall R274, Stanford, CA, 94305, United States of America, yihaokao@stanford.edu, Benjamin Van Roy

We present an algorithm for fitting a time-series forecasting model taking into account the objective of the control problem to be addressed using the model. This algorithm offers performance benefits over standard time-series regression methods when the model is mis-specified.

2 - Pathwise Optimization for Optimal Stopping Problems
Ciamac Moallemi, Assistant Professor, Columbia Business School, 3022 Broadway, Uris 416, New York, NY, 10027, United States of America, ciamac@gsb.columbia.edu, Vijay Desai, Vivek Farias

We introduce the pathwise optimization (PO) method. This is a new convex optimization procedure that builds on a dual martingale characterization to produce upper and lower bounds (and sub-optimal policies) on the value of optimal stopping problems. We develop an approximation theory for martingale duality approaches in general and the PO method in particular. We illustrate the practical benefits of our approach in high-dimensional option pricing examples.

3 - Q-learning and Enhanced Policy Iteration in Discounted Dynamic Programming
Dimitri Bertsekas, Professor, MIT, 77 Mass Avenue, 32D-660, Cambridge, MA, 02139, United States of America, dimitrib@mit.edu, Huizhen Yu

We introduce a new policy iteration-like algorithm for finding the optimal Q-factors in finite-state discounted Markovian decision problems. At each iteration, our algorithm solves an optimal stopping problem instead of a system of linear equations. It admits convergent asynchronous and stochastic iterative implementations in the lookup table representation form, and has low overhead and adequate exploration advantages.

■ TA38

C - Room 9A, Level 3

Applications of Complementarity Problems and Variational Inequalities

Sponsor: Optimization/Linear Programming and Complementarity (Joint Cluster ICS)
Sponsored Session

Chair: Andrew L. Liu, Assistant Professor, Purdue University, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, andrewliu@purdue.edu

1 - On the Existence of Pricing Strategies in the Discrete Time Heterogeneous Single Bottleneck Model
Satish Ukkusuri, Associate Professor, Purdue University-West Lafayette, Room G175F, Civil Engineering Building, 550 Stadium Mall Dr., West Lafayette, IN, 47907, United States of America, sukkusur@purdue.edu, Doan Kien

This research will discuss a complementary formulation for the pricing problem in a single bottleneck problem. Applying linear programming duality, we prove that the optimal dual variable values provide an optimal toll with which the system optimal solution is also an equilibrium solution. Extensive computational results are reported to demonstrate the insights from the formulation with different user classes.

2 - On the Solution of Complementarity Problems Arising in American Options Pricing
Liming Feng, UIUC, University of Illinois at Urbana-Champaign, 117. Transportation Building, MC-238, 104 S Mathews Ave, Urbana, IL 61801, fenglm@illinois.edu, Jose Luis Morales, Vadim Linetsky, Jorge Nocedal

In this talk, we present an algorithm for the solution of linear complementarity problems that arise in American options pricing. The algorithm is a two-phase method that combines the active-set identification properties of the projected SOR iteration with the second-order acceleration of a reduced-space phase. Numerical results on pricing American options in the Black-Scholes-Merton model and Heston's stochastic volatility model will be presented.

3 - Emissions Trading, Point-of-Regulation and Facilities Sitting in Electric Markets
Andrew L. Liu, Assistant Professor, Purdue University, 315 N. Grant St., West Lafayette, IN, 47907, United States of America, andrewliu@purdue.edu, Yihsu Chen

This talk examines the effects of regional CO2 trading on firms' capacity expansion and siting decisions in the electric sector. We consider three different emissions trading implementations: source-, load- and first-seller approaches. Equilibrium models are formulated as complementarity problems. For open-loop investment open-loop problems, we can show solution existence and equivalence; for closed-loop problems, which are EPECs, numerical results will be shown.

4 - Generalized Nash Equilibrium and Lemke's Algorithm: Theory and Applications
Dane Schiro, University of Illinois at Urbana-Champaign, 104 South Mathews Avenue, Urbana, IL, 61801, United States of America, schiro1@illinois.edu, Uday Shanbhag, Jong-Shi Pang

In a generalized Nash equilibrium problem where equilibrium conditions can be formulated as an LCP, solution methods commonly impose a shared multiplier assumption for shared constraints. This research develops a framework in which Lemke's algorithm will find a solution for the unshared multiplier problem under certain assumptions. Both the theoretical development and applicability of the framework to a wide range of problems will be discussed.

■ TA39

C - Room 9B, Level 3

Integer Programming

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Ricardo Fukasawa, Assistant Professor, University of Waterloo, 200 University Avenue West, Kitchener, ON, N2L3G1, Canada, rfukasaw@math.uwaterloo.ca

1 - Stronger Cuts From Weaker Disjunctions
Andrea Qualizza, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, qualizza@cmu.edu, Egon Balas

We discuss an enhancement of the Balas-Jeroslow procedure for strengthening Disjunctive cuts for mixed 0-1 programs. When applied to a split cut derived from a source row of the simplex tableau the enhanced procedure yields, besides the mixed integer Gomory cut, also cuts that are sometimes stronger. We show how weakening a disjunction can yield stronger cuts.

2 - Designing an Efficient Branch-and-bound Approach for Exact MIP
Daniel Steffy, Georgia Institute of Technology, 765 Ferst Dr. NW, Atlanta, GA, 30332, United States of America, desteffy@gatech.edu, Thorsten Koch, Kati Wolter, William Cook

We present a hybrid approach for solving mixed-integer-programming problems exactly over the rational numbers. By performing many operations using fast floating-point arithmetic and then verifying and correcting results using symbolic computation exact solutions can be found without relying entirely on rational arithmetic. Computational results will be presented based on an exact branch-and-bound algorithm implemented within the constraint integer programming framework SCIP.

3 - MIP Approximations for Bilinear Programming Problems
Akshay Gupte, Doctoral student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, akshayg@gatech.edu, Myun Seok Cheon, Shabbir Ahmed, Santanu Dey

This work studies MIP restrictions of a bilinear MINLP by using the boundedness assumption on our variables. We study single and multi term bilinearities and bounded bilinear variables. Facets of the convex hull of the discrete set in the extended space are added as valid inequalities to the MIP. We also explore constraint branching as the variable bounds get refined during the branch and cut algorithm.

4 - Convex Sets and Minimal Sublinear Functions
Amitabh Basu, Carnegie Mellon University, Pittsburgh, PA, United States of America, abasu1@andrew.cmu.edu, Giacomo Zambelli, Gerard Cornuejols

We show that, given a closed convex set K containing the origin in its interior, the support function of the set $\{y\in K^* | \exists x\in K\mbox{ such that } \langle x,y \rangle =1\}$ is the pointwise smallest among all sublinear functions σ such that $K=\{x\st \sigma(x)\leq 1\}$. We then show applications of this result in cutting plane theory for Mixed-Integer Programs.

■ TA40

C - Room 9C, Level 3

Modeling and Computation in Stochastic Programming

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: Ellis Johnson, Professor, Georgia Institute of Technology, School of ISyE, Atlanta, GA, 30332-0205, United States of America, ellis.johnson@isye.gatech.edu

1 - Computational Study for Chance-constrained Stochastic Programs
Feng Qiu, Student, Georgia Tech, ISyE, Atlanta, GA, 30332-0205, United States of America, fqiu@gatech.edu, Shabbir Ahmed, Santanu Dey

We propose a branch and cut method for solving linear programs with k-out-of-m constraints. These problems arise in sample average approximations of chance constrained stochastic programs. The method is based on exploiting star convexity structure and monotonicity of the problem in an integer programming formulation of the problem.

2 - A Stochastic Programming Approach to Air Traffic Flow Management
Yu-Heng Chang, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, United States of America, yhchang@gatech.edu, Senay Solak, John-Paul Clarke, Ellis Johnson

We study the air traffic flow management problem in the presence of weather, which determines optimally how and when to send the aircraft towards an airspace sector and how aircraft react in response to the weather realizations. Two-stage and multistage stochastic programs are proposed, a rolling horizon method to approach the problems is presented, and Lagrangian relaxation and subgradient methods are suggested to justify the rolling horizon method.

3 - Optimization of R&D Project Portfolios Under Endogenous Uncertainty
Senay Solak, University of Massachusetts Amherst, Isenberg School of Management, Amherst, MA, United States of America, solak@som.umass.edu, Earl Barnes, Ellis Johnson, John-Paul Clarke

We consider the problem of optimizing a portfolio of R&D projects with several stochastic attributes. A formal description of the corresponding decision process is introduced, which leads to the modeling of the problem as a multistage stochastic integer program with decision dependent uncertainty realizations. Efficient solution procedures based on sample average approximation and Lagrangian decomposition are then developed to solve the resulting large scale problem.

■ TA41

C - Room 10A, Level 3

Nonlinear Programming I

Contributed Session

Chair: Zhen Xie, Argonne National Laboratory, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, zhenxie@mcs.anl.gov

1 - D-Optimal Design: A Constrained Non-linear Integer Programming Approach
Mujahid Syed, PhD Student, University of Florida, ISE Departement, Gainesville, FL, United States of America, smujahid@ufl.edu, Ilias Kotsireas, Panos Pardalos

D-Optimal Design consists of solving a set of Periodic Auto-Correlation Functions (PAF). This set can be modeled as a system of non-linear integer equations (quadratic). The objective is to find a pair of feasible sequences containing {-1,+1} that solve the system of equations. In this work, we will explore some of the exact and heuristic methods that can be used to solve this problem.

2 - A New Global Algorithm for Concave Separable Quadratic Knapsack Problems
Jaehwan Jeong, PhD Candidate, University of Tennessee, 329 Stokely Management Center, Knoxville, TN, 37996, United States of America, jjeong3@utk.edu, Chanaka Edirisinghe

Many algorithms have been proposed to solve convex separable quadratic knapsack problems; however, algorithms for the concave problems are quite sparse. In this paper, we introduce a new algorithm based on Lagrange multiplier intervals generated by break points. It solves concave separable quadratic knapsack problems efficiently, guaranteeing the global minimum. Preliminary computational results are provided for both the convex and concave cases with comparisons to currently existing methods.

3 - Solving SVM Classification Problem using Gradient Projection and Incomplete Cholesky Decomposition
Gitae Kim, Graduate Student, Kansas State University, 2033 Durland Hall, Manhattan, KS, 66506, United States of America, gitaekim@ksu.edu, Chih-Hang(John) Wu

This research is to solve v-Support Vector Machine for classification problems using gradient projection and incomplete Cholesky decomposition method. Support vector machine requires solving a quadratic programming problem with dense Hessian matrix. In this research, we use a gradient projection type approach with the matrix splitting method to find the direction of the projection and the incomplete Cholesky decomposition method for large scale problems.

4 - Optimization of Black-box Functions with Integer Variables
Zhen Xie, Argonne National Laboratory, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, zhenxie@mcs.anl.gov, Sven Leyffer

Derivative-Free Optimization is a challenging problem in mathematical programming. It is even challenging when the black-box function contains integer decision variables. Most solver for this problem are based on pattern search which may fail even for convex quadratic functions. We present a fast and robust solver for Derivative-Free Optimization over black-box function with integer variables.

■ TA42

C - Room 10B, Level 3

Stochastic Programming - Sampling Methodology and Applications

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Guzin Bayraksan, Assistant Professor, University of Arizona, Systems & Industrial Engineering, Tucson, AZ, 85721, United States of America, guzinb@sie.arizona.edu

1 - Fast Approximations for the Efficient Frontier of a Stochastic Capacity Sizing Model
Tara Rengarajan, University of Texas at Austin, C2200 OR/IE Department of Mechanical Engineer, Austin, United States of America, tara_rengarajan@mail.utexas.edu, David Morton

We seek the efficient frontier (EF) of a bicriteria stochastic capacity sizing model, trading off cost of system design and the probability of satisfying random demand. We show that under a convex EF there is a family of sampling approximations that converges uniformly to the EF. Furthermore, each such approximation can be obtained in strongly polynomial time. We validate our results on problem instances for which the distribution of demand is concave for a range of realistic risk levels.

2 - A Sampling-based Sequential Approximation Method
Peguy Pierre-Louis, University of Arizona, 1127 E James E. Rogers Way, Tucson, United States of America, pierrelp@email.arizona.edu, David Morton, Guzin Bayraksan

We develop an algorithm for two-stage stochastic programs with continuous second stage and uncertainty in the right-hand side. We sequentially partition the support of the random vector and use Jensen's inequality to generate deterministic lower bounds on the optimal objective value. An upper bound is formed through stratified Monte Carlo sampling with control variates. The algorithm uses a stopping rule that ensures an asymptotically valid confidence interval on the gap of the solution found.

3 - Empirical Effects of Clustering on Price Stability in a Stochastic Model for Power Grids
Leo Lopes, Monash University Maths, Australia, leo.lopes@monash.edu, Catherine Wang, Daniel Reich

In Brazil, dual prices from of a stochastic program help determine payments to hydroelectric generators. Instability in these prices over the last few months is a growing cause of concern. We investigate the sensitivity of first stage duals to the topology of the underlying scenario tree. We present our method for constructing scenario trees by clustering time-series data and link the variability of the dual prices obtained under different tree topologies to features of the optimization model.

4 - Reclaimed Water Network Design Under Temporal and Spatial Growth and Demand Uncertainties

Weini Zhang, Ph.D Student, University of Arizona, Systems & Industrial Engineering, University of Arizona, Tucson, AZ, 85721, United States of America, wzhang@email.arizona.edu, Guzin Bayraksan, Kevin Lansey, Gunhui Chung

We present a cost effective reclaimed water distribution network design using two-stage stochastic binary programming with random recourse. We consider both construction and energy costs expanded during a twenty-year period and consider uncertainties in network growth and reclaimed water demands. A specialized algorithm is developed to exploit the structure of the branched network to efficiently solve the problem. Computational results are presented on a realistic problem.

■ TA43

C - Room 1, Level 2- Mezzanine

Operations Models in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: Burhaneddin Sandikci, Assistant Professor, University of Chicago Booth School of Business, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States of America, burhan@chicagobooth.edu

1 - Hybrid Lagrangian Relaxation-Column Generation for Advanced Scheduling in Healthcare

Yasin Gocgun, PhD Candidate, Industrial and Systems Engineering at University of Washington, Industrial and Systems Engineering, University of Washington, Seattle, WA, 98195, United States of America, gocgun@gmail.com, Archis Ghate

We present advanced scheduling problems where arriving jobs are scheduled to future time-periods in a finite-length booking horizon. We model these problems as Markov Decision Processes (MDPs), and develop a hybrid Lagrangian relaxation-column generation method for their approximate solution. Healthcare applications of these problems will be discussed.

2 - A Multi-stage Stochastic Programming Model for Surgery Planning

Serhat Gul, Post-doctoral Research Associate, Northeastern University, 334 Snell Engineering Center, 360 Huntington Ave, Boston, MA, 02115, United States of America, serhatgul.az@gmail.com, Brian T. Denton, John Fowler

We propose a multi-stage stochastic mixed integer programming formulation for the allocation of surgeries to operating rooms (ORs) over a finite planning horizon. We consider the demand for surgery and surgical duration to be random variables. The objective is to minimize two competing criteria: expected surgery cancellations and OR overtime. We discuss properties of the model and an implementation of progressive hedging to find near optimal surgery plans.

3 - Cost-Effective Alternatives to Liver Biopsy in the Management of Chronic Hepatitis C in the U.S.

Shan Liu, Stanford University, 334 Olmsted Road, Apt 306, Stanford, CA, 94305, shanliu@stanford.edu, Jeremy Goldhaber-Fiebert, Michaîl Schwarzinger, Fabrice Carrat

Chronic hepatitis C causes liver fibrosis. Liver biopsy is the gold standard for assessing fibrosis prior to treatment, but carries serious risks and costs. FibroTest is a noninvasive biomarker proposed as an alternative to biopsy. We assessed the cost effectiveness of six screening strategies and treatment for U.S. patients in a Markov decision model. Results show early treatment of HCV is superior to screening. If screening is required, FibroTest is a cost effective alternative to biopsy.

4 - Monitoring Glaucoma Patients using Visual Field Progression and Intraocular Eye Pressure

Jonathan Helm, University of Michigan, Industrial and Operations Engineering, 1205 Beal Ave, Ann Arbor, MI, United States of America, jhelm@umich.edu, David C. Musch, Joshua D. Stein, Mark Van Oyen, Mariel Lavieri

We develop an analytic model to monitor patients with moderate open-angle glaucoma using visual field progression and intraocular eye pressure. More aggressive treatment is given to patients with higher likelihood of progression. The model is calibrated using the Collaborative Initial Glaucoma Treatment Study.

■ TA44

C - Room 2, Level 2- Mezzanine

Applications of OR to Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Mustafa Sir, Assistant Professor, University of Missouri, Industrial and Manufacturing Systems Eng, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America, sirm@missouri.edu

1 - Robust Nurse Scheduling Problem

Arezou Mobasher, University of Houston, W228, Engr. Bldg 2, 4008, Houston, TX, United States of America, amobasher@uh.edu, Gino Lim

We develop robust nurse scheduling models that consider patient demand variability as well as nurse preferences. A multi-objective integer programming model is developed for the NSP that considers different aspects of the goals such as cost issues, patient and nurse satisfaction, and nurse idle times. Patient demand variability is captured using relative robust optimization method. A robust solution methodology is developed to provide a step-by-step procedure for solving the NSP model.

2 - Agent-based Simulation of Perioperative Staff

Bryan Pearce, Clemson University, 101 Freeman Hall, Clemson, SC, 29634, United States of America, bpearce@clemson.edu, Nathan Huynh, Lawrence Fredendall, Kevin Taaffe

The perioperative environment is marked by factors such as diversity in patient requirements, incomplete information, and conflicting process and safety goals. A high degree of process variability results, interruptions are common, and task sets, sequences, and durations fluctuate. Simulation of staff members within this environment is accomplished with Agent-based techniques to abstract the stream of available information and the decision making process used.

3 - Optimal Emergency Scheduling Policy using Dynamic Programming

Narges Hosseini, Graduate Student, Clemson University, 110 Freeman Hall, Clemson University, Clemson, SC, 29634, United States of America, nhossei@clemson.edu, Maria Mayorga, Kevin Taaffe

The management and staffing of operating rooms (OR) is very expensive. As ORs are opened, hospital operators want to use them optimally while maintaining the quality of service and patient safety. Most hospitals with an OR serve elective cases; in addition, some hospitals serve emergency cases that require service as soon as possible. In this research, DP has been used to find an optimal scheduling policy of emergency cases that minimizes patient waiting costs as well as OR related costs.

4 - Optimal Nurse Scheduling Based on Quantitative Models of Work-Related Fatigue

Mustafa Sir, Assistant Professor, University of Missouri, Industrial and Manufacturing Systems Eng, E3437 Lafferre Hall, Columbia, MO, 65211, United States of America, sirm@missouri.edu, Esra Sisikoglu, Rung-Chuan Lin, Kalyan Pasupathy, Linsey Barker

Previous nurse scheduling models have mainly focused on managerial constraints to minimize costs. Although some models incorporate nurse preferences and safety guidelines, human factors (e.g., fatigue) have been generally ignored. Fatigue has been linked to reduced performance, nursing injuries, and medical errors, and has been shown to be affected by schedule-related parameters (e.g., shift length). We developed a nurse scheduling model incorporating quantitative models of fatigue.

■ TA45

C - Room 6, Level 2- Mezzanine

Optimization in Medical Decisions

Sponsor: Health Applications
Sponsored Session

Chair: Jingyu Zhang, North Carolina State University, 375 Daniels Hall, 111 Lampe Dr, North Carolina State University, Raleigh, NC, 27695, United States of America, jzhang2@ncsu.edu

1 - Physician Panel Sizing for the Patient Centered Medical Home

Mayank Sharma, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, mxsharma@us.ibm.com, Ching-hua Chen-Ritzo, Jianying Hu

Future increases in the demand for primary care are likely to exacerbate the difficulty of providing patients with timely and continuous access to care. Our work investigates the impact of panel composition and patient arrival patterns on panel size optimization. We study the implications with respect to managing new patients arrivals.

2 - Monitoring Cost in Healthcare Claims Data for Drug Surveillance
Yihan Guan, PhD Candidate, Stanford University, Huang Engineering Center 212F, Stanford, CA, 94305, United States of America, yihan@stanford.edu, Margret Bjarnadottir

We propose a new method for real-time post-marketing drug surveillance. The method monitors costs in claims data and is based on risk-adjusted group-sequential analysis. The effectiveness of this method is demonstrated in a study of claims data from 2.4 million members. Tradeoff between statistical significance level and power is addressed. The study shows that monitoring costs in claims data can efficiently detect drug safety signals.

3 - Optimal Strain Selection for the Annual Influenza Vaccine
Osman Ozaltin, University of Pittsburgh, Pittsburgh, PA, United States of America, oyo1@pitt.edu, Oleg A. Prokopyev, Andrew J. Schaefer, Mark S. Roberts

Seasonal influenza is a major public health concern and the first line of defense is the flu shot. We formulate a multistage stochastic mixed-integer programming model to determine the best flu shot composition, along with the timing of its manufacturing. We propose a branch-and-price algorithm, which can solve very large instances efficiently. We address various policy questions about the optimal allocation of scarce flu prevention resources.

4 - A Large-Scale Classification Systems for Early Cancer Diagnosis and Detection
Eva Lee, Professor & Director, Georgia Institute of Technology, Center for Operations Research in Medici, Industrial & Systems Engineeriing, Altanta, GA, 30332-0205, United States of America, eva.lee@gatech.edu

Early detection remains key to incurable or aggressive forms cancers. In this talk, we describe a machine-learning framework for classification. It consists of a pattern recognition module, a feature selection module, and a classification modeler and solver. Results for early detection for breast and lung cancers will be presented. This work is joint with Emory Winship Cancer Institute.

■ TA46

C - Room 7, Level 2- Mezzanine

Joint Session Invited Panels/ JFIG: Success as a Junior Faculty

Cluster: Invited Panels on Professional Issues/ Junior Faculty Interest Group
Invited Session

Moderator: Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa, AL, United States of America, bkeskin@cba.ua.edu

1 - Success as a Junior Faculty
Panelists: Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa, AL, United States of America, bkeskin@cba.ua.edu, John Fowler, Arizona State University, School of Computing, Informatics, and Decision Systems Engineering, Tempe AZ, United States of America, john.fowler@asu.edu, Gal Raz, Associate Professor of Business Administration, University of Virginia, Darden School of Business, 100 Darden Blvd., Charlottesville VA 22903, United States of America, razg@darden.virginia.edu, Wedad Elmaghraby, Robert. H Smith School of Business, Van Munching Hall, University of Maryland, College Park, MD 20742, United States of America, Wedad_Elmaghraby@rhsmith.umd.edu, Mark Lewis, Associate Professor, Cornell University, School of ORIE, 226 Rhodes Hall, Ithaca NY 14850, United States of America, mel47@cornell.edu

In this panel, we will discuss a wide variety of topics that are important for success as a junior faculty. Topics include, but not limited to, the expectations for tenure, getting national recognition, role of mentoring, and time management. The panelists will share their success stories and tips for success. Then, the floor will be open to questions from the audience.

■ TA47

C - Room 8, Level 2- Mezzanine

Large-Scale Networks and Applications

Cluster: Complex Systems
Invited Session

Chair: Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

Co-Chair: Abe Zeid, Northeastern University, 360 Huntington Ave, Boston, 02115, United States of America, zeid@coe.neu.edu

1 - Dynamical and Bursty Interactions in Social Networks
Ginestra Bianconi, Assistant Professor, Northeastern University, 360 Huntington Ave, Boston, MA, 02115, United States of America, G.Bianconi@neu.edu

Human social interactions are multi-scale phenomena, spanning over very different communities sizes and temporal scales. In this talk I will focus on the small group formation and the short-time scale behavior of social interactions, showing evidence that the inter-contact times and the duration of contacts in face to face interactions are distributed according to power-laws. A modeling for this phenomena is presented in which we propose that a reinforcement mechanism, a kind of "temporal preferential attachment" might be responsible for such observed feature. Comparison with group formation in animal experiments will be also discussed.

2 - Analysis of Composite Networks
Ben Baumer, CUNY, New York, NY, United States of America, BBaumer@gc.cuny.edu, Amotz Bar-Noy, Prithwish Basu

Network science aims at discovering the common organizing principles behind the emergence and existence of diverse genres of networks. These networks often interact with each other during their coexistence, e.g., social network interactions over communication networks. Such interacting composite networks can be modeled as a union of individual networks alongside mappings across their elements. We show how certain composite network properties, e.g., stretch and load of random mappings, can be estimated using combinatorial and probabilistic analysis.

3 - The Statistical Mechanics of Complex Software Development
Nimesh Patel, Graduate Student, Northeastern University, 360 Huntington Ave, 334SN, Boston, MA, 02115, United States of America, patel.nim@husky.neu.edu, Abe Zeid, Sagar Kamarthi, Kal Bugrara

This research analyzes how evolution occurs in software projects. We will discuss network statistical properties and explain their significance for improving the strategic and operational decision making. We will study how the evolution differs with at product and production level. At the product level each software attribute is considered a node and the connection between the attributes a link. At the production level we will analyze the interaction patterns among developers. We will analyze the link between the software architecture and the project organization.

4 - Shared Mental Model Formation and Mutual Learning on Social Networks
Hiroki Sayama, Assistant Professor, Binghamton University, P.O. Box 6000, Binghamton, NY, 13902, United States of America, sayama@binghamton.edu, Shelley D. Dionne, Chanyu Hao, Benjamin J. Bush

We created a networked agent-based model of team development processes, where agents share individual opinions, evaluate and respond to the opinions expressed by others, and modify their understanding of the team as well as the problem itself based on the responses. Our simulation results illustrate how social network structure, heterogeneity of agents' domains of expertise, level of their mutual interest, and mutual learning rate will affect the team development and performance improvement.

■ TA48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Decision Frameworks - Don't Square the Circle

Jeremy Walker, Decision Frameworks Inc., 12006 Pebble Hill Drive, Houston, TX, 77024, United States of America, jeremy@decisionframeworks.com

Do you find your teams trying to square a circle? Are they focused on solving the right problem? Come see the value of proper decision framing combined with practical decision analysis. View the latest framing tools and techniques in DTrio integrated with TreeTop's state-of-the-art decision trees, tornados and cumulative probabilities curves. Quality Decision Making - derived, not divined.

2 - statistics.com - Data Mining In Excel

Peter Bruce, President, statistics.com, 612 N. Jackson Street, Arlington, VA, 22201, United States of America, pbruce@statistics.com

The workshop will illustrate common data mining classification and prediction techniques using XLMiner, a comprehensive data mining add-in for Excel that offers neural nets, trees, naive Bayes, logistic and linear regression, discriminant analysis (as well as clustering and association rules). The role of partitioning the data into training and validation samples will be discussed.

■ TA49

C -Room 10, Level 2- Mezzanine

The Role and Value of Information Technologies in Healthcare

Sponsor: Information Systems
Sponsored Session

Chair: Vallabh Sambamurthy, Michigan State University, College of Business, East Lansing, India, sambamurthy@bus.msu.edu

1 - Learning Curves of Agents with Diverse Skills it Enabled Physician Referral Systems

Tridas Mukhopadhyay, Tepper School of Business, Carnegie Mellon University, Pittsburgh, United States of America, tridas@cmu.edu, Seung Hyun Kim, Param Singh

This study examines learning curves in an IT enabled physician referral systems setting to determine whether agents achieve performance improvements from cumulative experience at different rates and how IT transform the learning dynamics in this setting. We present a hierarchical Bayes model that accounts for different agent skills (domain and system), and estimate learning rates for three types of referral requests: emergency (EM), non-emergency (NE), and non-emergency out of network (NO).

2 - The Impact of Automation of Systems on Medical Errors: Evidence From Field Research

Ravi Aron, Asst. Professor, Johns Hopkins University, 100 N. Charles ST, Room 1115, Baltimore, MD, 21201, United States of America, raviaron@jhu.edu, Praveen Pathak, Shantanu Dutta, Ramkumar Janakiraman

We use panel data from a balanced panel of wards from two hospitals spanning a three-year period to investigate the impact of automation of the core error prevention functions in hospitals on medical error rates. We show that the automation of the process of recording and observing agent actions will have significant impact on reducing error rates. We show that there are complementarities between quality management training and the automation of control systems in reducing medical errors.

3 - A Multi-Level Investigation of IS Avoidance in Healthcare Groups

Gerald Kane, Assistant Professor of Information Systems, Boston College, 140 Commonwealth Ave, Chestnut Hill, MA, 01536, United States of America, gerald.kane@bc.edu, Joe Labianca

This paper examines the effects of IS avoidance on patient care delivered by healthcare groups using three different levels of analysis - individual doctor, shared group, and configural group. We find that IS avoidance is significantly and negatively related to patient care only at the configural group level of analysis, which suggests that IS avoidance is detrimental to performance only in certain situations.

4 - Unity in Diversity: Electronic Patient Record Use in Multidisciplinary Practice

Michael Barrett, Reader-Asc Prof, University of Cambridge, Judge Business School, Cambridge, United Kingdom, m.barrett@jbs.cam.ac.uk, Eivor oborn, Elizabeth Davidson

We examine the use of Electronic Patient Records in multidisciplinary care. We apply practice theory to investigate the oppositional tendencies toward diversity and unity in EPR use and suggest that these dynamics are inherent in multidisciplinary practice. Our study contributes to the literature a granular, practice-based understanding of EPR use in multidisciplinary work. It highlights the collective, interdependent influences among agents on technology use in these settings.

■ TA50

C -Room 11, Level 2- Mezzanine

Distributed Control of Information Networks

Cluster: Cloud Computing
Invited Session

Chair: Cathy Xia, Associate Professor, The Ohio State University, 210 Baker Systems Engineering Bldg, 1971 Neil Ave, Columbus, OH, 43210, United States of America, xia.52@osu.edu

1 - Approximate and Lower-complexity VCG Mechanism with Many Bidders

Jean Walrand, Professor, University of California-Berkeley, Berkeley, CA, United States of America, walrand@berkeley.edu, Libin Jiang

It is well known that the VCG mechanism can elicit truthful bidding and achieve the optimal allocation of resources. However, the computational requirement of VCG is high since it requires solving one optimization problem for each bidder. In this work, we consider a mechanism where only one optimization problem needs to be solved and truthful bidding is an approximate Nash equilibrium. In particular, when there are many bidders, the mechanism is nearly incentive compatible.

2 - A Unified Framework for Joint Power and Rate Control of Multi-hop Rechargeable Sensor Networks

Zhoujia Mao, Student, The Ohio State University, maoz@ece.osu.edu, Can Emre Koksal, Ness Shroff

In this work, we study the problem of jointly controlling the data queue and battery buffer to maximize the long-term average sensing rate of a rechargeable sensor network under certain QoS constraints. We proposed a unified algorithm structure and analyze the performance of the algorithm for all combinations of finite and infinite data and battery buffer sizes. We also provide a distributed version of the algorithm with provable efficiency based on imperfect scheduling.

3 - A Lyapunov-based Proof of Optimality of Join the Shortest Queue Routing

R Srikant, Professor, University of Illinois at Urbana-Champaign, University of Illinois, CSL, 1308 W. Main St., Urbana, IL, 61801, United States of America, rsrikant@illinois.edu, Atilla Eryilmaz

We consider a simple discrete model of a multi-queue system which operates under the join-the-shortest (JSQ) policy. We show heavy-traffic optimality of the JSQ policy by setting the drift of a Lyapunov function equal to zero in steady-state. While the considered traffic model is simple, the method has the advantage of being simple and captures the idea of state-space collapse using elementary techniques.

4 - Linear-speed Distributed Algorithms for Optimal Control of Information Networks

Cathy Xia, Associate Professor, The Ohio State University, 210 Baker Systems Engineering Bldg, 1971 Neil Ave, Columbus, OH, 43210, United States of America, xia.52@osu.edu, Li Zhang, Zhen Liu, Hanhua Feng

Many network-based problems are naturally distributed optimization problems. Most of the distributed solutions provided by existing work focused on the stability and asymptotic optimality, while the practical convergence speed of these algorithms attracted little attention. In this talk, we present new techniques that lead linear speed algorithms for the distributed control of information networks.

■ TA51

C -Room 12, Level 2- Mezzanine

Modeling the Defense Analysis II

Sponsor: Military Applications
Sponsored Session

Chair: Bill Fox, Professor, Naval Postgraduate School, Monterey, CA, 93943, United States of America, wpfox@nps.edu

1 - Mathematical Techniques in Computational Linguistics
Joe Myers, U.S. Army Research Laboratory, United States, josePhD.myers@us.army.mil

DoD has developed machine translation capability for a small set of important languages through stochastic/Bayesian techniques. The cost of developing more systems for other languages is both prohibitive and not feasible. We need to help foster efforts for these languages in a structured modeling approach. We will discuss some new mathematical techniques being developed by researchers to accomplish this modeling.

2 - Surge Employment in Counter Directed Energy Weapon (DEW) Operations
Donald Gaver, Distinguished Professor, Naval Postgraduate School, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, DGaver@nps.edu, Patricia Jacobs

DEWs such as high-energy lasers and high-power microwave are potential opponent/"Red" (R) threats to friendly/"Blue" (B) aircraft (a/c). We present simple stochastic models of the effect of tactical employment of a nearly simultaneous arrival or surge by B a/c (both active and decoy) into R-DEW protected space. The models represent atmospheric impediments to R-DEW attack. The models allow B to decide on the force size to commit against an R-DEW installation so as to achieve objectives.

3 - Quantitatively Testing and Adding to Disruptive Technology Theory using Technology Forecasting DEA
Ann-Marie Lamb, PhD Student, Engineering & Technology Management, Portland State University, Portland, United States of America, ajlamb@pdx.edu, Timothy Anderson

Technology policy makers, military leaders, and managers continue to struggle with the dilemma of detecting when, and if, to invest in emerging/disruptive technology development. This presentation is an early thesis proposal extending an earlier initial study implication that technology forecasting using data envelopment analysis (TFDEA), which allows for study of technology evolution and state-of-art assessment, has strong potential for breakthrough early technology intelligence assessment.

■ TA52

C -Room 13, Level 2- Mezzanine

Sensor Placement for Homeland Security

Cluster: Homeland Security and Defense
Invited Session

Chair: Cynthia Phillips, Senior Scientist, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, caphill@sandia.gov

1 - Sensor Placement and Sensitivity Tuning for Municipal Water Networks
Cynthia Phillips, Senior Scientist, Sandia National Laboratories, Mail Stop 1318, P.O. Box 5800, Albuquerque, NM, 87185-1318, United States of America, caphill@sandia.gov

We consider placing sensors in a municipal water network when we can choose both sensor location and the sensitivity and specificity of the contamination warning system. An event detection system (EDS) monitors continous sensor output, determining when to signal an anomaly. EDS parameters control the tradeoff between false alarms and false negatives. We describe a MIP approximation to the nonlinear sensor placement problem and report the results of initial experiments on a real network.

2 - Multi-Stage Sensor Placement for Water Contamination Warning Systems
William Hart, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, United States of America, wehart@sandia.gov, Regan Murray, Jean-Paul Watson

The optimization of sensor placements is a key aspect of the design of contamination warning systems for automatically detecting contaminants in water distribution systems. Although researchers have generally assumed that all sensors are placed at the same time, in practice sensor networks will likely grow and evolve over time. We describe a multistage formulation that models budget uncertainty, which we solve with a scenario-based decomposition heuristic (Progressive Hedging).

3 - Using Model Skeletonization and Impact Aggregation for Low-memory Sensor Placement Optimization
Robert Janke, Research Scientist, U.S. EPA, 26 West Martin Luther King Drive, Mail NG-16, Cincinnati, Oh, 45268, United States of America, Janke.Robert@epamail.epa.gov, Cynthia Phillips, Katherine Klise, Regan Murray

Contamination warning systems for water distribution networks are designed to detect contamination incidents to facilitate a response that minimizes public health and economic impacts. Here we present results using model skeletonization and impact aggregation to minimize the computational and memory requirements needed for locating sensors in large, complex networks.

4 - Sensor Placement for Optimal Event Characterization Performance
Garrett Barter, Senior Member of Technical Staff, Sandia National Labs, P.O. Box 969, MS 9406, Livermore, CA, 94551, United States of America, gbarter@sandia.gov

Contaminant sensor placement is often cast as an optimization problem to minimize objectives such as the probability of failed detection or public health impact. In the case of an actual incident, the sensor network data will also be utilized for event characterization to estimate source location, size and hazard areas. We present a sensor placement methodology to optimize for event characterization performance, and also compare the results to traditional placement objectives.

■ TA53

C -Room 14, Level 2- Mezzanine

Marketing Channels

Sponsor: Marketing Science
Sponsored Session

Chair: Tansev Geylani, Associate Professor, University of Pittsburgh, Katz Graduate School of Business, 320 Mervis Hall, Pittsburgh, PA, 15260, United States of America, tgeylani@katz.pitt.edu

1 - The End of the Robinson-Patman Act? Evidence From Case Data
Tansev Geylani, Associate Professor, University of Pittsburgh, Katz Graduate School of Business, 320 Mervis Hall, Pittsburgh, PA, 15260, United States of America, tgeylani@katz.pitt.edu

Robinson-Patman Act (RP) is an antitrust statute that limits price setting in distribution channels. We investigate whether the Act's legal threat has changed in the recent years. The results suggest that the probability of a plaintiff winning a case has significantly decreased after two landmark Supreme Court rulings. The results also indicate that smaller plaintiffs over time have fared worse than larger ones, a trend that challenges the notion that RP protects small businesses.

2 - The Emergence of the Warehouse Clubs and Consumption Trends in the US
Anthony Dukes, Assistant Professor, University of Southern California, ACC 306E, Los Angeles, United States of America, dukes@marshall.usc.edu

We explore the pricing and assortment strategies of warehouse clubs in light of the rise in US individual consumption over the past 30 years. We show how the warehouse club's pricing and assortment strategies are relatively more profitable than conventional retailers as consumers become heavier users. We further suggest that the warehouse club accelerates individual consumption. Its package sizes and tiered memberships choices are consistent with heavy consumption.

3 - Wal-Mart's Impact on Supplier Profits
Vincent Nijs, Assistant Professor, University of California-San Diego, Rady School of Management, Otterson Hall, Room 3S147, La Jolla, CA, 92093, United States of America, vnijs@rady.ucsd.edu

Little is known about Wal-Mart's influence on suppliers' performance. Manufacturers suggest Wal-Mart uses its power to squeeze their profits. In this paper we study the validity of that claim. We investigate the underlying mechanisms that may cause changes in manufacturer profits following Wal-Mart market entry. We find that post-entry supplier profits increased by almost 18% on average, whereas profits derived from incumbent retailers decreased only marginally.

4 - Retailers Competing with Inventory Availability
Aydin Alptekinoglu, Assistant Professor, Southern Methodist University, 6212 Bishop Blvd, Dallas, TX, 75275, United States of America, aalp@cox.smu.edu, Ashkan Zeinalzadeh, Gurdal Arslan

Consider two retailers that can replenish their inventories only at a positive fixed order cost. What ties their replenishment decisions strategically is the customers' substitution behavior: a fixed percentage of customers facing shortages in one firm attempt to buy from the other firm. If fixed order costs are zero, equilibrium exists (shown by others). Else, single-period game has an equilibrium, whereas the multiple-period game may not (we show simple sufficient conditions for nonexistence).

■ TA54

C -Room 15, Level 2- Mezzanine

Technology Sourcing, Capabilities and Services

Sponsor: Technology Management/New Product Development
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 - Conceptualization and Measurement of Service Process Modularity
Thomas Frandsen, PhD candidate, Copenhagen Business School, Department of Operations Management, Solbjerg Plads 3, Frederiksberg, DK-2000, Denmark, tfr.om@cbs.dk, Juliana Hsuan

This paper explores how service process modularity can be conceptualized and measured. We take the service process as a system where its various elements can be decomposed into simpler elements. We apply the Service Modularity Function to measure the degree of service process modularity of a Danish financial service provider.

2 - Execution Capabilities of Distributed Technology Projects: A Comparative Evaluation of Efficiency
Anant Mishra, Assistant Professor, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States of America, amishra6@gmu.edu, Sriram Thirumalai, Kingshuk K. Sinha

With technology projects becoming increasingly distributed across firm and country boundaries, project execution has become a central concern for managers. This study examines how efficiency of projects varies across different types of distributed project organization. Further, it identifies the impact of project execution capabilities on the efficiency of projects. Using the econometric approach of stochastic frontier analysis, we examine data from 830 technology projects.

3 - Fluid Teams and Fluid Tasks: The Impact of Diversity in Experience and Team Familiarity
Bradley Staats, Assistant Professor, UNC - Chapel Hill, Campus Box 3490, McColl Building 4702, Chapel Hill, NC, 27599-3490, United States of America, bstaats@unc.edu

We consider how fluid teams and fluid tasks interact to affect team performance. We study the effect of diversity in experience on a team's ability to respond to changing tasks. Using detailed data from a software services firm, we find that though diverse experience across team members decreases flexibility to change, diverse experience within team members increases flexibility. Our results highlight the need for nuanced approaches to leveraging experience in managing teams.

4 - Dynamic Learning Strategies for High-Tech Start-Up Ventures
Jennifer Bailey, Georgia Institute of Technology, 800 West Peachtree St. NW, Atlanta, GA, 30308-, United States of America, jennifer.bailey@mgt.gatech.edu, Cheryl Gaimon

We model a dynamic capabilities-based view of the high-tech start-up venture. We explore the different costs, risk penalties and innovation return potential for exploration versus exploitation learning. Funding partners set dynamic goals to motivate the venture to maximize innovation value and minimize risk. The optimal rates of learning are driven by the rates of change in the goals. This is interesting for venture managers who drive innovation and keep pace with industry clockspeed.

■ TA55

C -Room 16, Level 2- Mezzanine

Strategy, Organization and New Product Development

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Jürgen Mihm, INSEAD, Constance de Blvd, Fontainebleau, France, jurgen.mihm@insead.edu

1 - Resource Allocation for New Product Development: Top-Down or Bottom-Up?
Jeremy Hutchison-Krupat, Georgia Institute of Technology, 800 W. Peachtree St, Atlanta, GA, 30308, United States of America, jhk@gatech.edu

Firms wishing to pursue strategic new product development (NPD) initiatives, face several key challenges. NPD initiatives require cross-functional collaboration where functional managers and senior management rarely know the difficulty the initiative poses for each function. Given this information asymmetry, along with the firm's organizational characteristics, senior management must decide whether to dictate budget allocations, or delegate this responsibility to the functional managers.

2 - A Structured Approach to Form Creative Teams
Manuel Sosa, INSEAD, Boulevard De Constance, Fontainebleau, France, manuel.sosa@insead.edu, Franck Marle

We introduce a novel approach to form temporary creative teams. We exploit the notion of creative interactions, which recognizes that people trigger the generation of creative ideas when interacting with each other for task-related matters. The approach is validated in an experimental setting and illustrated in a software development organization.

3 - Portfolio Management Under Risk and Ambiguity
Leonardo Santiago, Federal University of Minas Gerais, Department of Production Engineering, Av. Antonio Carlos, 6627 - Pampulha, Belo Horizonte, MG, 31270-901, Brazil, lsantiago@ufmg.br, Pirooz Vakili

We consider the impact of decision makers' aversion to risk and ambiguity on selection of R&D portfolios. We investigate this issue in a two-stage and interdependent model that links the development stage with that of commercialization. We highlight the distinction between these two stages and discuss the implications of incorporating ambiguity in the decision process.

4 - Collaborative Search
Jürgen Mihm, INSEAD, Constance de Blvd, Fontainebleau, France, jurgen.mihm@insead.edu

Search has become a widely accepted paradigm to describe innovation activities. Formal models of search have incorporated a broad spectrum of different aspects relevant to search, such as cognition or organizational embedding. We contribute to the understanding of search by studying under which circumstances it is beneficial to have several organizational players search collaboratively.

■ TA56

C - Room 1, Level 1

Joint Session SIM/ QSR: Metamodeling for Deterministic and Stochastic Simulations

Sponsor: Simulation Society/ Quality, Statistics and Reliability
Sponsored Session

Chair: Bruce Ankenman, Associate Professor, Northwestern University, Department of Industrial Engineering, Evanston, IL, 60208, United States of America, ankenman@northwestern.edu

1 - Optimization Under Unknown Constraints
Bobby Gramacy, Assistant Professor, University of Chicago, Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, rbgramacy@chicagobooth.edu, Herbert K.H. Lee

We consider optimization for computer experiments under unknown constraints, i.e., when simulation is required to determine real-valued responses and check constraints. We develop GP surrogates to approximate both simulator outputs. A new integrated improvement criterion recognizes that responses that violate the constraint are still informative about the function, and thus potentially useful in the optimization. We illustrate our approach on a problem from health care policy.

2 - Simulation-Based Estimation of Cycle Time using Quantile Regression
Nan Chen, Research Assistant, University of Wisconsin Madison, 1513 University Ave, Madison, WI, 53705, United States of America, nchen3@wisc.edu, Shiyu Zhou

Production cycle time is an important performance measure in manufacturing systems, and thus it is of interest to characterize distributional properties, such as quantiles, for informative decision making. In this paper, we propose a nonlinear quantile regression model to investigate the relationship between stationary cycle time quantiles and corresponding throughput rates of a complex system. Extensive numerical studies are presented to demonstrate the effectiveness of our methods.

3 - Statistical Ensemble of Multiple Computer Models
Young Deok Hwang, PhD Student, Department of Statistics, University of Wisconsin-Madison, Rm1270 1300 University Ave., Madison, WI, 53706, United States of America, hwang@stat.wisc.edu, Peter Qian

Ensemble of multiple computer models is getting more traction in many fields. We propose a new type of design, called sliced U design, for running such models. A sliced U design is a U design based on an orthogonal array with strength two that can be divided into different slices, each of which is a Latin hypercube design associated with each individual model. Also will be discussed is a two-step procedure for integrating data from multiple computer models for estimating the average output mean.

4 - Metamodel-based Simulation Input Model Uncertainty Analysis
Russell Barton, Professor, Pennsylvania State University, Smeal College of Business, 406 Business Building, University Park, PA, 16802, United States of America, rbarton@psu.edu, Barry L Nelson

The distribution of simulation output statistics includes variation from the finiteness of samples used to construct input probability models. This talk describes a strategy to characterize the distribution of output statistics as explicit functions of the input probability distributions. Metamodels and bootstrapping are used to permit a nonparametric approach.

■ TA57

C - Room 2, Level 1

Computational Methods in Finance

Sponsor: Financial Services Section
Sponsored Session

Chair: Zhen Liu, Assistant Professor, Missouri University of Science & Technology, United States of America, zliu@mst.edu

1 - Monte Carlo Methods on American Option Sensitivity Estimation
Nan Chen, Assistant Professor, The Chinese University of Hong Kong, 709A, William Mong Engineering Building, The Chinese University of Hong Kong, Hong Kong, China, nchen@se.cuhk.edu.hk, Yanchu Liu

In this paper, we investigate how to develop efficient Monte Carlo estimators to American option sensitivities. Using two features of the exercising boundary of the optimal stopping problem, the "continuous-fit " and "smooth-pasting" conditions, we derive unbiased estimators for first and second-order derivatives. Our method can be easily embedded into some popular algorithms for pricing one-dimensional American options. Numerical examples illustrate accuracy and efficiency of the method.

2 - Option Pricing Under a Mixed-Exponential Jump Diffusion Model
Ning Cai, Hong Kong University of Science & Technology, Kowloon, Hong Kong - PRC, ningcai@ust.hk

In this paper, we propose a jump diffusion model for asset prices whose jump sizes are mixed-exponentially distributed. The mixed-exponential distribution can approximate any distributions as closely as possible, including various heavy tail distributions such as power-and exponential-type distributions, and can lead to closed-form Laplace transforms of option prices and deltas of lookback and barrier options.

3 - Accelerating Measuring Shortfall Probability of a Portfolio Through Parallel Computing on GPUs
Hai Lan, Assistant Professor, Shanghai Jiao Tong University, 535 Fahua Rd, BLDG 10 ROOM 307, Shanghai, China, hailan2009@u.northwestern.edu

Shortfall Probability of a portfolio acts as an important risk measure in the automatic trading application. The measurement of shortfall probability below certain shortfall level requires heavy computation, especially when the studied portfolio is consisted of complex derivatives. Recent development in multiple comparison with control is applied to save computation effort. We also accelerate the simulation by applying the new development of parallel computing.

4 - Robust Option Pricing - An Epsilon-arbitrage Approach
Chaithanya Bandi, Massachusetts Institute of Technology, 77 Mass. Ave, Cambridge, MA, 02139, United States of America, cbandi@mit.edu, Si Chen, Dimitris Bertsimas

We combine the idea of e-arbitrage with robust optimization to propose a tractable approach to price a wide variety of options. We take a set based model for uncertainty and reduce the pricing problem to computing best possible replicating portfolio for the given uncertainty set.Computational tractability and modeling flexibility are the main advantages of this approach. We also provide a potential explanation for implied volatility smile and provide empirical evidence supporting it.

■ TA58

C - Room 3, Level 1

Free-boundary Problems in Finance

Cluster: Quantitative Finance
Invited Session

Chair: Arun Chockalingam, Visiting Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, achockal@purdue.edu

1 - The Impacts of Risk Aversion and Market Regimes on the Valuation of Employee Stock Options
Tim Leung, Assistant Professor, Johns Hopkins University, 3400n Charles Street, Baltimore, MD, 21218, United States of America, timleung@jhu.edu

We study the valuation of multiple employee stock options (ESOs) in a regime-switching financial market. The risk-averse holder's optimal hedging and exercising strategies are determined from a stochastic control problem with optimal multiple stopping. We analyze the underlying system of variational inequalities and solve for the holder's optimal exercise boundaries. Among other results, we find that switches of market regimes may induce the holder to exercise blocks of ESOs.

2 - Acquisition of Project-specific Assets with Bayesian Updating
Dharma Kwon, Assistant Professor, University of Illinois at Urbana-Champaign, Department of Business Administration, Champaign, IL, 61820, United States of America, dhkwon@illinois.edu, Steven Lippman

We study the effect of learning on the optimal policy and the time-to-decision in a sequential decision model with two irreversible alternatives, exit and expansion. In our model, the firm undertakes a small-scale pilot project with a noisy return so as to learn, via Bayesian updating, about the project's profitability before making the expansion or exit decision. We find that the time-to-decision does not necessarily have a monotonic relation with the arrival rate of new information.

3 - Robust Portfolio Selection with Adjustable Ambiguity Aversion
Roy Kwon, Associate Professor, University of Toronto, 5 King's College Road, Toronto, Ontario, Toronto, Canada, rkwon@mie.utoronto.ca, Jonathan li

We present a new approach for portfolio selection when ambiguity of the underlying financial model exists. In particular, our approach allows an investor to optimize his/her portfolio while seeking a balance between relying on his/her knowledge of a reference model and taking into account possible ambiguity of the model. We introduce a new penalty framework based on mean-covariance information of models. Our approach enjoys the benefits of both computational and analytical tractability.

4 - A Computational Method for Stochastic Impulse Control Problems with Applications in Finance
Haolin Feng, Assistant Professor, Lingnan College, Sun Yat-sen University, 135 Xing Gang Xi Road, Guangzhou, 510275, China, FengHaoL@mail.sysu.edu.cn, Kumar Muthuraman

We consider the instantaneous control of a 1-D diffusion process with holding and transaction costs. Transactions costs have a fixed and a proportional component, making it an impulse control problem. The objective is to minimize the total expected discounted costs. We develop a scheme to transform the resulted free-boundary problem into a sequence of fixed boundary problems. Theoretical guarantee of convergence and optimality are provided. We also illustrate a couple of applications in finance.

■ TA59

H - Salon A, 4th Floor

Analytic Hierarchy Process

Contributed Session

Chair: Prashant Tarun, Assistant Professor, Steven L. Craig School of Business, Missouri Western State University, St. Joseph, MO, 64507, United States of America, ptarun@missouriwestern.edu

1 - Optimizing the Future Energy Supply Budget
Dave Zvipore, National University of Science and Technology(Zimbabwe), 7110 Pumula North, Bulawayo, Zimbabwe, davezvipore@yahoo.com

Using Goal Programming & Analytical Hierarchy Process to realize the optimal hierarchy for energy sources investment priority &utilization budget in the future industry. The objective of this model is to establish priorities in comparing all the major global energy sources. P1goal: Environmental impact. P2 goal: Efficiency. P3 goal: Availability. P4 goal: Compatibility. Subject to globalenergy source and consumption data. Priority ranking: Solar, Hydrogen power, Wind energy Hydroelectricity, Nuclearpower, Gasoline, Thermoelectricity.

2 - AHP Group Decision Aggregation Through Principal Components Analysis

Natalie Scala, PhD Candidate, University of Pittsburgh, Department of Industrial Engineering, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, natalie.scala@gmail.com, Kim Needy, Luis Vargas, Jayant Rajgopal

This research presents a mathematical aggregation technique for group judgments in the Analytic Hierarchy Process when the geometric mean cannot be used. Situations exist where dispersion around the mean is violated and decisions cannot be changed. Principal Components Analysis is used to develop an improved method of group judgment aggregation.

3 - Analysis of Alternatives of Electricity Supply for a Colombian Petroleum Refinery. A Decision Analysis

Mario Castillo, Full Professor, Universidad de los Andes, Carrera 1 Este # 19 A - 40, Bogotá, Colombia, mcastill@uniandes.edu.co, Luis Novoa, Ezequiel Acosta, Sergio Cabrales

The Colombian Petroleum Company ECOPETROL faces an energy supply shortage in the incoming years for a particular Refinery. The company must select the best alternative for energy generation between Gas, Coke and combinations, considering risk and benefits criteria. We present a simulation-risk analysis model, and a multi-criteria qualitative model (AHP).

4 - Applications of Multicriteria Decision Analysis to Select Foreign Markets to Export

Diana Lesmes, Professor, Universidad de los Andes, Cr. 1 No. 18A-10, Bogotá, Colombia, d-lesmes@uniandes.edu.co, Angela Reyes, Mario Castillo

An Analytic Network Process (ANP) model and a Multi-Attribute Utility Theory (MAUT) model are applied for selecting countries to export software services. The decision makers are managers and/or owners of Colombian Smalls and Medium Enterprises (SMEs). In conclusion, the applied models are more adequate to take market expansion decisions than the currently model used.

5 - Divergence of Pairwise Comparison Matrices Computed using the Successive Geometric Mean (SGM) Method

Prashant Tarun, Assistant Professor, Steven L. Craig School of Business, Missouri Western State University, St. Joseph, MO, 64507, United States of America, ptarun@missouriwestern.edu, Victoria Chen, H. W. Corley

This research focuses on developing a theoretical basis for the divergence behavior of pairwise comparison matrices computed using the successive geometric mean (SGM) method in the matrix generation phase of the three-phase methodology for a multiple stage, multiple objective optimization model.

■ TA60

H - Salon B, 4th Floor

Soft Skills for Decision Analysts

Sponsor: Decision Analysis
Sponsored Session

Chair: William Klimack, Senior Consultant, Kromite LLC, 6700 Woodlands Pkwy, Suite 230-262, The Woodlands, TX, 77382, United States of America, bklimack@kromite.com

1 - Overview of the Soft Skills Workshop

William Klimack, Senior Consultant, Kromite LLC, 6700 Woodlands Pkwy, Suite 230-262, The Woodlands, TX, 77382, United States of America, bklimack@kromite.com

Decision analysis professionals have identified interpersonal skills as a significant barrier to adopting decision analysis methodologies. In order to support adoption of decision analysis, the Soft Skills Workshop was developed. Conducted for three years, the Workshop has received feedback as a valuable developmental experience for both decision analysis professionals and ORMS professionals in general. We provide an overview of the Soft Skills Workshop.

2 - Soft Skills Workshop - Working with Individuals

Paul Wicker, Senior Consultant, Decision Strategies, Inc, 10260 Westheimer Suite 250, Houston, TX, 77042, United States of America, pwicker@decisionstrategies.com

In order to employ the techniques of decision analysis and operations research effectively, a practitioner must have a level of expertise working with both individuals and groups. This overview of the Soft Skills Workshop will review the sections of the course that cover Client Interaction, Interviewing Subject Matter Experts, and Problem Definition. Assessing the complexity of the decision, best practices for interviewing, and working to appropriately define the problem will be reviewed.

3 - Soft Skills Workshop - Working with Groups

Freeman Marvin, Executive Principal, Innovative Decisions, Inc., 1945 Old Gallows Rd, Ste 207, Vienna, VA, 22182, United States of America, ffmarvin@innovativedecisions.com

The Soft Skills Workshop teaches decision and OR analysts the people skills needed for successful analysis projects. Analysts need to work with six categories of people: clients, project teams, stakeholders, subject matter experts, working groups, and senior decision makers. This section presents an overview of the skills taught in the workshop for working successfully with team members, working groups, and senior decision makers.

4 - Lessons Learned and Apparent Trends From the Soft Skills Workshop Series

Jack Kloeber, Partner, Kromite LLC, 148 East Street Road, Suite 121, Feasterville, PA, 19053, United States of America, jkloeber@kromite.com

The softskills workshop has been taught three years in a row at the INFORMS Practice Conference. We will close this session with a discussion about what we have learned over the last three years regarding which skills seem to most needed, what workshop techniques seems to succeeding, how the workshop has changed, and what seem to be trends for the future.

■ TA61

H - Room 400, 4th Floor

Operations Management I

Contributed Session

Chair: Wenjun Gu, PhD Candidate, University of Illinois Urbana Champaign, 1206 S 6th St, 350 WH, Champaign, IL, 61820, United States of America, wgu3@illinois.edu

1 - Coordination of Pricing and Sourcing in a Multiple Supplier, Multiple Retailer Supply Chain

Bing Liu, The University of Alabama, Box 870226, Tuscaloosa, AL, 35401, United States of America, bing.liu@ua.edu, Charles Sox

This research studies the centralized coordination of sourcing and pricing in a multiple supplier, multiple retailer supply chain. Even within a centralized supply chain competition between suppliers or retailers can occur even though it is not encouraged. We investigate the concavity of the overall profit function and conduct experiments to compare the overall performance with common price strategy against differentiated price strategy. In addition, we study the cost of ignoring competition.

2 - Capacity Collaboration Between Two Competing Firms

Eren Cetinkaya, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, erencet@umich.edu, Hyun-Soo Ahn, Izak Duenyas

We consider capacity collaboration between two firms competing in the market. We show that even if firms compete, considerable gains can be realized when firms build and share capacity. We examine how the extent of collaboration and intensity of competition influence the firms' capacity and pricing decisions. We also show when and how firms can achieve the coordinated solution through negotiation. We find that under some situations, competition may decrease the total capacity built.

3 - Physician Decision Processes in the Emergency Department

Jillian Berry, Student, Harvard Business School, Soldiers Field, Boston, MA, 02163, United States of America, jberry@hbs.edu, Anita Tucker

This study examines and models the ordering behavior of physicians in the Emergency Department (ED) of a hospital. It is then assessed whether sequential or parallel processing of decisions is appropriate given the setting.

4 - Organizational Structure for the Twenty-first Century

Michael Lim, Bangor University, Alun Building, A104, College Road, Bangor, LL572DG, United Kingdom, michael.lim@bangor.ac.uk, Sally Sambrook, Gareth Griffiths

We trace the emergence of the bureaucratic organizational structure, noting its compatibility to the industrialization period. We then develop the Environment-Management-Workers-Customers-Structure-Outcome framework of organizational structure development, and use it to argue that the bureaucratic structure is inadequate for coping with current expectations. Finally, we present the Hierarchy-Community Phenotype Model of organizational structure as an alternative for the twenty-first century.

5 - Product Line Design and Capacity Constraint
Wenjun Gu, PhD Candidate, University of Illinois Urbana Champaign, 1206 S 6th St, 350 WH, Champaign, IL, 61820, United States of America, wgu3@illinois.edu, Dilip Chhajed, Nicholas Petruzzi

We study a monopolist's quality and pricing decisions under capacity constraint. Results show that the firm always lowers quality to produce more products and that it offers niche products for high segment only at low capacity and extends to a product line at high capacity. However, if market cannibalization effect is weak, the firm switches strategy from niche products to standard products for both segments at medium capacity. We also determined the value of extra capacity to the firm.

■ TA62

H - Room 402, 4th Floor

Modeling Equipment Failures and Maintenance in Aviation

Sponsor: Aviation Applications
Sponsored Session

Chair: Jady Handal, PhD, Federal Aviation Administration, 800 Independence Av, SW, Washington, DC, 20591, United States of America, jady.handal@faa.gov

1 - The Economic Aspect of Service Quality for the National Airspace System
Ana Rodriguez, Senior aviation analyst, GRA, Incorporated, 115 West Av., Suite 201, Jenkintown, PA, 19046, United States of America, anar@gra-inc.com

The goal of this analysis is to measure how the quality of service provided by NAS facilities is affected by the amount and type of maintenance performed on these equipment. The paper presents several econometric analyses to characterize relations between the number of hours of maintenance of different types (specialists vs. non-specialists) and the quality of service of facilities.

2 - Impact of Lightning Strikes on Aviation System Outages
Jasenka Rakas, PhD, University of California at Berkeley, 107B McLaughlin Hall, Civil and Environmental Engineering Dept, Berkeley, CA, 97420, United States of America, jrakas@berkeley.edu, Aurélien Vidal

In this study, a statistical method is developed to estimate the number of outages caused by lightning strikes, which takes into account both the time detection of the outage and the localization of the strikes. The method is then applied to the top 35 airports between 1999 and 2005. The results obtained are significantly larger compared to the number of outages automatically reported by the Federal Aviation Administration.

3 - An Empirically-based Tool for Maintenance Staffing Level Decisions in the National Airspace System
Xuegao An, GRA, Incorporated, 115 West Av, Suite 201, Jenkintown, PA, 19046, United States of America, xuegaoa@gra-inc.com, Jady Handal

Maintenance on FAA facilities is performed by ATO Technical Operations. The growing number of NAS facilities, with the aging of the installed base means that maintenance needs will increase. On the other hand, budget pressure constrains the growth in maintenance resources; there is a need to develop a systematic approach to using maintenance resources efficiently. This paper describes a tool to determine the level of staffing needed to meet maintenance requirements.

■ TA63

H - Room 404, 4th Floor

Military Decision Analysis

Sponsor: Decision Analysis
Sponsored Session

Chair: Greg Parnell, Professor of Systems Engineering, United States Miltary Academy, Rm 432, Mahan Hall, West Point, NY, 10996, United States of America, gregory.parnell@usma.edu

1 - Innovative Decision Analysis Case-Based Teaching Techniques for Military Applications
Robin Dillon-Merrill, Georgetown University, 517 Hariri Bldg, Washington, DC, 20057, United States of America, rld9@georgetown.edu, Gary Smith, Steve Heidorn

The traditional approach for training is to identify relevant topics, lecture to those topics, and provide some small examples to illustrate points. We describe an innovative approach that uses the case-study method to engage the students in learning decision analysis. The result was a rich basis for in-class exercises that allowed students to absorb the material in an active learning environment, and to provide a strong basis for applying the material in the real world.

2 - Sensitivity Analysis of Decision Models via Random Sampling of Vectors in a Bounded Region
Jeff Weir, Associate Professor, Air Force Institute of Technology, 2950 Hobson Way, WPAFB, OH, 45433, United States of America, Jeffery.Weir@afit.edu, Alex Gutman

This work seeks to address two issues; high-dimension sensitivity analysis in multi-criteria decision models and generating random vectors over complex regions without the use of acceptance-rejection filters. The solution to both of these issues is the Vectors in a Bounded Region (VBR) algorithm which enables us to randomly select weight vectors from a weight space defined by intervals, which gives a decision maker a new, innovative way to perform high-dimensional sensitivity analysis.

3 - Capital Planning for the U.S. Army using Decision Analysis and Optimization
Lee Ewing, PhD, Naval Postgraduate School, 1411 Cunningham Rd., Monterey, CA, 93943, United States of America, plewing@nps.navy.mil

The U.S. Army seeks analytical support building the Program Objective Memorandum (POM) which outlines how the Department of Defense and the Army allocate yearly funding over a six year period. This presentation provides an overview of the methodology, example analysis, and challenges we have and continue to face in integrating decision analysis techniques and optimization in the development of capital planning tools which inform the Army's equipping decisions.

4 - WholePersonnel: Multi-Attribute Modeling to Inform "Personnel Quality" Decisions
Rob Dees, Assistant Professor, US Army, 314A South Moore Loop, West Point, NY, 10996, United States of America, Robert.Dees@usma.edu

In order to support many personnel decisions effectively, the Army must quantify the "quality" of individuals. Currently, the Army does not have a means to holistically quantify the quality of individuals, and as such is not able to understand tradeoffs in the quality, quanitity, and cost trade space. We offer WholeSoldier, WholeOfficer, and WholeCadet performance models. With these measures, the Army will be better able to recruit, select, promote, retain, and separate personnel.

■ TA64

H - Room 406, 4th Floor

Health Care, Modeling and Optimization I

Contributed Session

Chair: George Miller, Institute Fellow, Altarum Institute, 3520 Green Court, Suite 300, Ann Arbor, MI, 48105, United States of America, george.miller@altarum.org

1 - A Probabilistic Model for Decreasing the Rate of No-show in Hospital Appointments
Kai Yang, Professor, Wayne State University, Manufacturing Engineering Building, 4815 4th Street, Detroit, MI, 48202, United States of America, ac4505@wayne.edu, Susan Yu, Adel Alaeddini

The number of no shows has a significant impact on the cost and resource planning of almost all healthcare systems. Meanwhile, it has been proven that that the traditional reminder system has only marginal effects on reducing this rate. In this study we develop a Bayesian model for relating the rate of no shows to the investigated factors and selecting appropriate overbooking strategy to reduce the rate of no-show in John D. Dingell VA Medical Center, Detroit, Michigan.

2 - Development of the Patient Scheduling System using Data Mining and Simulation-Based Optimization
Parviz Kheirkhah, PhD Candidate, Department of Industrial Engineering - University of Houston, E222 Engineering Building 2, Houston, TX, 77204, United States of America, p_khe@yahoo.com, Amir Sharafkhaneh, Qianmei Feng

Our study on the no-show problem in Veterans Health care Administration in zone 16 shows that patient scheduling can benefit from an effective overbooking strategy. To assist patient overbooking, we developed a decision support system using data mining and simulation-based optimization. Based on the prediction models for the patient show-up probability and the number of walk-ins, a simulation-based optimization model is developed that can schedule appointments using overbooking.

3 - Optimal Policy for Cervix Cancer Prevention and Treatment for Colombian Women

Raha Akhavan-Tabatabaei, Assistant Professor, Universidad de los Andes, Cra 1 Este # 19A-40, Bogotà, Colombia, r.akhavan@uniandes.edu.co, Natalia Garcia, Diana Marcela Sanchez, Thomas Yeung

We propose a Markov Decision Process model to find the optimal policy for prevention and treatment of cervix cancer in Colombian women. The optimal decision in each stage is based on risk factors such as age and family history as well as the advancement of disease. The cost function takes into account costs of prevention and treatment versus the risk of not reacting. We apply the model to a population of women in Bogotà, Colombia and show numerical results.

4 - Multi-service Location Models Across VA Healthcare Networks

Hande Musdal, Northeastern University, 360 Huntington Ave, Boston, MA, 02115, United States of America, musdal.h@husky.neu.edu, James Benneyan

Location-allocation models that seek to determine the optimal location of multiple primary and tertiary medical services across a geometric network of facilities can result in significant cost, operational, and service improvements. We investigate the simultaneous optimal assignment of multiple healthcare services across a large integrated network of Veterans Affairs medical centers and ambulatory care facilities. Preliminary results, modeling issues, and ramifications are discussed.

5 - Forecasting Collections for the Veterans Health Administration (VHA)

George Miller, Institute Fellow, Altarum Institute, 3520 Green Court, Suite 300, Ann Arbor, MI, 48105, United States of America, george.miller@altarum.org

We describe new methods to forecast insurance reimbursements and copayments collected by the VHA. Econometric models project collections as a function of local workload, patient demographics, and economic conditions. These projections are adjusted to reflect anticipated improvements in collections using estimates of the extent to which historical collections represent best practice and the pace by which the gap between historical experience and best practice is anticipated to be reduced.

■ TA65

H - Room 408, 4th Floor

Inventory Management I

Contributed Session

Chair: Jun-Yeon Lee, University of Houston-Victoria, 14000 University Blvd, Sugar Land, TX, 77479, United States of America, leej@uhv.edu

1 - Inventory Competition for Newsvendors Under the Objective of Profit Satisficing

Chunming Shi, Wilfrid Laurier University, 75 University Avenue West, Waterloo, ON, N2L3C5, Canada, cshi@wlu.ca, Xuan Zhao

Inventory competition for newsvendors has been studied extensively under risk neutrality. In this paper, we study this problem under the objective of profit satisficing which is based on downside-risk aversion.

2 - Spare Parts Management with Dual Supply Sources and Two Demand Classes

Shenghao Zhang, Associate Professor, Department of Industrial Engineering, The School of Management, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, 710049, China, shhzhang@mail.xjtu.edu.cn, Yi Wang, Sean X. Zhou

We consider a periodic-review, infinite-horizon, inventory system with two service-differentiated demand classes and dual supply sources. We adopt a base-stock type policy with two parameters to control inventory replenishment, and non-anticipated rationing policy or anticipated one to allocate on-hand inventory. We provide exact evaluation procedure of system costs and develop an algorithm to find optimal solutions. Numerical studies illustrate the superior of anticipated rationing policy.

3 - Good Practice in Decision Making: Facts and Myths

K. Nadia Papamichail, Senior Lecturer in Information and Decision Systems, Manchester Business School, University of Manchester, Booth Street West, Manchester, M15 6PB, United Kingdom, nadia.papamichail@mbs.ac.uk

In the current turbulent economic environment managers strive to solve complex problems and take sound decisions. This paper presents a framework for assessing organisational decision making performance. Based on interviews with decision analysts the work outlines essential elements of good decision making. The findings of the project are presented along with examples of good and bad practice.

4 - Vendor-managed Inventory in a Continuous-review Inventory System

Jun-Yeon Lee, University of Houston-Victoria, 14000 University Blvd, Sugar Land, TX, 77479, United States of America, leej@uhv.edu

Vendor-Managed Inventory (VMI) is an industry practice where the supplier assumes the responsibility of managing and replenishing the inventory at the retailer. In this paper we study the benefits of VMI from economies of scale in a continuous-review stochastic inventory system. We also examine the impact of various parameters on the benefits of VMI.

■ TA66

H - Room 410, 4th Floor

Logistics I

Contributed Session

Chair: Alp Ertem, JB Hunt Transport Inc, 705 W Putman St Apt L4, Fayetteville, AR, 72701, United States of America, alpertem@gmail.com

1 - A Graphical Method Addressing Problems of the Dual-robot Stocker System

Pansoo Kim, Assistant Professor, Kyungpook National University, 1370 Sankyuk-Dong, Puk-Gu, Daegu, 702701, Korea, Republic of, pskim@knu.ac.kr, Jihye Lee, Jeongwon Yang

As a consequence of the more sophisicated design, move requests imposed on the Dual-Robot Stocker system greatly increased. For solving this problem, the industry adopted the dual-robot stocker system that two robots are moving along the same guide line in the stocker system. This research develops a graphical method solution to estimate a precise delivery rate of the dual robot stocker system.

2 - The (R, Q) Inventory Model with Discounting

Kaj Rosling, Professor, The Linnaeus University, Department of Engineering, Växjö, SE-35195, Sweden, kaj.rosling@vxu.se

The theory of average-cost optimal (R, Q) policies is generalized to discounting over an infinite horizon. Simple and striking results are presented. A very precise approximation of the optimal policy is derived from the average-cost solution and an estimate of the average depreciated value of the set-up cost. The derivations assume continuous review and demand.

3 - Collaborative Transportation Management in the Supply Chain: Shipper and Carrier Perspectives

Ieelong Chen, North Dakota State University, Logistics and Transportation Program, 1340 Administration Ave, Fargo, ND, 58102, United States of America, ieelong.chen@ndsu.edu, Joseph Szmerekovsky

The literature on Collaborative Transportation Management (CTM) is reviewed and its relationship to existing supply chain theory is detailed and clarified. The majority of the CTM literature is shown to be from the shipper as opposed to the carrier perspective. To fill this deficiency, this work defines and analyzes the value of CTM from the carrier perspective.

4 - A Procurement Auctions-based Framework for Disaster Relief Operations

Alp Ertem, JB Hunt Transport Inc, 705 W Putman St Apt L4, Fayetteville, AR, 72701, United States of America, alpertem@gmail.com, Nebil Buyurgan

The holistic framework is developed in a way that auctioneers and bidders compete amongst each other in multiple rounds of the procurement auction. Combining the multiple phases of procurement auctions is unique both in the auction literature and in the disaster relief research, and it helps the humanitarian organizations supply the immediate and long-term requirements in the disaster location more efficiently.

■ TA67

H - Room 412, 4th Floor

Economics I

Contributed Session

Chair: Chen-hui Yang, PhD Candidate, Xi'an Jiaotong University, No.28 Xianning West Road, Xi'an, 710049, China, chenhui_y@yahoo.com

1 - Estimating Real Money Balances for U.S.A.: A Simultaneous 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 assume that the supply of money is fixed by the central bank whereby the interest rate is solely determined by the demand for money and a single equation method is used in empirical work. In this study, we consider both the demand for and supply of money in the U.S. in determining equilibrium real money balances.

2 - Analyzing the Disparity in Macro Economic Data in Different China Areas

Zhang Aiying, University of International Business and Economics, No.10, Huixin Dongjie, Chaoyang District, Beijing, China, arbelazhang@gmail.com, Bin Zhang

China is a large country with complicated disparities in economy of different areas. This paper introduces the clustering and analysis of all 287 prefectural cities in China. We collect 19 indices of macro economic data for each city. Data reduction and clustering are adopted to form 7 groups among all cities according to their economic features. Then we conclude the homogeneities and heterogeneities among city groups, which provide valuable analysis of different types of China regional economy.

3 - The Hedging Strategy of the Company and Contract Price Under the Company & Farmer Pattern

Chen-hui Yang, PhD Candidate, Xi'an Jiaotong University, No.28 Xianning West Road, Xi'an, 710049, China, chenhui_y@yahoo.com, Xinmei Liu, Zhenxiang Wei

Company & Farmer pattern is relatively mature to industrialize Chinese agriculture, but the default rate is as high as 80%. To establish a stable contractual company-farmer relationship, we consider the futures markets to study the optimal hedging strategy of the company and contract price by constructing an expected utility model. Dividing the enterprises into the large enterprises and the small and medium enterprises, We find that they take different hedging strategy and pricing strategy.

4 - Is it Bad Luck or Bad Timing

Iva Rashkova, London Business School, Sussex's Place, London, NW1 4SA, United Kingdom, irashkova.PhD2009@london.edu

The paper studies the effect of one's commitment to an event on potential future decisions considered in the same mental frame. The expectation and the reference value change according to an anricipation-realization-memory framework. Finally, with the closure of the event's mental account, the decision space returns to follow a long-run evolution process. Thus, the same option could be accepted at one point in time and rejected at another, hence making the timing of its arrival crucial.

■ TA68

H - Room 415, 4th Floor

Social Interactions in Business: Models and Processes

Sponsor: eBusiness

Sponsored Session

Chair: Jacomo Corbo, University of Pennsylvania-The Wharton School, 3730 Walnut Street, 555 Jon M. Huntsman, Philadelphia, PA, 19104, United States of America, jacomo@wharton.upenn.edu

1 - A Game-Theoretic Analysis of the ESP Game

Shaili Jain, Harvard University, 33 Maxwell Dworkin, Cambridge, MA, 02138, United States of America, shailij@gmail.com, David Parkes

The ESP game is a game for labeling images on the web. We present a game-theoretic model the ESP game. Under a model that captures current game dynamics, we show focusing on low effort, high frequency words is an equilibrium. We establish more desirable equilibria under an alternate model, where players receive more points for infrequent words. The technical results make use of a stochastic dominance argument. These results suggest the possibility of formal incentive design in human computation.

2 - Human Capital, Social Capital, and the Peter Principle

Chonnikarn Fern Jira, Harvard Business School, 52 HBS Student Mail Center, Boston, MA, 02163, United States of America, cjira@hbs.edu, David M. Waguespack, Lee Fleming

What attributes that tend to enhance an individual's promotion actually produce positive spillovers for those whom he eventually manages? We address the relationship between managers' human and social capital and the performance of the groups they manage. We argue that although human capital (individual contribution) influences promotion, group performance depends more heavily on social capital in the form of social brokerage. We present evidence from the Internet Engineering Task Force.

3 - Optimal Discriminatory and Non-discriminatory Marketing Strategies with Network Effects

Kartik Hosangar, The Wharton School, 3730 Walnut Street, Philadelphia, 19104, United States of America, khosangar@wharton.upenn.edu, Jacomo Corbo

We focus on finding adoption-maximizing and profit-maximizing marketing strategies and study the problems in two main cases: with and without price discrimination. For either setting and either objective, we show how to compute optimal or approximative strategies and contrast how well they fare against each other. We show that while price discrimination is always beneficial, under many externality conditions the different to pricing policies without discrimination is small.

4 - Spreading the Oprah Effect: The Diffusion of Demand Shocks in a Recommendation Network

Eyal Carmi, New York University, 44 West 4th Street, New York, NY, 10012, United States of America, ecarmi@stern.nyu.edu, Gal Oestreicher-Singer, Arun Sundararajan

We study the magnitude and persistence of the diffusion of exogenous demand shocks (created by book reviews on the Oprah Winfrey show and on the Sunday NYTimes) on an e-commerce recommendation network (the Amazon co-purchase network). Using matched sample approach we identify the extent of variation caused by the visibility of the online network and separate its effect from variation caused by hidden product complementarity. We also link this diffusion to different network structure properties.

■ TA69

H - Salon F, 6th Floor

Joint Session-RAS/ TSL: Recent Advances in Transportation Planning Systems

Sponsor: Railway Applications/ Transportation Science and Logistics Society

Sponsored Session

Chair: Ravindra Ahuja, University of Florida, Industrial & Systems Engineering, Gainesville, FL, 32611, United States of America, ahuja@ufl.edu

1 - A New Solution for Rail Service Network Design Problem

Endong Zhu, CIRRELT, Université de Montréal, Montréal, Canada, endong@crt.umontreal.ca, Teodor Gabriel Crainic, Michel Gendreau

We propose a new heuristic solution for the scheduled service network design problem in rail freight transportation. The model consider the two major decision makings in tactical level, scheduled service selection, blocking policy at the same time, and it is extremely complicated and very large-scaled when applied in rails. A new heuristic method is developed to solve large-scale problems. Numerical results show that the proposed heuristic produces good solutions for real-life size instances.

2 - An Algorithmic Approach to Design an Optimal Truckload Plan for Less-Than-Truckload (LTL) Carriers

Artyom Nahapetyan, Innovative Scheduling Incorporated, Gainesville FL, United States of America, Artyom@InnovativeScheduling.com

A Less-Than-Truckload (LTL) carrier receives multiple shipments and consolidates them into full truckloads. The decision problem faced by LTL carriers is to determine what truckloads to make, how to schedule them, and how to route shipments on them to meet shipment committed service times and minimize the total trucking cost. This presentation describes an algorithmic approach to solve this problem and computational results obtained by applying it to the data provided by several LTL carriers.

3 - Computational Results of Solving Large-Scale Network Design and Routing Problems

Ravindra Ahuja, University of Florida, Industrial & Systems Engineering, Gainesville, FL, 32611, United States of America, ahuja@ufl.edu

Network design and routing problems are very prevalent in the field of logistics and transportation. We have developed MIP and network optimization algorithms for several real-world network design and routing problems arising in railroad and truckline applications. In this talk, we describe the computational results of these algorithms. We will share the lessons learnt, what works and what does not work in practice.

■ TA70

H - Salon G, 6th Floor

Queuing Theory Applications in Aviation

Sponsor: Aviation Applications
Sponsored Session

Chair: David Lovell, Associate Professor, University of Maryland, 1173 Glenn Martin Hall, College Park, United States of America, lovell@umd.edu

1 - Queueing Models with Scheduled Arrivals for Aircraft Operations

Tasos Nikoleris, University of California, Berkeley, 107 McLaughlin Hall, Berkeley, CA, United States of America, nikoleris@gmail.com, Mark Hansen

Queueing models for trajectory-based aircraft operations, are presented. Aircraft are assigned scheduled times of arrival at a server, which they meet with some normally distributed stochastic error. The model is extended to account for aircraft's runway occupancy time, and to track any aircraft's delay through a network of servers.

2 - Queuing Models of the National Airspace System at Multiple Spatio-Temporal Resolutions

P.K. Menon, President and Chief Scientist, Optimal Synthesis, Inc., 95 First Street, Suite 250, Los Altos, CA, 94022-2777, United States of America, menon.optisyn@gmail.com, Monish Tandale, Prasenjit Sengupta

An automatic method for deriving queuing models of the National Airspace System at a desired spatio-temporal resolution is presented. A software package and the associated graphical user interface implementing this methodology is described. Analysis of a few Next-Generation air traffic management concepts using these queuing models is given. Potential role of these models in deriving traffic flow management strategies is discussed.

3 - Departure Queue Management and Reduction

Steven Stroiney, Sensis, 85 Collamer Crossings, East Syracuse, NY, 13057, United States of America, steve.stroiney@sensis.com, C.J. Knickerbocker, Benjamin Levy

Under today's airport operations, departing aircraft often encounter a long queue while waiting to take off. Departure management aims to reduce these queues along with the associated delays, congestion, fuel burn, and emissions. A departure management tool in development at Sensis Corporation achieves these benefits by (1) maintaining a virtual departure queue, rather than a physical departure queue at the runway end, and (2) adjusting the departure sequence to improve runway throughput.

■ TA71

H - Salon H, 6th Floor

DEA Models

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Finn Førsund, University of Oslo, finn.forsund@econ.uio.no

1 - Extensions of Data Envelopment Analysis Through Composite Data Symmetry

David Lengacher, Concurrent Technologies Corp, 100 CTC Drive, johnstown, pa, 15904, United States of America, lengachd@ctc.com

This paper discusses an innovative way to overcome the most often encountered obstacles when attempting to apply data envelopment analysis (DEA) as an integral part of performance management. It then reviews key approaches to handling multiple composite peer-groups within DEA and considers their suitability for modeling various applications.

2 - Some Ulterior Effects in the DEA Models

Vladimir Krivonozhko, Institute for Systems Analysis, KrivonozhkoVE@mail.ru, Finn Førsund, Andrey Lychev

Applications of the DEA models show that inadequate results may arise in some cases: a) too many efficient units may appear in some DEA models; b) a DEA model may show an inefficient unit from the point of view of experts as an efficient one. The purpose of this paper is to reveal the causes of such results. Next, we suggest methods for improving DEA models adequacy.

3 - Categorical and Continuous Non-discretionary Variables in Data Envelopment Analysis: A Comparison of Two Single-stage Models

Julie Harrison, Lecturer, University of Auckland, Department of Accounting & Finance, Private Bag 92019, Auckland, 1142, New Zealand, j.harrison@auckland.ac.nz, Paul Rouse, Jamie Armstrong

Non-discretionary or environmental variables are regarded as important in many production processes, but there is no consensus on the right approach to incorporate these variables into the analysis of efficiency in Data Envelopment Analysis (DEA). This paper compares the performance of two single-stage models: the Banker and Morey (1986a) model, which incorporates continuous environmental variables and the Banker and Morey (1986b) model, which incorporates categorical environmental variables. Simulation analyses are conducted using a shifted Cobb-Douglas function with one non-discretionary input, two discretionary inputs and one output. Tests are performed to evaluate the accuracy of each model in its assessment of efficiency, where the categorical non-discretionary inputs are calculated from the continuous non-discretionary inputs. The distribution of the inputs, the sample size, the production function, and the number of categories for the categorical inputs are varied. Overall, we find the results of the Banker and Morey (1986b) model are systematically positively-biased, while the results of the Banker and Morey (1986a) model are systematically negatively-biased. We find that the performance of both models improves as the importance of the non-discretionary variable in the production function declines. The Banker and Morey (1986a) model is the dominant single-stage DEA model used in the literature, but we find in some instances its performance is inferior to the Banker and Morey (1986b) model, which is rarely used. In particular, we find the Banker and Morey (1986a) model's performance declines relative to the Banker and Morey (1986b) model as sample size increases. This finding is of particular note as in many real-world applications business units fall into distinct rather than continuous performance environments.

■ TA72

H - Salon J, 6th Floor

Facility Logistics I

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin, 1513 University Ave, Madison, United States of America, ananth@engr.wisc.edu

1 - Analyzing Flexible Design Configurations in Autonomous Vehicles-based Warehouses

Debjit Roy, Department of Industrial and Systems Engineering, University of Wisconsin-Madison, Madison, WI, 53705, United States of America, droy@wisc.edu

Autonomous Vehicle-based Storage and Retrieval System (AVS/RS) uses vehicles and lifts to transfer unit loads in warehouses. In this research, we evaluate various design configurations that offer different degrees of flexibility and autonomy in horizontal and vertical movement. Specialized queuing network algorithms are developed to analyze the system performance.

2 - Approach to Optimizing Costs and Service Level by Repositioning the Customer Order Decoupling Point

Detlef Spee, Fraunhofer IML, Germany, Detlef.Spee@iml.fraunhofer.de, Michael Schmidt, Michael ten Hompel

The customer order decoupling point (CODP) is the link in the supply chain between processes based on uncertain information. This paper focuses on developing an approach for identifying a CODP that provides the highest potential for achieving business objectives. Goal of the paper is to present an effective and chronological sequence of tasks, analyses and methods, criteria, and indicators that can help a production planner determine the CODP.

3 - Modeling and Analysis of a Bottle Line

Remco Bierbooms, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, R.Bierbooms@tue.nl, Ivo Adan

We study a bottle line for beer consisting of several machines, the bottle-neck being the filler. The bottles are transported by an automatic conveyor system which also has a buffer function. Hence, an important design issue is the length of the conveyor. We model the bottle line as a stochastic fluid flow model and demonstrate the use of this model to analyze the line performance.

4 - Analysis of Picker Blocking in a Bucket Brigade Order Picking System

Soondo Hong, PhD Candidate, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, hongs@tamu.edu, Brett Peters, Andrew Johnson

This study examines the significance of picker blocking and hand-off delay in bucket brigade order picking system. The issues of blocking and hand-off delay are quantified through simulation studies and the relevant analytical models are identified. Our analytical results identify several conditions for high order picking throughput, such as batch picking, uniform picking performance, and immediate hand-off (at a pick face, an upstream worker yields remaining picks to a downstream worker).

■ TA73

H - Salon K, 6th Floor

Supply Chain Design and Logistics Models

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Debra J. O'Connor, Assistant Professor, College of the Holy Cross, One College St., Worcester, MA, 001610, United States of America, doconnor@holycross.edu

1 - Improving Computational Tractability of Logistics Models using Cost-structure Trade-offs

Agha Ali, Chairman, University of Massachusetts- Amherst, FINOPMGT, Isenberg School, Amherst, MA, 01003, United States of America, aiali@som.umass.edu, Debra J. O'Connor

Inherent in logistics scenarios are cost trade-offs among alternative solutions that when formally incorporated can strengthen model representation by contracting the solution space. Whereas valid inequalities seek to better represent the convex hull, cost-structure trade-offs seek to eliminate feasible solutions that are dominated with respect to cost. We apply the incorporation of cost-structure trade-offs for the solution of multi-modal and multi-period logistics scenarios. Computational results reveal that solutions for logistics scenarios with up to 1600 demand points, 32 distribution centers can be obtained in a few seconds.

2 - Scheduled Penalty Variable Neighborhood Search with Application to Time-Constrained Tours

Barrett Thomas, University of Iowa, S210 John Pappajohn Business Building, Iowa City, IA, 52242, United States of America, barrett-thomas@uiowa.edu, Emanuele Manni, Jeffrey Ohlmann

We discuss a variant of variable neighborhood search for constrained constrained combinatorial optimization problems. The method operates on relaxed versions of the problems by penalizing constraints in the objective. Solution feasibility is achieved by increasing the penalty term throughout the search. In this case, the penalty is increased in a scheduled fashion in the manner of simulated annealing. We demonstrate the performance of the algorithm on the orienteering problem with time windows and on the traveling salesman problem with time windows.

3 - Robust Strategic Supply Chain Design

Edward Huang, Research Assistant, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, edwardhuan@gmail.com, Marc Goetschalckx

A model for the robust strategic supply chain design is presented. Its objective function trades off the central tendency of the supply chain profit with the dispersion of the profit as measured by the standard deviation for any value of the assigned weights. We derive a cut to eliminate the infeasible region efficiently and present a branch-and-interval algorithm applying the proposed cut to find all the Pareto-optimal supply chain configurations within a prescribed optimality tolerance.

4 - Inventory Control with Supply Chain Yield Information

Tae Su Cheong, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, taesu.qlink@gmail.com, Chelsea White III, Alan Erera

An infinite horizon MDP is used to model an inventory control problem where freight, subject to random shrinkage in transit, is transported from an origin to a destination through intermediate locations. We show for a related deterministic model that the effective pipeline inventory position is a sufficient statistic for determining the optimal order quantity. We present and evaluate several related heuristics and heuristics based on ADP.

■ TA74

H - Room 602, 6th Floor

Signalized Intersection Performance Measurement Using Mobile Sensors

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Xuegang Ban, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St, JEC 4034, RPI, CEE, Troy, NY, 12180, United States of America, banx@rpi.edu

1 - Delay Pattern Estimation for Signalized Intersections using Sample Travel Times

Xuegang Ban, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St, JEC 4034, RPI, CEE, Troy, NY, 12180, United States of America, banx@rpi.edu, Hao Peng, Ryan Herring, Alexandre Bayen

Intersection delay pattern describes the delay an imaginary vehicle may experience when passing the intersection at certain time. We show in this presentation that sample intersection travel times, e.g. those obtained from mobile traffic sensors (such as GPS cell phones) or wireless sensors, can be used to estimate such pattern. The proposed method is a combination of basic kinematic wave theory which defines the functional form of the delay pattern and an optimization method to estimate the parameters of the pattern using sample travel times. The method is tested using microscopic traffic simulation and field data.

2 - Real Time Queue Length Estimation for Signalized Intersections using Travel Times From Mobile Sensors

Hao Peng, Rensselaer Polytechnic Institute, JEC 5107, CEE, RPI, 110 8th St, Troy, NY, 12180, United States of America, haop@rpi.edu, Zhanbo Sun, Xuegang Ban

We study how to estimate real time queue lengths at signalized intersections using intersection travel times collected from mobile traffic sensors. By detecting these critical points in intersection travel times or delays, the real time queue length can be re-constructed. The proposed model is based on kinematic wave theory and an optimization method, which is a "reverse" process of traditional queue length estimation methods. The model is tested using simulation, field tests, and NGSIM data.

3 - Real-time Intersection Queue Length Estimation using Vehicle Trajectories

Yang Cheng, TOPS Lab. UW-Madison. 2205 Engineering Hall. 1415 Engineering Drive. Madison, WI 537,cheng8@wisc.edu, Xiao Qing, Jing Jin, Bin Ran

Arterial street traffic performance measurements are essential for advanced traffic management systems (ATMS) and advanced traveler information systems (ATIS). Although nearly forty percent of the nation's vehicle miles traveled (VMT) occur on arterials, the development of real-time arterial traffic performance measurement systems is not as mature as their freeway counterpart because of the two major challenges: 1) arterial traffic conditions are more complicated than the ones on freeways because of the periodic interruptions from traffic signals, random frictions from crossing traffic on minor streets and driveway related activities, etc; 2) the current traffic collection technologies deployed on arterials are not sufficient for measuring real-time operational performances in a high resolution manner. Provided with GPS instrumented vehicles, an innovative approach for assessing arterial intersection performances using vehicle trajectory data is presented. A simple critical points extraction algorithm is introduced where critical points of the vehicle trajectories are defined as the points representing the changing vehicle dynamics. The critical points extraction technology can also be used as a data reduction method in any on-board device to reduce the communication cost. Utilizing the critical points, a shockwave based method can be applied to detect the signal timing on a high resolution basis, i.e. cycle-by-cycle. In the case study, the intersection queue length will be estimated for both isolated and coordinated intersections under various prevailing traffic conditions. The performance of this methodology is further verified by simulation and NGSIM trajectory data and the results are promising.

4 - The Traffic Flow Impact of the use of Dynamic Message Signs

Zichuan Li, lizichuan@gmail.com

This study analyzes the traffic flow impact of the use of Dynamic Message Signs (DMS). DMS is a popular freeway control strategy to communicate with drivers on the road. However, how those messages impact the traffic still remains unknown to transportation researchers and practitioners. This study exams the impact of different type of DMS message to freeway traffic with archive detector data from CHART of Maryland. The model is estimated by WinBUGs, a Markov Chain Monte Carlo simulation package.

Tuesday, 11:00am - 12:30pm

■ TB01

C - Ballroom D1, Level 4

Wind Power Modeling

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Jorge Valenzuela, Associate Professor, Auburn University, 3304 Shelby Center, Auburn, AL, 36849, United States of America, valenjo@auburn.edu

1 - Wind Power Forecasting Uncertainty Modeling in Unit Commitment
Jianhui Wang, Assistant computational engineer, Argonne National Laboratory, 9700 S. Cass Ave., Bldg 221, Argonne, IL, 60439, United States of America, jianhui.wang@anl.gov, Audun Botterud, Jean Akilimali, Vladimiro Miranda

We investigate the modeling of wind power forecasting uncertainty in the unit commitment (UC) problem. We use two formulations: stochastic vs. deterministic. In the stochastic approach, the uncertainty in wind power forecasting is captured by a number of scenarios while a point forecast of wind power output is used in a deterministic alternative.

2 - Pumped Storage in Systems with Very High Wind Penetration
Aidan Tuohy, Electricity Research Centre, University College Dublin, Dublin, Ireland, aidan.tuohy@ucd.ie, Mark O'Malley

This paper models the operation of a power system with high levels of wind energy, with and without a pumped storage unit. A unit commitment model which accounts for the uncertainty inherent in wind is used; this makes the option of storage more attractive. The main benefit from storage is shown to be a decrease in wind curtailment. At high levels of wind, the usage of storage reduces curtailment sufficiently to justify the additional capital costs. Modeling sensitivities are also performed.

3 - Time Dependence of Correlations in Wind Output Between Wind Power Facilities and System Demand
William (Bill) Rosehart, rosehart@ucalgary.ca, John MacCormack, Hamid Zareipour

The output of individual Wind Power Facilities (WPF) is known to be variable. When several WPF are present the correlations in the outputs among facilities and the system demand must be considered to assess the expected variability in aggregate output and demand. However, the correlations between different WPF outputs and aggregate system demand may not be fixed. This paper uses Alberta system data to create a time dependent model of the correlations between WPF and aggregate demand.

4 - A Probabilistic Model for Estimating Wind Farm Revenues
Jorge Valenzuela, Associate Professor, Auburn University, 3304 Shelby Center, Auburn, AL, 36849, United States of America, valenjo@auburn.edu

In this presentation, we evaluate the economics of wind energy by developing a probabilistic model to compute the probability distribution of wind farm revenues. The power system is assumed to consist of conventional generating units and one aggregated wind farm (AWF). Load uncertainty, availabilities of generating units, and the uncertainty in wind power output are implicitly accounted for. The model is illustrated with a power system consisting of 32-unit and one AWF.

■ TB02

C - Ballroom D2, Level 4

Stochastic Programming in Energy

Cluster: Energy: Modeling the Interface Between Markets and Operations
Invited Session

Chair: Asgeir Tomasgard, Professor, NTNU, Alfred Getz vei 3, 7491, Norway, asgeir.tomasgard@iot.ntnu.no

1 - Performance Measures of Stochastic Models for Daily Schedule of Hydro-wind Power Production Systems
Maria Teresa Vespucci, University of Bergamo, via Marconi 5, Dalmine, BG, 24044, Italy, maria-teresa.vespucci@unibg.it, Marida Bertocchi, Asgeir Tomasgard, Mario Innorta

A stochastic programming model for the daily coordination of hydro power plants and wind power plants with pumped storage is introduced, with scenarios of hourly wind power production obtained by combining wind power production forecast error scenarios with information from the weather forecast. The value of the stochastic model is assessed by means of ex-ante measures, based on the Modified Value of Stochastic Solution, and ex-post measures, based on the Value of Stochastic Planning.

2 - Benders Decomposition for Solving a Large-Scale Stochastic Multi-Period Natural Gas Market Model
Ruud Egging, Civil and Environmental Engineering, College Park, MD, United States,, University of Maryland, regging@umd.edu

The World Gas Model is a Mixed Complementarity Problem for the global natural gas market. To address the consequences of future uncertainties in the gas market we have extended the model to an extensive-form stochastic model. The inclusion of multiple stochastic scenarios enlarges the model size drastically with a severe impact on computer memory and calculations time needed to solve the model. We present a Benders Decomposition approach to address the calculation time and memory issues.

3 - Multistage Stochastic Programming for NG Infrastructure Design with a Production Perspective
Adrian Werner, Research Scientist, SINTEF Technology and Society, Postboks 4760 Sluppen, Trondheim, 7465, Norway, adrian.tobias.werner@sintef.no, Marte Fodstad, Lars Hellemo, Kjetil Midthun, Adela Pages, Asgeir Tomasgard

Investments into natural gas infrastructure should be evaluated in the light of existing and planned system design. Also operational aspects (e.g., production assurance) are key factors in this phase. We describe an integrated model for decision support combining strategic and operational aspects. Based on a scenario tree approach, it accommodates long- and short-term uncertainty and extreme events. We also discuss a solution approach for such large scale stochastic integer programming problems.

■ TB03

C - Ballroom D3, Level 4

Bioenergy and Forest Products: Strategic Planning, Logistics and Supply Chain

Sponsor: Energy, Natural Resources and the Environment//Forestry
Sponsored Session

Chair: Hayri Onal, University of Illinois at Urbana-Champaign, Dept. Agricultural and Consumer Economics, Urbana, IL, 61801, United States of America, h-onal@illinois.edu

1 - FuelOpt - A Decision Support System for Forest Fuel Logistics
Patrik Flisberg, Forestry Research Institute of Sweden, Dag Hammarskjölds Väg 36A, Uppsala, Sweden, pafli@mweb.co.za, Mikael Frisk, Mikael Rönnqvist

The Forestry Research Institute of Sweden and major Swedish forest companies have developed a planning system for forest fuel logistics with the objective of optimizing procurement of forest fuels. The optimization model provides decision support for questions about chipping technology, location of chipping operations, and the allocation of chip assortments to heating plants. Results from two large case studies are reported.

2 - Development of Biofuel Supply Curves using a Spatially-explicit Supply Chain Optimization Model
Nathan Parker, Institute of Transportation Studies, University of California, Davis, CA, United States of America, ncparker@ucdavis.edu, Quinn Hart, Bryan Jenkins

The cost and quantity of cellulosic biofuels will depend on the spatial layout of the supply chain due to the expense of moving cellulosic materials. We have developed a spatially explicit supply chain optimization model that evaluates the optimal configuration of biorefineries under various supply, technology, demand and competition scenarios. Results will be presented from a study of U.S. biofuel supply for the year 2017 using forest, agricultural and municipal waste resource bases.

3 - Strategic Planning for an Integrated and Sustainable Bio-energy and Forest Products Supply Chain
Yan Feng, University Laval, Pavillon Adrien-Pouliot, Quebec, QC, G1K 7P4, Canada, Yan.Feng@cirrelt.ca, Sophie D'Amours, Luc Lebel, Mustapha Nour El Fath

With the rapid development of bio-energy and bio-technology, opportunities arise to convert biomass into value-added products such as energy, bio-fuels, and chemicals, to reduce dependences on insecure petroleum-based energy. In this research, we present a strategic planning model for an integrated and sustainable bio-energy and forest product industry supply chain to determine the best investment decisions that maximize the values of the supply chain while minimizing its carbon footprint.

4 - Estimating the Supply of Woody Biomass for Energy use in Pennsylvania

Marc McDill, Penn State School of Forest Resources, University Park, PA, United States of America, mmcdill@psu.edu

While interest in woody biomass for energy production is growing, the physical supply of wood overestimates the amount available because costs of harvesting, collecting and transporting wood make much of it economically unusable. This paper discusses a methodology for providing spatially-explicit estimates of the amount of wood available for use as an energy feedstock as a function of the price that a user is willing to pay. A preliminary application is presented for Pennsylvania.

■ TB04

C - Ballroom D4, Level 4

Understanding Competitive Behaviour in Electricity Markets

Cluster: Electrical Energy Systems
Invited Session

Chair: Eddie Anderson, Professor, University of Sydney, Faculty of Economics and Business, Sydney, Australia, edward.anderson@sydney.edu.au

1 - Strategic Consumption of Electricity

Golbon Zakeri, University of Auckland, 70 Symonds St., Auckland, New Zealand, g.zakeri@auckland.ac.nz

We will present a model for a major consumer of electricity who sees and responds to spot prices. We will discuss the attributes of this model and time permitting discuss how it may be utilized in optimal tariff setting for lines companies.

2 - Supply Function Equilibria: Step Functions and Continuous Representations

Par Holmberg, Research fellow, Research Institute of Industrial Economics (IFN), Grevgatan 34, Stockholm, Sweden, Par.Holmberg@ifn.se, David Newbery, Daniel Ralph

In electricity markets generators must submit step-function offers to a uniform price auction, but they are most simply modelled as pure-strategy Nash equilibria of continuous supply functions (SFs). Critics argue that the discreteness and discontinuity of the required steps can rule out pure-strategy equilibria, resulting in price instability. We prove that if prices must be selected from a finite set the resulting step function converges to the continuous SF as the number of steps increases.

3 - Firm-based Measurements of Market Power in Transmission-constrained Electricity Markets

Yen-Yu Lee, PhD Student, University of Texas at Austin, Austin, TX, United States of America, yenyu@mail.utexas.edu, Ross Baldick, Jin Hur

Two different approaches to analyzing firm-based market power considering transmission constraints are proposed. One is an application of the transmission constrained residual demand Jacobian, while the other is a generalization of the "residual supply index" to the case of transmission constraints. These two approaches provide complementary evaluations of market power and could be applied to real-world electricity markets.

4 - Existence of a Supply Function Equilibrium for Electricity Markets

Eddie Anderson, Professor, University of Sydney, Faculty of Economics and Business, Sydney, Australia, edward.anderson@sydney.edu.au

Electricity markets can be modelled using supply function equilibrium (SFE). We consider an asymmetric duopoly with fixed marginal costs and capacity constraints. When at low demand scenarios only the cheaper firm is used, and at high demand scenarios the more expensive firm is at its capacity, then it may be impossible to find an SFE that is independent of demand distribution. But we show a unique SFE, involving a vertical segment, which depends on the demand distribution.

■ TB05

C - Ballroom D5, Level 4

Game Theory II

Contributed Session

Chair: Nelson Uhan, Assistant Professor, Purdue University, School of Industrial Engineering, Purdue University, West Lafayette, IN, 47907, United States of America, nuhan@purdue.edu

1 - Newsvendor Problem with Dependent Demand Sources

Kemal Guler, Principal Scientist, Hewlett-Packard Labs, 1501 Page Mill Rd, Ms 1140, Palo Alto, CA, 94304, United States of America, kemal.guler@hp.com, Burcu Aydin, Mehmet Sayal, Enis Kayis

Faced with multiple demand streams, a newsvendor has to decide the right level of capacity to satisfy total demand. The case with independent demand streams is well documented in the literature. In this work, we investigate how the structure of dependence in the demand sources affect newsvendor's decisions.

2 - An Analytical Study of Supplier's Behavior and Buyer's Subsidy Strategy

Mike Mingcheng Wei, Washington University, One Brookings Dr., Campus Box 1133, St. Louis, MO, 63130, United States of America, weim@wustl.edu, Tao Yao, Bing Jiang

Supplier default is common in emerging markets. Suppliers under the threat of default have different objectives from profit-seeking companies. This paper analytically tests how profit-seeking or survival-seeking behavior, single-period or two-period consideration, and buyer's subsidy influence the supplier's and buyer's final utilities.

3 - Interchange Fee Rate, Merchant Discount Rate and Retail Pricing Decisions for a Credit Card Network: A Game-theoretic Approach

Hangfei Guo, Lingnan University, 8 Castle Peak Road, Tuen Mun, HK, Hong Kong, Hong Kong - PRC, hangfeiguo@ln.edu.hk, Mingming Leng, Yulan Wang

We consider a credit card network involving an issuer, an acquirer, and a merchant selling multiple products to consumers who buy with credit cards issued by the issuer. The interchange fee is paid by the acquirer to the issuer while the merchant discount fee is paid by the merchant to the acquirer. We consider two game-theoretic settings to determine the interchange fee rate, the merchant discount rate, and the retail price for each product sold by the merchant. First we construct a two-stage sequential game and compute the Stackelberg solution. Next, we develop a three-person cooperative game and derive necessary conditions for the supermodularity of our game. We then use Shapley value and nucleolus to determine the interchange fee and merchant discount rate. A sensitivity analysis is also provided to examine the impacts of the issuer's and the acquirer's operation costs on the two-stage game solution and the nucleolus-based rates.

4 - Game Theory Application to Strategic Bidding Behaviours of Gencos in Electricity Market

Dong Joo Kang, Senior Researcher, Korea Electro-technology Research Institute, 665-4, Naeson2-dong, Uiwang, 437-808, Korea, Republic of, unlimit0909@hotmail.com, Sunju Park

Most of electricity markets in the world are operating power pools based on the competitive bidding mechanism. The electricity market has its unique characteristic different from other commodity markets. It is very important to consider the supply-demand balance on real-time basis because it is almost impossible to store the electric energy with economic feasibility. This study proposes a game theoretic approach to the strategic bidding behaviour analysis in electricity markets.

5 - Cost Sharing Mechanisms for Scheduling Problems Under General Demand Settings

Nelson Uhan, Assistant Professor, Purdue University, School of Industrial Engineering, Purdue University, West Lafayette, IN, 47907, United States of America, nuhan@purdue.edu, Sindhura Balireddi

We investigate cost sharing mechanisms for scheduling problems under a setting in which each bidder can be allocated one of several levels of service. In particular, we study how to design acyclic mechanisms under general demand settings that are weakly group-strategyproof, approximately budget-balanced, and approximately efficient, using approximation algorithms for the underlying scheduling problems. This work is an extension of results due to Brenner and Schaefer (2008).

■ TB06

C - Ballroom E, Level 4

Tutorial: Decentralized Supply Risk Management

Cluster: Tutorials
Invited Session

Chair: Volodymyr Babich, Georgetown University, McDonough School of Business, Washington, DC, United States of America, vob2@georgetown.edu

1 - Decentralized Supply Risk Management
Volodymyr Babich, Georgetown University, McDonough School of Business, Washington, DC, United States of America, vob2@georgetown.edu, Goker Aydin, Damian Beil, Zhibin Yang

In a 2008 survey of 138 companies, 58% reported that they suffered financial losses within the last year due to a supply disruption. The tutorial will emphasize the challenges and opportunities in supply risk management arising from the decentralized nature of supply chains and highlight how supply risks influence the interactions among firms in supply networks, review insights into decentralized supply risk management from the extant academic research and point out important future research directions.

■ TB07

C - Ballroom F & G, Level 4

Daniel H. Wagner Prize for Excellence in Operations Research

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research
Invited Session

Chair: Allen Butler, President, Daniel H. Wagner Associates, Inc., 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, Allen.Butler@va.wagner.com

1 - Universal Tool for Vaccine Scheduling - Applications for Children and Adults
Hannah Smalley, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, hkolberg3@gatech.edu, Pinar Keskinocak, Faramroze G. Engineer, Larry K. Pickering

Georgia Institute of Technology, in collaboration with the CDC, developed decision support tools for creating optimized catch-up immunization schedules for four target groups: children through age 6, adolescents ages 7 through 18, and adults ages 19+ in the U.S., and children and adolescents through age 19 in Canada. Each decision support tool constructs the recommended immunization schedule for the user by means of a dynamic programming (DP) algorithm. The tools simplify and expedite the tedious process of manually constructing immunization schedules, and eliminate errors.

2 - Kimberly-Clark Latin America Builds an Optimal Scheduling System
Germán Riaño, LAO OR Manager, Kimberly Clark Latin American Operations, Carrera 11 A No. 94-45 Piso 5, Bogota, Colombia, German.Riano@kcc.com, Vittal Prabhu, Nazrul Shaikh, David Sànchez, Jorge Arias, Danilo Abril, Esteban Rodrìguez

We present an optimization-based solution for lot-sizing and scheduling with sequence-dependent setups at Kimberly-Clark Latin America. The formulation weighs inventory, set-up and backorder costs leading to a large MIP. We developed heuristics to reduce its size, obtaining schedules in minutes for industrial scale problems. This solution has replaced manual plans in five countries, reducing finished product inventories up to 45%, increasing yield and uptime by 2% and service levels by 2.4%.

■ TB08

C - Room 11A, Level 4

Retail and Competitive Location Models

Sponsor: Location Analysis
Sponsored Session

Chair: Ho-Yin Mak, The Hong Kong University of Science and Technology, China, hymak@ust.hk

Co-Chair: Michael Lim, Asst Professor, University of Illinois, 350 Wohlers Hall, 1206 S. 6th Street, Champaign, 61820, United States of America, mlim@illinois.edu

1 - Why are the Banks Still Opening Branches? The Impact of Virtual Channel on Physical Channel Capacity
Mei Xue, Boston College, 350 Fulton Hall, 140 Commonwealth Ave, Chestnut Hill, MA, 02467, United States of America, xueme@bc.edu, Jun Hang, Lorin Hitt

Multi-channel service systems that combine both physical and virtual (e.g., online or phone) service locations as well as employee-based full service and customer self-service have evolved in most service industries. In this paper we present a spatial competition model that relates customer use of virtual channels to the optimal capacity of physical channels. The predictions of our model are then tested using data on retail bank locations and found to hold in the US market.

2 - Modeling Competitive Facility Location Problems: New Approaches and Results
Zvi Drezner, Professor, California State University - Fullerton, 800 N. State College Blvd., Fullerton, CA, 92834, United States of America, zdrezner@fullerton.edu, Tammy Drezner, Oded Berman, Dmitry Krass

The gravity model as applied to competitive facility location is described. The gravity model is used mainly by marketers to estimate the market share attracted by competing retail facilities. Extensions to this basic model include: modeling uncertainty, minimizing the probability that the attracted market share falls short of a certain target, demand generated by intercepting a flow of customers, market expansion and lost demand.

3 - Dynamic Equilibrium Facility Location on Networks
Terry Friesz, Marcus Chaired Professor, Penn State University, 305 Leonhard Building, University Park, PA, 16802, United States of America, tfriesz@psu.edu, Tao Yao, Bo Zhang

We formulate a dynamic Stackelberg leader-follower game wherein a firm with pricing power enters a network market already occupied by oligopolistic firms described by a differential Nash equilibrium. Qualitative properties of the game are studied; an algorithm is proposed and tested.

4 - A Decomposition Method for Solving Location-allocation Problems
Alper Murat, Assistant Professor, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, amurat@wayne.edu

We develop a novel decomposition method for solving n-facility location-allocation problems (LAP) as a series of two facility LAPs. Two facility LAPs are polynomially solvable. The decomposition method therefore reduces the complexity of LAPs with large number of facilities. This approach also allows tackling LAPs with nonlinear cost functions more easily. Extensive experimental results demonstrate the effectiveness of the proposed method.

■ TB09

C - Room 11B, Level 4

Retail Operations Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Adam Mersereau, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, ajm@unc.edu

1 - Vertical Integration Strategies in Fast Fashion Industry
Yen-Ting Lin, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, Yen-Ting_Lin@unc.edu, Ali Parlakturk, Jayashankar Swaminathan

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.

2 - The Manufacturer-Retailer Interactions Under Different Procurement Sourcing Modes

Hao-Wei Chen, University of Minnesota, 111 Church ST. SE, Minneapolis, MN, 55455, United States of America, hwchen@ie.umn.edu, Diwakar Gupta, Haresh Gurnani

Many retailers offer to fast-ship out-of-stock items at no additional cost to their customers. Fast-shipped items can be procured from either the manufacturer who supplied the original order, or a distributor, or through an alliance of retailers. We analyze how different sourcing options affect the manufacturer's and the retailer's decisions and the supply chain performance.

3 - An Empirical Investigation of Store Performance Under a Retail Chain's Sales Incentive Plan

Saravanan Kesavan, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, skesavan@unc.edu, Nicole DeHoratius, Adam Mersereau

We evaluate a large retailer's pilot program that studied the impact of changing sales incentives for its store associates. We report the differential impact of this new incentive design on different departments within the store and the underlying cause for some of the unexpected changes.

4 - Initial Shipments of New Products at Zara

Adam Mersereau, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, ajm@unc.edu, Andres Garro, Jérémie Gallien

Given uncertain popularity of new products by location, fast-fashion retailer Zara faces a tradeoff. Large initial shipments to stores reduce lost sales in the critical first few days of the product life-cycle, but maintaining stock at the warehouse allows restocking flexibility once initial sales are observed. In collaboration with Zara, we develop and test a solution involving a data-driven model of forecast updating and a dynamic program allocating limited stock by location over time.

■ TB10

C - Room 12A, Level 4

Emerging Issues in Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Tong Wang, Assistant Professor, National University of Singapore, Singapore, 119245, Singapore, tong.wang@nus.edu.sg

1 - Sale and Trade-In of a Durable Product with Technology Innovations

Kate Jiayi Li, Assistant Professor, Suffolk University, 73 Tremont Street, Boston, MA, United States of America, jzl120@psu.edu, Susan Xu

Trade-ins can be used to incentivize consumers to upgrade to products featuring newly-introduced technology and to help companies gain better control over secondary markets. In this paper, we consider a monopolistic manufacturer who offers a technology product developed under a stochastic innovation process to a market consisting of heterogeneous consumers. We derive optimal selling and trade-in prices and examine the impact of consumer valuation, costs, and innovation frequency.

2 - Can Manufacturer Order Information and Increased Retailer Order Volatility Reduce Supply Chain Cost?

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

In this paper, we consider a supply chain with one manufacturer and two retailers to answer the following question: How backward information sharing from the manufacturer to the retailers on the queue size at the manufacturer can be coupled with order management of the retailers to provide Pareto improvement to the supply chain performance?

3 - Externalities in Supply Chain Competition

Wenjie Tang, INSEAD, Boulevard de Constance, Fontainebleau, France, wenjie.tang@insead.edu, Tong Wang

We consider a situation where two down-stream agents in a supply chain first cooperate in investment and then compete to split the total expected profits. We focus on agents' decision of cooperative investment and timing to enter the market. In equilibrium, we find that agents prefer simultaneous entry when the competition is mild, and sequential entry when that is intense. We further study the principal's decision of contract that coordinates both the investment and the entry timing.

4 - Innovation Pricing in Digital Supply Chains

Ayhan Aydin, PhD Candidate, University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, aaydin@chicagobooth.edu, Dan Adelman, Rodney Parker

We investigate the upstream pricing strategies in supply chains with substantial investment requirements in capital and technology, motivated by digital supply chains and an industry partner. We ask: Under competition for upstream resources and in the downstream market, is it possible for a firm to encourage its customers to invest in their resources while still being able to recoup the benefits of doing so? We find an optimal pricing strategy for "drive and exploit".

■ TB11

C - Room 12B, Level 4

Carbon Emissions and Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Saif Benjaafar, Professor, University of Minnesota, 111 Church Street SE, Minneapolis, United States of America, saif@umn.edu

1 - Joint Production and Investment Decisions Under Carbon Emission Regulations

Yan Jiang, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, YanJiang2008@u.northwestern.edu, Diego Klabjan

In emission intensive industries manufacturers can invest in new technologies to reduce carbon emissions. Under carbon regulations, their investment decisions will change the production cost structure. We study joint production and investment decisions under under command-and-control and market-based regulations(e.g. carbon tax and cap-and-trade) for a manufacturer.

2 - Waste-to-Energy: Operating Under Regulation

Baris Ata, Northwestern University, Evanston, IL, United States of America, b-ata@kellogg.northwestern.edu, Deishin Lee, Mustafa Tongarlak

Two compelling environmental challenges are pollution from landfilling and emissions from energy consumption. We consider a waste-to-energy firm and determine the optimal operating strategy: accept the entire, potentially volatile waste instead of contracting for a steady baseload fraction of it. From the regulator's perspective, distributing the subsidy as a lump sum rather than as a price premium per kwh of electricity induces the operating decisions that are better for the environment.

3 - Multi-Facility Location and Design Under Uncertain Transportation and Production (Energy) Costs

Ozge Islegen, PhD Candidate, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States of America, oislegen@stanford.edu, Erica Plambeck

Where and how much manufacturing capacity should a multi-national firm build? We investigate how the firm's optimal decisions and expected profit vary with the magnitude, variability and correlation in transportation and regional production costs. The results are relevant to design of climate/energy policy.

4 - Stochastic Inventory Systems with Carbon Constraints

Saif Benjaafar, Professor, University of Minnesota, 111 Church Street SE, Minneapolis, United States of America, saif@umn.edu, Rowan Wang, David Chen

We describe how various environmental policies, including strict caps, cap-and-offset, cap-and-trade, and carbon taxes, can be incorporated into models of stochastic inventory systems. For versions of these settings, we show how the optimal policy can be characterized. We also describe how the presence of limits (or costs) on carbon emission modifies the optimal policy.

■ TB12

C - Room 13A, Level 4

Supply Chain/Marketing Interface

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Rachel Chen, University of California at Davis, Graduate School of Management, Davis, CA, 95616, United States of America, rachen@ucdavis.edu

Co-Chair: Lucy Gongtao Chen, Assistant Professor, National University of Singapore, 15 Kent Ridge Drive, Singapore, Singapore, bizcg@nus.edu.sg

1 - The Profitability and the Pricing Power in Assemble-to-Order Supply Chains

Lucy Gongtao Chen, Assistant Professor, National University of Singapore, 15 Kent Ridge Drive, Singapore, Singapore, bizcg@nus.edu.sg, Jihong Ou, Ding Ding

We study whether a supply chain member always prefers having the pricing power in assemble-to-order systems. Three scenarios are studied by considering different power positions each party can take up. We find that the system-wide profit is the highest when the assembler is most powerful. However, it is not always optimal for the assembler or a supplier to demand the pricing power. Further, a supplier's benefit from assembling with an expensive component may not always be positive.

2 - Optimal Production Planning with Emissions Trading

Sean X. Zhou, Assistant Professor, Department of Systems Engineering and Engineering Management, The Chinese University of Hong Kong, Shatin, N. T., Hong Kong, Hong Kong - PRC, zhoux@se.cuhk.edu.hk

We develop a dynamic production system in which a manufacturer produces a single product to satisfy random customer demand. Each unit produced would generate emissions and so consume a certain number of emission allowances. The manufacturer can use a green or a regular technology or both to produce. We characterize the optimal emissions trading and production policies that minimize the manufacturer's expected total discounted cost.

3 - Customer Return Policies and Pricing for Competitive Firms

Wenjing Shen, Drexel University, 101 N. 33rd Street, Philadelphia, United States of America, ws84@drexel.edu, Gulay Samatli, Avijit Banerjee, Seung-Lae Kim

Customers may not know their valuation of a product at the time of purchase. To encourage purchasing retailers often allow return and refund. We consider two competing firms selling substitutable products to customers, and evaluate the equilibrium pricing decisions and refund policies. We find that a full refund policy does not necessarily increase profit, depending on a number of factors such as cost, salvage value, average valuation, and product differentiation, etc.

4 - A Data-driven Approach to Optimal Staffing in Call Centers

Vivek Ramamurthy, UC Berkeley, 450/42 Sutardja Dai Hall, Berkeley, CA, 94720, United States of America, vivek_ramamurthy@berkeley.edu, J. George Shanthikumar, Z. Max Shen

We consider the problem of determining the optimal staffing levels in a call center over time, while making minimal assumptions about the call arrival process. Toward this end, we propose a data-driven approach to derive a smoothed estimate of the total cost as a function of the call profile forecast and the staffing level, which may then be optimized with respect to staffing level. We illustrate the same with real data.

5 - Competition and Product Line Inefficiency: When and Why They Can Be Good News to Firms

Liwen Chen, Assistant Professor, City University of Hong Kong, Department of Marketing, Hong Kong, Hong Kong - PRC, Liwen.Chen@PhD.mccombs.utexas.edu, Yusen Xia, Steve Gilbert

We show that the presence of a rival producing a low-end substitute for the incumbent's product may benefit the incumbent. We also find that, if the incumbent can credibly commit to limiting the amount of capacity to produce the original version of her product, then interactions with a strategic supplier will tend to cause her to offer a broader product line. The final portion of our paper investigates how such an OEM can invest in capacity to balance this trade-off among strategic priorities.

■ TB13

C - Room 13B, Level 4

Service Management in Humanitarian Operations

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Alfonso Pedraza Martinez, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, Alfonso.PEDRAZAMARTINEZ@insead.edu

1 - Demonstrating the Impact of Fleet Management for Health Delivery: An Evaluation of Riders for Health

Jessica McCoy, Management Science & Engineering, Stanford University, Stanford, CA, 94305, United States of America,jhmccoy@stanford.edu, Hau Lee

The "last mile" of health care delivery is a very challenging operation in resource-limited economies. We develop analytical models to evaluate the logistics efficiencies, health worker productivity, and health intervention coverage of Riders for Health, an NGO that seeks to improve health care accessibility in Africa through transportation management systems.

2 - The Influence of Framing on Inventory Pre-positioning

Paulo Gonçalves, Associate Professor, University of Lugano, Switzerland, paulo.goncalves@usi.ch

Inventory pre-positioning is an important aspect of humanitarian relief operations. Using a newsvendor framework, this work investigates how framing affects humanitarians' decisions regarding the quantity of water jerry-cans and blankets that should be pre-positioned in a regional depot.

3 - Coordination of Incentives in Field Vehicle Fleet Management in Humanitarian Operations

Alfonso Pedraza Martinez, PhD Candidate, INSEAD, Boulevard de Constance, Fontainebleau, 77300, France, Alfonso.PEDRAZAMARTINEZ@insead.edu, Sameer Hasija, Luk Van Wassenhove

We study incentive alignment in international humanitarian organizations, focusing on field vehicle fleet management. Headquarters of these organizations recommend policies to national offices that carry out humanitarian programs. From field research we observe that often these policies are not followed by national offices. Using principal-agent models we show that aligning incentives between headquarters and national offices imposes challenges that are unique to humanitarian operations.

4 - Fleet Management for Humanitarian Logistics

Mahyar Eftekhar, PhD Candidate, HEC Paris School of Management, 11 Residence Expansiel, Group HEC, Jouy En Josas, 78350, France, mahyar.eftekhar@mailhec.net, Andreas Robotis, Luk Van Wassenhove

Vehicle fleet sizing is a major challenge for humanitarian organizations. We present a finite time horizon MIP model. The parameters of our model are estimated based on real data provided by the International Committee of the Red Cross. We find that it is optimal to keep inventory leveled and avoid inventory variations.

■ TB14

C - Room 14, Level 4

WORMS Keynote Session

Sponsor: Women in OR/MS
Sponsored Session

Chair: Sadan Kulturel-Konak, Associate Professor of Management Information Systems, Penn State Berks, Tulpehocken Rd. P.O. Box 7009, Reading, PA, 19610, United States of America, sadan@psu.edu

1 - Forging International Linkages of Women in OR Academia

Alice E. Smith, Professor and Chair, Auburn University, 3301 Shelby Center, Auburn, AL, 36849, United States of America, smithae@auburn.edu

This talk will focus on the motivations, mechanisms and rewards of forging international alliances and collaborations amongst women in operations research academia. From doctoral students through senior full professors, there are benefits, both professionally and personally, from interacting with counterparts abroad. This interaction is especially important to those academics in countries with a developing scholarly research infrastructure.

2 - Lessons From the Lives of Women OR/MS "Veterans"
Candace A. Yano, Professor, University of California, Haas School of Business, IEOR Department, Berkeley, CA, 94720, United States of America, yano@ieor.berkeley.edu

In this talk, I will share common themes gleaned from informal interviews with a number of well-established female OR/MS professionals about their life experiences and the words of wisdom that they offer for younger generations. I will also share some of my own experiences and advice. A portion of the session will be dedicated to Q&A and discussion.

■ TB15

C - Room 15, Level 4

Behavioral Operations

Contributed Session

Chair: Tayfun Keskin, Assistant Professor, The University of Washington, Bothell, 3557 Lake Austin Blvd. Apt. D, Austin, TX, 78703, United States of America, tayfunkeskin@gmail.com

1 - Exploding Offers and Explosive Reactions: Behavioral Effects of Short Ultimatum Deadlines
Nelson Lau, INSEAD, 1 Ayer Rajah Avenue, Singapore, 138676, Singapore, nelson.lau@insead.edu, Ilia Tsetlin, Neil Bearden

We show via experiments that use of exploding offers can be inefficient and costly. Presented with a sequential game where Proposer chooses either exploding or extended deadline, Responder accepts or rejects exploding deadline if so offered, there is some chance of a better outside offer after the short but before the long deadline, and Responder chooses to reward/punish Proposer whenever a partnership is formed, Proposers systematically underestimate the consequence of reward/punish decisions.

2 - Duopoly Competition in Waiting Time with Reference Effect
Liu Yang, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States of America, ly11@duke.edu, Peng Sun, Francis de Vericourt

In this paper, we investigate how reference effect and customers' loss aversion attitude affect firms' waiting time competition strategies. We consider two firms competing in waiting times and the reference point is formed as the minimum of the two waiting times. We prove the existence of a unique (Pareto optimal) Nash equilibrium. We show that comparing to the no reference effect case, the equilibrium waiting times are shorter, and firms tend to announce a same waiting time.

3 - The Human Dynamics of Change at Essential Singularities
Jim Hazy, Associate Professor, Adelphi University, 1 South Avenue, Garden City, NY, 11530, United States of America, hazy@adelphi.edu

When a single internal variable such as cash flow is modeled, two parameters are identified to describe the control environment within which the system's dynamic stability is determined. Changes to the first parameter, measuring the complexity of organizing needed, can cause the dynamics bifurcate into two stable states, one with and one without an effective organing regime. Which state dominates depends upon the second parameter measuring the efficacy of the business model.

4 - You Can Leave When the Systems Are in Place: A Behavioral Analytical Model of Transactive Memory
Tayfun Keskin, Assistant Professor, The University of Washington, Bothell, 3557 Lake Austin Blvd. Apt. D, Austin, TX, 78703, United States of America, tayfunkeskin@gmail.com, N. Bora Keskin, Nazim Taskin

This research provides the theoretical foundation for collaborative information technology moderation on team performance. We proved that CIT functionality level plays a role in enhancing the group performance. The role is not direct but it is rather a moderation effect that alleviates the negative departure impact. We employ transactive memory theory to explain how individuals develop and exchange knowledge in a group and how skills and knowledge can be lost due to departure.

■ TB16

C - Room 16A, Level 4

Scheduling I

Contributed Session

Chair: Susan Slotnick, Associate Professor, Cleveland State University, OSM Department, BU 542, 2121 Euclid Avenue, Cleveland, OH, 44115, United States of America, s.slotnick@csuohio.edu

1 - Sequencing Aircraft Landings Under Consideration of Aircraft Classes
Dirk Briskorn, University of Cologne, Cologne, Germany, briskorn@wiso.uni-koeln.de, Raik Stolletz

We consider the sequencing of aircraft landings. Each aircraft belongs to a class and has a designated target time. Deviation of target time and landing time incurs a penalty. Landings must be separated by a minimum timespan. In our setting, aircraft of the same class differ only by their target times. We provide basic ideas of efficient algorithms for problems with a fixed number of classes, a fixed number of runways, and a piece-wise linear convex penalty function.

2 - Coordination Mechanism for Parallel Machine Scheduling
Kangbok Lee, New York University, 44 West 4th Street, New York, NY, United States of America, klee3@stern.nyu.edu, Joseph Leung, Michael Pinedo

We consider coordination mechanisms for the distributed scheduling of n jobs on m parallel machines, where each agent acts selfishly in pursuing its maximum utility whereas the overall system performance is measured by a central objective. We consider a variety of central objectives and derive the lower and upper bounds of the price of anarchy, which is defined by the maximum ratio of the objective function value of a Nash equilibrium schedule versus that of an optimal, coordinated schedule.

3 - A General Optimisation Method for the Appointment Scheduling Problem
Paulien Koeleman, VU University Amsterdam, Department of Mathematics, De Boelelaan 1081, Amsterdam, Netherlands, paulien@few.vu.nl, Ger Koole

We present an efficient optimization method for the outpatient appointment scheduling problem in a very general setting. The goal is to minimize both patients' waiting times with the doctor's idle time and tardiness. We incorporate late and early arrivals, no-shows, different patient types and emergency arrivals. For evaluation of schedules a simulation model is used. Numerical examples will be presented.

4 - The Repositioning Problem 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, Iris Forma, Tal Raviv

Bike-sharing systems allow people to rent a bicycle at a rental station, use them and return them at another station. In this system it is required to meet the fluctuating demand for bicycles, which is achieved through a repositioning operation, consisting of decisions on routes that special trucks should follow and the number of bicycles that should be removed or placed in each station. We model the repositioning problem, formulate a MILP and develop methods to solve problems of realistic size.

5 - Scheduling with Order Acceptance: A Taxonomy and Review
Susan Slotnick, Associate Professor, Cleveland State University, OSM Department, BU 542, 2121 Euclid Avenue, Cleveland, OH, 44115, United States of America, s.slotnick@csuohio.edu

In a firm that strives to align its functions to maximize profit, the coordination of capacity with demand may require that orders be turned away. There is a trade-off between the revenue brought in by a particular order, and all of its associated costs of processing. The present study reviews the body of research that considers two decisions: which orders to accept for processing, and how to sequence them.

■ TB17

C - Room 16B, Level 4

OR for Service Delivery

Cluster: OR/MS in India
Invited Session

Chair: M Rammohan Rao, Indian School of Business, ISB, Hyderabad, AP, 500032, India, mr_rao@isb.edu

1 - Sensei: Evaluating Spoken English Skills for Call Center Agents
Ashish Verma, Senior Researcher, IBM Research - India, 4, Block-C, Institutional Area, Vasant Kunj, New Delhi, De, 110070, India, vashish@in.ibm.com, Om Deshmukh, Shajith Ikbal, Himanshu Chauhan

Presently the spoken language evaluation process in offshore call centers, which involves human experts, is subjective, non-scalable and time-consuming. In this paper we present a system, called Sensei, which is designed to automate the spoken English evaluation process addressing the problems associated with human evaluation. Sensei evaluates pronunciation, which includes articulation and syllable stress, spoken grammar and listening comprehension through a web interface.

2 - A Framework for Efficient and Effective Business Service Resumption
Soujanya Soni, Research Staff Member, IBM Research, 4,block-C, Institutional Area, Vasant Kunj, New Delhi, 110070, India, sousoni1@in.ibm.com, Vinayaka Pandit, Arindam Khan, Soujanya Soni

At the time of a disruption, a business user typically knows only the initial impacts. Moreover, decisions taken based purely on the initial impact will not only be inefficient, insufficient, but could also be wrong! In this work, we are proposing a framework which captures the details of the resources and the dependencies in an appropriate representation and Compute to suggest efficient and effective alternatives for a business manager as means of decision support for Business Resumption.

3 - Optimal Capacity Ramp-up Strategies for New Service Delivery Facility Under Market Uncertainties
Munish Goyal, Research Staff Member, IBM Research, AC2 L1, ISB, GACHIBOWLI, Hyderabad, AP, 500032, India, mungoyal@in.ibm.com, Manish Chouhan

Today, India is facing acute shortage of skills needed to meet the demand of its fast-growing economy. Constrained supply of quality educators coupled with high demand for education services has worsened the problem. In this work, we identify optimal skill capacity build-up strategies for delivering services at new facilities under uncertainty in demand for services, availability of skill in open market, skill acquisition through learning and turnover.

4 - Simulation Modeling to Improve Design of IT Services Delivery
Aliza Heching, Research Staff Member, IBM TJ Watson Research, 1101 Kitchawan Road, Route 134, Yorktown Heights, NY, 10598, United States of America, ahechi@us.ibm.com, Yixin Diao, Nirmit Desai, Dipyaman Banerjee, Gaargi Dasgupta

The size of the IT services delivery market in India is due in part to the wage differential between skilled manpower in India relative to other industrialized countries. Recent rising wages and the appreciation of the Rupee against the Dollar pose challenges to this offshoring delivery model. We describe the application of Lean principles to improve the competitive position of a services delivery provider in India. Simulation aids in decisions including staffing, scheduling, and training.

■ TB18

C - Room 17A, Level 4

OR/MS Software II

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Douglas A. Samuelson, President and Chief Scientist, InfoLogix, Inc., Annandale, VA, United States of America, samuelsondoug@yahoo.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Transparency and Flexibility in Optimization Models
Lonnie Chrisman, Chief Technology Officer, Lumina Decision Systems, Los Gatos, CA, 95033, United States of America, lchrisman@lumina.com

Optimization and generalized equilibrium models are traditionally cumbersome to develop, difficult to extend, and cryptic. Enhancements new to Analytica Optimizer 4.3 bring the transparency and flexibility of hierarchical influence diagrams, intelligent arrays and uncertainty analysis to these classes of applications. Analytica encourages progressive model refinement leading to understandable graphical models.

2 - Integrating Simulation and Stochastic Optimization for Risk Minimization
Douglas A. Samuelson, President and Chief Scientist, InfoLogix, Inc., Annandale, VA, United States of America, samuelsondoug@yahoo.com

We discuss how to use simulation embedded in a statistics and experimental design package to fit distributions from collected data, produce an estimated response surface, and base stochastic optimization on that estimated pattern, using currently available commercial software packages, with process control and risk analysis applications.

3 - Teaching OR and Analytics to Future Practitioners using SAS On-Demand
Ed Hughes, Product Manager, SAS Institute, Inc., 500 SAS Campus Dr., Cary, NC, 27513, United States of America, Ed.Hughes@sas.com, Manoj Chari

OPTMODEL from SAS/OR provides a natural tool for teaching optimization modeling, due to its high-level programming features and its access to a wide range of solvers. Just as important, SAS provides all of the data, analytic, and reporting capabilities needed to support the building and implementation of relevant OR models. All of these capabilities are included in SAS OnDemand for Academics, providing higher education faculty and students worldwide with free online access to SAS software.

■ TB19

C - Room 17B, Level 4

Dynamic Pricing

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Paat Rusmevichientong, Cornell University, School of ORIE, Ithaca, United States of America, paatrus@cornell.edu

1 - Dynamic Pricing in the Presence of Demand Shocks
Omar Besbes, Columbia University, 3022 Broadway, New York, NY, 10027, United States of America, ob2105@columbia.edu, Denis Saure

We study a dynamic pricing problem in the presence of changes in the demand environment. In particular, we analyze the trade-off between future sales (in an uncertain environment) and instantaneous sales and the resulting optimal inventory depletion trajectories.

2 - Dynamic Pricing Under a Parametric Choice Model
Paat Rusmevichientong, Cornell University, School of ORIE, Ithaca, United States of America, paatrus@cornell.edu, Josef Broder

We consider a stylized dynamic pricing model in which a monopolist prices a product to a sequence of customers, who independently make purchasing decisions based on the price offered according to a parametric choice model. The parameters of the model are unknown to the seller, whose objective is to determine a pricing policy that minimizes the regret. We establish a complete regret profile for this problem.

3 - Dynamic Pricing with Adjustment Constraints
Josef Broder, Cornell University, Ithaca, NY, 14853, United States of America, jbroder@cam.cornell.edu, Paat Rusmevichientong

We study the problem of dynamic pricing under price-adjustment constraints, in which a seller prices a product to a sequence of customers, with limited knowledge about the customers' willingness to pay for the product. The seller's goal is to offer a sequence of prices that maximizes his total revenue, subject to a constraint on the number of price changes allowed. We analyze the effects of switching constraints on revenue generation under a variety of assumptions on the selling environment.

■ TB20

C - Room 18A, Level 4

Airline Codesharing and Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Milind Sohoni, Indian School of Business, AC4-L1, ISB, Gachibowli, Hyderabad, 500032, India, milind_sohoni@isb.edu

1 - Network Revenue Management with Product Specific No-shows
Sumit Kunnumkal, Indian School of Business, AC4, Level 1, 4116, Hyderabad, India, sumit_kunnumkal@isb.edu, Kalyan Talluri, Huseyin Topaloglu

We consider the revenue management problem of jointly making the capacity control and overbooking decisions on an airline network. We propose a tractable solution approach which involves solving a linear program that uses samples of the demand and show-up random variables. We show that our method yields a tighter upper bound and higher profits than that obtained by a deterministic linear program.

2 - Dynamic Decentralized Airline Alliance Revenue Management
Huaning Cai, PhD Candidate, University of California, Berkeley, 4177 Etchverry Hall, Berkeley, CA, 94720, United States of America, huaning@ieor.berkeley.edu, Andrew Lim

A key feature of airline alliances is that multiple partners share common resources but make pricing decisions in a decentralized manner in response to stochastic demand over time. In this talk, we show how decentralized pricing agents can be coordinated with the aid of revenue sharing contracts.

3 - OD Nesting with Dependent Demand
Bill Pun, Northwestern University, 1303 Maple Ave Apt 2W, Evanston, IL, 60201, United States of America, billpun@billpun.com, Diego Klabjan, Fikri Karaesmen

We propose a static model capturing capacity nesting at the itinerary level given dependent demand. The problem is formulated as a two-stage stochastic model with nested maximum operation in the second stage. We establish several inequalities among existing static models and the proposed model. Algorithmic approaches are presented.

4 - Airline Codeshare Optimization
Sergey Shebalov, Principal Research Analyst, Sabre Holdings, Dallas/Fort Worth, TX, United States of America, Sergey.Shebalov@sabre-holdings.com, Diego Klabjan, Sumit Kunnumkal, Milind Sohoni

Globalization of airlines cooperation significantly increased profitability evaluation of codeshare flights. We present an approach that uses customer choice model directly in the optimization formulation and identifies the best set of partner flights for codeshare. To manage problem size and run time we developed and evaluate two decomposition approaches. We tested our model on several real world scenarios and initial computational results indicate up to 1.5 percent revenue increase.

■ TB21

C - Room 18B, Level 4

Renewable Energy - Analysis and Optimization

Sponsor: Service Science
Sponsored Session

Chair: Lev Virine, Lead Analyst, Ziff Energy, 1117 Macleod Tr. S.E., Calgary, AB, Canada, lev.virine@ziffenergy.com

1 - Decision Analysis in Energy Industry: When Gas Power Generation Can Be Replaced by Renewables?
Lev Virine, Lead Analyst, Ziff Energy, 1117 Macleod Tr. S.E., Calgary, AB, Canada, lev.virine@ziffenergy.com

The presentation includes the analysis of options for meeting electricity needs based on multiple criteria, including capital and operating cost, other environmental impact, subsidies, social impact, and others. The alternatives include improving efficiency of gas and coal power generation, nuclear power, and renewables. The comparative analysis of multiple models was performed. The analysis of the integrated model demonstrated gradual increase of gas power generation and some renewables.

2 - Exploring Biofuels and Technology Changes to the US Vehicle Fleet
Xirong Jiang, Senior consulting decision analyst, Lumina Decision Systems, Inc, 26010 Highland Way, Los Gatos, CA, 95033, United States of America, xirong@lumina.com, Max Henrion, Costa Samaras, Surya Swamy

A variety of technology and policy developments will radically transform the US vehicle fleet over the next 40 years. We illustrate the use of ATEAM (Analytica Transportation Energy Assessment Model) to understand how these changes are likely to interact and their effects on transportation costs, greenhouse gas emissions, and oil imports.

3 - Storage Capacity Optimization for Renewable Energy Integration with Electric Grid
Feng Gao, Dr., IBM Research - China, Building19, Zhongguancun Software Park, 8 Dongbeiwang West Rd, Haidian District, Beijing, 100193, China, gfgao@cn.ibm.com, Wenjun Yin, Jin Dong, Haifeng Wang

This paper considers a storage capacity optimization model in which different storage devices are used to stabilize overall power output of renewable energy resources integrated with the electric grid, and the cost of storage devices is minimized. The output power of renewable energy resources, such as that of a wind farm, is modeled as a stochastic process; and different feasible storage charging policies are studied for diverse grid integration requirements.

4 - A Multi-commodity Flow Approach for Biomass/Biofuel Supply Chain Design
Heungjo An, PhD Student, Texas A&M University, TAMUS 3131, College Station, TX, 77843-3131, United States of America, Heungjo.An@gmail.com, Wilbert Wilhelm

This paper formulates a multi-commodity production/distribution model to design the second-generation (e.g., cellulosic) biofuel supply chain from farms to customers. A time-staged network flow structure represents the unique aspects of the biofuel industry as a mixed integer program. A decomposition approach based on column generation is employed to deal with large-scale instances with test examples based on the Central Texas region.

■ TB22

C - Room 18C, Level 4

Optimizing Service Productivity

Sponsor: Service Science
Sponsored Session

Chair: Roland T. Rust, Distinguished University Professor and David Bruce Smith Chair in Marketing, Robert H. Smith School of Business, 3451 Van Munching Hall, University of Maryland, College Park, MD, 20742-1815, United States of America, rrust@rhsmith.umd.edu

1 - Optimizing Service Productivity
Roland T. Rust, Distinguished University Professor and David Bruce Smith Chair in Marketing, Robert H. Smith School of Business, 3451 Van Munching Hall, University of Maryland, College Park, MD, 20742-1815, United States of America, rrust@rhsmith.umd.edu, Ming-Hui Huang

Theory, supported by empirical research, shows that at any given time there is an optimal level of service productivity, but that the optimal level increases over time due to the advance of technology.The theory predicts conditions under which service productivity should be higher or lower, and results in testable empirical propositions, tested using data from over 700 service companies in each of two different time periods.The empirical analysis supports the theory.

2 - Multicriteria Decision Models in Service Producing Systems
Adiel Almeida, Professor, Federal University of Pernambuco, Recife-PE, Brazil, almeidaatd@gmail.com

This paper presents some characteristics related to the process of building decision model which are related to service producing system in contrast with the manufacturing producing system. The main aspect explored is related to the multiple objectives characteristics of both kind of producing systems. It is shown the hole played by multicriteria decision methods in service producing system, with some practical applications.

3 - Development of a Classification Scheme for Product-Service Systems

Chie-Hyeon Lim, Professor, Pohang University of Science and Technology, Department of Industrial and Management, Korea, Republic of, arachon@postech.ac.kr, Dong-Hee Lee, Kwang-Jae Kim, Kwang-Tae Park, Yoo S. Hong, Jun-Yeon Heo

Product-service system (PSS) is a novel type of business model integrating products and services in a single system. It has the potential to create economic, environmental, and social values to various stakeholders. This research proposes a PSS classification scheme with two dimensions, namely, the nature of stakeholder network and the change in value creation activities. More than one hundred PSS cases are classified across the two dimensions. The proposed scheme can serve as an effective basis for PSS evaluation and new PSS development.

■ TB23

C - Room 18D, Level 4

Joint Session Media Planning/ RMPS: Revenue Management for TV Advertising

Cluster: Media Planning and Optimization/ Revenue Management and Pricing Section
Invited Session

Chair: Ioana Popescu, Professor, INSEAD, 1 Ayer Rajah Avenue, Singapore, Singapore, ioana.POPESCU@insead.edu

1 - Volatility Based Scheduling of TV Ads

Sriram Subramanian, RSG Media Systems LLC, 14 E 38 St, New York, NY, 10016, United States of America, SriramSu@rsgsystems.com, Sebastian Souyris

Television ratings have significant volatility in audience composition that make effective scheduling of advertisements sold to specific demographics difficult. We test different forecasting models for audience composition by scheduling the advertisements based on the forecasted estimate of audience ratings and volatility using an integer program. Using data from a major cable network, we show considerable improvement in quality of schedules obtained.

2 - Bundling-based Revenue Management for the TV Advertising Scatter Market

Mihai Banciu, Assistant Professor of Operations and Decision Sciences, Bucknell University, School of Management, 117 Taylor Hall, Lewisburg, PA, 17837, United States of America, mihai.banciu@bucknell.edu, Prakash Mirchandani, Esther Gal-Or

We consider a revenue-maximizing monopolist TV network who offers advertising time in both prime time and non-prime time to a spot market that exhibits vertical differentiation. We show that the optimal solution depends on the absolute and relative availabilities of the resources as well as upon the extent of concavity of the consumer preferences for the products. We also explore how the possible bundling strategies change as we introduce an element of horizontal differentiation.

3 - Sales Optimization at NBC

Srinivas Bollapragada, Principal Scientiest, General Electric Research, 1 Research Circle, Niskyuna, NY, 12309, United States of America, bollapragada@research.ge.com

Over a period of ten years starting in 1996, we developed a number of optimization-based sales systems that NBC currently uses to maximize its revenues, improve sales operations and increase productivity. They help NBC-Universal to respond quickly to client requests, enable it to make the most profitable use of its limited airtime inventory, improve sales-force productivity, reduce rework by over 80 percent and improve customer satisfaction.

4 - Advertisement Scheduling with Variable Break Lengths

Pascale Crama, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, Singapore, pcrama@smu.edu.sg, Dana Popescu, Ajay Aravamudhan

In live TV, the commercial break lengths may not always be fixed, e.g., in live sports, injury time outs can have variable length. Since advertising is a significant share of the broadcaster's revenue, the quality of the advertising schedule is important. In a setting with stochastic breaks and two ad lengths, we find the optimal dynamic schedule. We present heuristics to solve the full size scheduling problem and evaluate their performance with data from a major sports channel.

■ TB24

C - Room 19A, Level 4

OR for Public Policy

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Mark Lawley, Professor, Purdue University, Weldon School of Biomedical Engineering, 206 S. Martin Jischke Drive, West Lafayette, IN, 47907, United States of America, malawley09@yahoo.com

Co-Chair: Feng Lin, Weldon School of Biomedical Engineering, 206 S. Martin Jischke Drive, West Lafayette, IN, 47907, United States of America, linf@purdue.edu

1 - Economics of Vaccine Coverage and Public Policy Implications

Hamed Mamani, Foster School of Business, University of Washington, Box 353226, Seattle, WA 98195-3226,hmamani@uw.edu, Debabrata Dey, Elodie Adida

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.

2 - Determining the Optimal Vaccine Vial Size

Ruben Proano, Assistant Professor, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, rpmeie@rit.edu, Aswin Dhamodharan

Vaccine are perishable products stored in vials that have an expiry period, which is the time a vaccine is safe for use after its vial has been punctured. Planning for long-term immunization campaigns involves a tradeoff between purchase, holding costs, and wastage cost. The larger the vial size is, the lower the transportation and storage costs, but the higher the risk of wasting unused vaccine doses. This study determines the vial size that minimizes the total cost for immunization campaigns.

3 - A Modeling Framework for Control of Screening Services

Lerzan Ormeci, Associate Professor, Department of Industrial Engineering, Koç University, Koc University, Sariyer, Istanbul, 34450, Turkey, lormeci@ku.edu.tr, Evrim Gunes, Derya Kunduzcu

We consider the optimal control of the colonoscopy services which provide both diagnosis and screening for colorectal cancer. We model the health of the population by a random environment that can be affected by screening services. The structures of optimal admission and scheduling policies are characterized. A numerical study explores the interaction between prioritizing screening services and the required capacity as well as the effectiveness of screening.

4 - Optimizing Alerting Decisions for Local and State Health Departments for Communicable Disease Events

Emine Yaylali, North Carolina State University, 111 Lampe Drive, Raleigh, NC, United States of America, eyaylal@ncsu.edu, Julie Ivy

To optimize alerting decisions for North Carolina Health Alert Network under the potential threat of an influenza outbreak, we modeled the public health system as a multi-agent POMDP where local and State health departments are decision makers. Computational results for near optimal solutions are obtained where observation and transition probabilities are estimated using data from latest H1N1 outbreak. Structural insights regarding the optimal policies at local and State levels are discussed.

■ TB25

C - Room 19B, Level 4

OR for the Public Interest - Energy, Environment and Infrastructure

Cluster: Public Policy
Invited Session

Chair: Erin Baker, Associate Professor, University of Massachusetts Amherst, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu

1 - Effect of Delays in the Connection-to-the-Grid Time of New Generation Power Plants Over Transmission Planning

Enzo Sauma, Pontificia Universidad Catolica de Chile, Ave. Vicuna Mackenna 4860, Santiago, Chile, esauma@ing.puc.cl, Jorge Vera, Fernando Traub

The start-up times of new power plants are subject to significant uncertainty and they have an important impact on the planning of the transmission network. We propose a model for the electricity network planning inspired in the Robust Optimization approach, which incorporates the uncertainty related with the time in which the new power plants will be connected. Using the proposed model, we measure the impact of these delays over the system cost and the optimal network plan, with a special focus on the effect of the delays in building some renewable power plants.

2 - Building Reliable Air-Travel Infrastructure Through Robust Schedule Planning

Vinayak Deshpande, Purdue University, 100 S. Grant St, West Lafayette, IN, 47907, United States of America, vinayak@purdue.edu, Mazhar Arikan, Milind Sohoni

Flight delays have been a growing issue and they have reached an all-time high in recent years. We develop stochastic models, using empirical data, to analyze the propagation of delays through air-transportation networks. We then analyze robustness measures for airline networks. Our analysis enables us to make policy recommendations regarding managing bottleneck resources in the air-travel infrastructure, which if addressed, could lead to a significant improvement in air-travel reliability.

3 - Fair and Efficient Implementation of Collective Extended Producer Responsibility Legislation

Beril Toktay, Associate Professor, Georgia Tech, 800 W Peachtree St NW, Atlanta, United States of America, Beril.Toktay@mgt.gatech.edu, Ozlem Ergun, Luyi Gui, Atalay Atasu

Using cooperative network game models in the context of resource sharing, we develop fair but practical cost allocation mechanisms to to maximize the welfare gains from EPR legislation. We evaluate the range of existing policy choices in order to assist in the design of effective EPR legislation for electronic waste.

4 - Optimal Climate Change Policy: R&D Investments and Abatement Under Uncertainty

Erin Baker, Associate Professor, University of Massachusetts Amherst, 220 ELab, Amherst, MA, 01003, United States of America, edbaker@ecs.umass.edu, Senay Solak

We address the following important public policy question: 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.

5 - Optimal Bidding of Electricity Storage using Approximate Dynamic Programming

Nils Loehndorf, University of Vienna, Department of Business Administration, Bruenner Str. 72, Vienna, 1210, Austria, nils.loehndorf@univie.ac.at, David Wozabal, Stefan Minner

We model the optimal bidding strategy of an electricity storage at a wholesale electricity market and propose a solution approach based on approximate dynamic programming. To demonstrate the efficiency of our approach, we evaluate the optimized bidding strategy using an econometric model of the PJM energy market.

■ TB26

C - Room 4A, Level 3

Analysis Frameworks for Complex Decision-Making Applications

Sponsor: Data Mining
Sponsored Session

Chair: Victoria Chen, University of Texas at Arlington, Industrial & Manuf. Sys. Engr. Department, Arlington, TX, 76019-0017, United States of America, vchen@uta.edu

1 - Bootstrap-based T2 Multivariate Control Charts

Poovich Phaladiganon, PhD Student, University of Texas at Arlington, Arlington, TX, United States of America, poovich.phaladiganon@mavs.uta.edu, Seoung Bum Kim, Victoria Chen

In this study, we extend the ideas of using the bootstrap method in univariate control charts to multivariate control chart, called the bootstrap percentile approach. This approach is determined as an alternative to construct the control limit based on T2 statistics. A simulation study was conducted to measure the performances of the proposed approach, kernel density estimation (KDE), and T2 control chart. The proposed method performed better than T2 chart while it is comparable to KDE.

2 - Convex Versions of Multivariate Adaptive Regression Splines

Diana Martinez, The University of Texas at Arlington, Industrial & Manuf. Sys. Engr. Department, Arlington, TX, 76019, United States of America, diana.martinezcepeda@mavs.uta.edu, Dachuan Shih, Victoria Chen

Multivariate Adaptive Regression Splines (MARS) is a flexible statistical modeling method that employs forward and backward algorithms. Many optimization methods depend on convexity, and a non-convex MARS approximation is inherently possible, however MARS can be adapted to accommodate the convexity constraint by two major modifications in the forward algorithm. Convex MARS is applied in four and nine dimensional inventory forecasting stochastic dynamic programming problems.

3 - Adaptive Value Function Approximation using Regression Splines

Subrat Sahu, University of Texas Arlington, Industrial & Manufacturing Systems Engg, Campus Box 19017, Arlington, TX, 76019, United States of America, subrat@uta.edu, Victoria Chen

We present an algorithm to approximate future value functions adaptively using regression splines. The performance comparison has been made to using neural network instead on a nine-dimensional inventory forecasting problem.

4 - A Multi-stage Decision-Making Framework for Evaluating Building Technologies

Pin Kung, The University of Texas at Arlington, Industrial & Manufacturing Systems Eng., Arlington, TX, 76019, United States of America, pin.kung@mavs.uta.edu, Victoria Chen

Green building has become a popular environmental topic in recent years. Leadership in Energy and Environmental Design (LEED), which was developed by the U.S. Green Building Council (USGBC), provides a building rating system and a set of guidelines. In our research, we organize building options into multiple stages of decision-making. For example, a greywater system is an option for a plumbing system. Performance criteria include both economic costs and environmental impacts.

■ TB27

C - Room 4B, Level 3

Integer Programming I

Contributed Session

Chair: Raf Jans, Associate Professor, HEC Montreal, 3000 Chemin de la Cote-Sainte-Catherine, Montreal, QC, Canada, raf.jans@hec.ca

1 - Knapsack Shooting Experiment

Sangho Shim, Postdoctoral Fellow, Georgia Institute of Technology, 765 Ferst Dr NW, GA-Tech ISyE, Atlanta, GA, 30332-0205, United States of America, shim@gatech.edu, Ellis Johnson

We explore the geometry of a knapsack shooting experiment, shooting in a random direction from the trivial solution (t_1=n). The knapsack shooting experiment hits most frequently the knapsack facet which is the 2-fold lifting of the mixed integer cut of a cyclic group polyhedron. The knapsack facet is one of those generated by Araoz, Evans, Gomory and Johnson in 2003. We also observe high concentration of shots on a small number of knapsack facets which have simple patterns.

2 - Primal-dual Simplex Method for Shooting

Wenwei Cao, Doctoral Student, Georgia Institute of Technology, 765 Ferst Dr NW, GA-Tech ISyE, Atlanta, GA, 30332-0205, United States of America, cww@gatech.edu, Sangho Shim, Ellis Johnson

Gomory (1969) solved the cyclic group problem by a dynamic programming algorithm. We discuss its complexity and introduce a (fractional) cutting plane algorithm as an alternative algorithm. Each cutting plane is generated by solving a shooting linear programming problem. We implement primal-dual simplex method to solve the shooting linear programming problem. A computational result is given on a Wong-Coppersmith digraph.

3 - The 0-1 Knapsack Problem with a Continuous Variable and Generalized Upper Bound Constraints

Esra Buyuktahtakin, Visiting Assistant Professor, University of Arizona - Tucson, Tucson, AZ, 85721, United States of America, esra@sie.arizona.edu, Zhuo Feng, Guzin Bayraksan

We investigate the polyhedral structure of the mixed 0-1 knapsack problem with a continuous variable and generalized upper bound (GUB) constraints. We derive different classes of facet-defining inequalities based on lifting continuous and binary variables from minimal GUB covers and continuous cover inequalities. Initial computational results on the multi dimensional version of the problem is presented.

4 - Binary Clustering Problems: Symmetric, Asymmetric and Decomposition Models

Raf Jans, Associate Professor, HEC Montreal, 3000 Chemin de la Cote-Sainte-Catherine, Montreal, QC, Canada, raf.jans@hec.ca, Jacques Desrosiers

Many IP formulations suffer from symmetry in their solution space. Due to this symmetry, many alternative solutions exist and need to be checked during the branch-and-bound algorithm. Consequently, the search is unnecessarily duplicated and computation times increase drastically. For general Binary Clustering Problems, we compare the symmetric, asymmetric and decomposition formulations and we discuss specific properties and relationships. We will also discuss specific examples.

■ TB28

C - Room 4C, Level 3

Nanomanufacturing & Nanoinformatics III

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qiang Huang, Assistant Professor, University of Southern California, 3715 McClintock Ave, Los Angeles, CA, 90089, United States of America, qiang.huang@usc.edu

1 - Statistical and Experimental Design Methods for Quality Assurance in Carbon Nanotube Production

Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, Boston, MA, 02115, United States of America, sagar@coe.neu.edu, Hatem Abuhimd, Abe Zeid

High rate high volume production of carbon nanotubes has drawn considerable attention from both researchers and commercial ventures. Alongside advances in physics and chemistry, statistical methods have supported the rapid development of carbon nanotube production in terms of sampling plans, hypothesis testing, quality assurance, and design of experiment. This work presents quality and statistical methods that support the production of carbon nanotubes and other nano elements.

2 - Robust Design Optimization for Computer Experiments

Jye Chyi Lu, Georgia Institute of Technology, Atlanta, GA, jclu@isye.gatech.edu, Martha Grover, Nagesh Adiga, Andres Hernandez

Computer experiments traditionally focused on modeling the mean behaviors. Variables are assumed to be continuous, and equal variance assumption is made. Robust design in computer experiments is an important new topic. Absence of natural replicates is a challenge in this research. In this presentation, we artificial group points to model variances. Methods for grouping and variable selection are systematically investigated.

3 - Atomistic Simulation-based Prediction of Carbon Nanotube (CNT) Growth in Microwave CVD Process

Satish Bukkapatnam, Professor, Oklahoma State University, 318, Enginnering North, School of Industrial Engineering, Stillwater, OK, 74075, United States of America, satish.t.bukkapatnam@okstate.edu, Changqing Cheng

A coarse-grained Monte Carlo (MC) model is employed to simulate CNT growth from graphene structure on the catalyst in a Chemical Vapor Deposition (CVD) synthesis process. The nonstationary evolution of growth rate of a CNT at each addition step is recoded at different process conditions. A local Gaussian process model is used to predict the as-grown CNT height at a given time step.

4 - Reliability and Maintenance of MEMS Subject to Multiple Dependent Competing Failure Processes

Qianmei Feng, Assistant Professor, University of Houston, Department of Industrial Engineering, E217 Engineering Bldg 2, Houston, TX, 77204, United States of America, qfeng@Central.UH.EDU, David Coit, Hao Peng

The problem of multiple dependent failure processes is of particular interest to micro-electro-mechanical systems (MEMS) researchers, which highly impacts widespread acceptance of MEMS. For MEMS subject to both wear degradation and random shocks that are dependent and competing, we propose a general reliability model based on random-shock and degradation modeling. A preventive maintenance policy using periodic inspection is also developed by minimizing the average long-run maintenance cost rate.

■ TB29

C - Room 5A, Level 3

Operations Research Invited Papers in QSR

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Bert Zwart, CWI, Science Park 123, Amsterdam, Netherlands, Bert.Zwart@cwi.nl

1 - A Computable Plug-in Estimator of Minimum Volume Sets for Novelty Detection

Yu Ding, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843-3131, United States of America, yu-ding@tamu.edu, Jianhua Huang, Chiwoo Park

Novelty detection is to detect anomalies by characterizing, as well as one could, what constitutes the normalcy. Current methods are to find the minimum volume set for a special class of measureable sets in a kernel space. These methods tend to generate loose boundaries, are sensitive to outliers, and consequently, have higher miss detection rates. We propose to use a computable density level set estimator, and provide theoretical and empirical supports of its use for novelty detection.

2 - Data Envelopment Analysis as Nonparametric Least-Squares Regression

Andrew Johnson, Texas A&M University, Department of Industrial and Systems Eng, College Station, TX, 77840, United States of America, ajohnson@tamu.edu, Timo Kuosmanen

Data envelopment analysis (DEA) can be alternatively interpreted as nonparametric least-squares regression subject to shape constraints on the frontier and sign constraints on residuals. This reinterpretation reveals the parametric programming model as a constrained special case of DEA. The residual can be treated as a composed term consisting of inefficiency and random variation. This linkage contributes to further integration of the econometric and axiomatic approaches to efficiency analysis.

3 - Structured Replacement Policies for Systems with Complex Degradation Processes

Alaa Elwany, Assistant Professor, Eindhoven Unviersity of Technology, Eindhoven, Netherlands, elwany@tue.nl, Nagi Gabraeel, Lisa Maillart

We consider a replacement problem for a single-unit system whose degradation can be monitored using dedicated sensors. First, we present a stochastic degradation modeling framework to characterize the path of the system's degradation. Next, we formulate the single-unit replacement problem as a Markov decision process. We show that the optimal replacement policy for systems with exponentially increasing degradation signals is a monotonically non-decreasing control limit policy.

■ TB30

C - Room 5B, Level 3

Computer Experiments II

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Ying Hung, Rutgers, Camden, NJ, United States of America, yhung@stat.rutgers.edu

1 - Sequential Optimization of a Computer Model: What's so Special About Gaussian Processes Anyway?

Hugh Chipman, Department of Mathematics & Statistics, Acadia University, Huggins Science Hall, Room 157, Nova Scotia, Canada,hugh.chipman@acadiau.ca, Pritam Ranjan

We consider the placement of turbines in a tidal system to maximize total power generated. Computer models can predict power, but are prohibitively slow for direct optimization, so a statistical model is used as a surrogate. Instead of a Gaussian process model, we use an adaptive nonparametric regression model (BART). By providing both point estimates and prediction uncertainty bounds, BART can be plugged into sequential design criteria to efficiently find optima.

2 - Sliced Sudoku-based Experimental Designs

Ben Haaland, benhaaland@hotmail.com, Xu Xu, Peter Qian

The Latin squares in the popular game Sudoku have 3 by 3 block and one-dimensional uniformity. This property and modifications of existing Galois field constructions are leveraged to construct sliced orthogonal array-based Latin hypercubes whose slices have the same property. These designs are available in a fair range of sizes and numbers of variables and they achieve greater individual slice uniformity than existing constructions.

3 - Gaussian Surrogates for Models with Time-Varying Inputs and Outputs

Max Morris, Professor, Iowa State University, Department of Statistics, IMSE Department, Ames, IA, 50011, United States of America, mmorris@iastate.edu

Computer models of dynamic systems are characterized by time-varying inputs and outputs. Time series output can often be reduced via principal components, but inputs may not have one or a few "characteristic shapes" necessary for effective PCA. In this talk, Gaussian process surrogates are developed for such models, with emphasis on appropriate covariance structure, some experimental design issues, and application to a model of marrow cell dynamics.

4 - Constructing Optimal Space-Filling Designs via Particle Swarms on GPU

Weichung Wang, Professor, National Taiwan University, No. 1, Section 4, Roosevelt Road, Taipei, 10617, Taiwan - ROC, wwang@ntu.edu.tw

Many optimal designs of computer experiments involve solving large scale discrete optimization problems. Population based stochastic methods are commonly used, even only sub-optimal solutions are usually obtained. We propose variants of particle swarm optimization algorithms to solve the target problems. In addition, we use massively parallel graphic process units (GPU) to accelerate the computations. Numerical results will be presented to illustrate the characteristics of the proposed schemes.

■ TB31

C - Room 5C, Level 3

Data Mining III

Contributed Session

Chair: Juheng Zhang, University of Florida, Warrington College of Business, 351 Stuzin Hall, Gainesville, FL, United States of America, Juheng@ufl.edu

1 - Discovering Potential High-value Credit Card Customers

Bin Zhang, Researcher, IBM Research - China, Diamond Building, Shangdi District, Beijing, China, zbin@cn.ibm.com, Jinyan Shao, Wei Zhao, Ming Xie, Jin Dong, Wenjun Yin

The number of credit card customers has been increased significantly in past years. Financial companies seek to register large amounts of credit cards in order to occupy the market. To better exploit the large customer base, it's critical for credit card companies to discover potential high-value customers from the common customers. This paper introduces the method of selecting key customer features and construct customer value forecasting model, and the result on credit card company dataset.

2 - A Data Mining Approach for Improving Branch Product Portfolio and Performance

Fidan Boylu, Assistant Professor, University of Connecticut, One University Pl., Stamford, CT, 06902, United States of America, fidan.boylu@business.uconn.edu

We look at the problem of deciding on a portfolio of products for maximum profitability of companies which offer a wide range of products for various industry segments in many different branches across the country. The performance of a branch is measured by metrics such as market penetration of products for a given branch in an industry segment. We use data mining methods, optimization tools and the actual data collected from various branches of an industry leading company to analyze the problem.

3 - An Improved Random Forest Algorithm Based on Weighting Trees

Hongbo Li, Researcher, IBM China Research Laboratory, Building 19 Zhongguancun Software Park, Beijing, 100094, China, hboli@cn.ibm.com, Hongwei Ding, Wei Wang, Jin Dong

As an excellent ensemble learning method, random forest has achieved success in various domains. However, random forest will generate many noisy trees that will affect the classification accuracy, when training data has high dimension with many noisy features. Here, we present Trees Weighting Random Forest (TWRF) to solve this problem by weighting the trees according to their classification ability in ensemble. Experimental results show that TWRF has better performance than traditional methods.

4 - Using Data Mining Methods to Predict Freshmen Student Attrition

Dursun Delen, Associate Professor, Oklahoma State University, 700 N. Greenwood Ave., Tulsa, OK, 74106, United States of America, dursun.delen@okstate.edu

In this study, using several years of institutional data along with a set of popular data mining techniques, we developed analytical models to predict freshmen student attrition. Of the model types employed, support vector machines and information-fusion based ensembles performed the best with better than 80% prediction accuracy on the holdout sample.

5 - Linear Discrimination with Strategic Missing Values

Juheng Zhang, University of Florida, Warrington College of Business, 351 Stuzin Hall, Gainesville, FL, United States of America, Juheng@ufl.edu, Gary J. Koehler, Haldun Aytug

This paper studies the problem where agents strategically hide information and a decision maker needs to estimate default values for missing data for use in discriminant analysis. We show that the decision maker can use a set of default values that induce agents to engage in certain behavior to minimize her misclassification rate.

■ TB32

C - Room 6A, Level 3

Computationally Expensive Optimization Problems in Disaster Planning and Management

Sponsor: Computing Society
Sponsored Session

Chair: Gino Lim, Associate Professor PhD, University of Houston, E211, Engineering Building 2, Houston, TX, 77204, United States of America, ginolim@uh.edu

Co-Chair: Shabnam Zangeneh, PhD Candidate, Research Assistant, University of Houston, Department of Industrial Engineering, Houston, TX, szangeneh6@uh.edu

1 - Rule-Based Multi-Criteria Optimization for Hospital Evacuation

Zelda Zabinsky, Professor, University of Washington, Industrial and Systems Engineering, Seattle, WA, 98195, United States of America, zelda@u.washington.edu, Onur Mete

We develop an interactive multi-criteria rule-based optimization methodology, where multiple users express their constraints and preferences in terms of rules. Our algorithm produces an estimated subset of Pareto optimal solutions for the users. We apply our approach to a hospital evacuation problem where the problem structure is not easily defined and patients have different requirements which are expressed by medical rules and facilities have changing capacities dependent on conditions.

2 - Supply Chain Crisis Management Among Industrial Distributors
Malini Natarajarathinam, Texas A&M University, 3367 TAMU, College Station, TX, 77843, United States of America, malini@entc.tamu.edu, Arunachalam Narayanan, Ismail Capar, Daniel Jennings

In recent years, there has been several instances of disruptions in global supply chains. Especially in US, we experienced both natural disasters like hurricanes and man-made disasters like terrorist attacks. These events led to several researchers and practitioners question the resilience of firms in this country. In this study we focus on firms involved in the distribution of industrial products in United States and provide insights on factors, that affect their crisis management strategies.

3 - A Novel Approach to Define Hurricane Evacuation Zones
Shabnam Zangeneh, PhD Candidate, Research Assistant, University of Houston, Department of Industrial Engineering, Houston, TX, szangeneh6@uh.edu, Gino Lim

The history of recent hurricanes revealed that many people died due to lack of time for evacuation. Heavy traffic on the evacuation routes was one of the causes for delaying the process which can be reduced by having a systematic evacuation. In this paper, we address the problem of establishing hurricane evacuation zones using the cluster analysis. The output is a set of hurricane evacuation zones in which a higher priority is given to the residents located in the more dangerous areas.

■ TB33

C - Room 6B, Level 3

Metaheuristics

Sponsor: Computing Society
Sponsored Session

Chair: Mary Beth Kurz, Associate Professor, Clemson University, Clemson University, Clemson, SC 29631, Clemson, SC, 29631, United States of America, MKURZ@clemson.edu

1 - Investigation of Parameter Tuning of Metaheuristics on Quadratic Assignment Problem (QAP)
Thashika Rupasinghe, Clemson Univerisity, Department of Industrial Engineering, 110 Freeman Hall,Clemson University, Clemson, SC, 29634-0920, United States of America, rthashi@clemson.edu, Mary Beth Kurz

This study utilizes Tabu Search, Simulated Annealing, Genetic Algorithms and Artificial Immune Algorithms widely applied in solving QAP and investigates the impact of parameter tuning, solution representation and metaheuristic design on an algorithm's performance. An extensive parameter tuning process is carried out and 130 test cases are from the QAPLIB. We have used nonparametric and parametric statistical analyses and conclusions are drawn with indications of possible future research.

2 - A Tabu Search for Solving the Minimum p-envy Location Model in EMS Location Problems
Sunarin Chanta, PhD Student, Clemson University, 203 Freeman Hall, Department of Industrial Engineering, Clemson, SC, 29634, United States of America, schanta@clemson.edu, Maria Mayorga, Mary Beth Kurz, Laura McLay

We propose a minimum p-envy location model for EMS systems to reduce inequity of access to service among all zones using the concept of envy which minimizes the differences in individual outcomes,based on the locations of all p serving facilities. Because of complexity in the objective,a tabu search is developed for solving the problem. The effects of selecting different types of tabu list structure and different choices of tenure time length are tested by conducting computational experiments.

3 - Minimizing Makespan and Number of Tardy Jobs on a Flexible Flowshop with Unrelated Machines
Mary Beth Kurz, Associate Professor, Clemson University, Clemson University, Clemson, SC 29631, Clemson, SC, 29631, United States of America, MKURZ@clemson.edu, Srikanth Badrinarayanan

We consider a bi-objective flexible flowline scheduling problem, in which processing and setup times are machine dependent (unrelated machines at the same stage) to minimize the makespan and number of tardy jobs. We focus on the difference in solutions found by considering a weighting approach versus a solution-family approach in which several (versus one) solutions are found. In light of the combinatorial nature of this problem, a NSGA-II approach is taken.

4 - Metaheuristics for Solving the Uncapacitated Single Allocation p-hub Median Problem
Ornurai Sangsawang, Clemson University, 203 Freeman Hall, Department of Industrial Engineering, Clemson, SC, 29634, United States of America, osangsa@clemson.edu, Mary Beth Kurz

Hub networks are used in distribution systems including telecommunication, airline network, and postal delivery systems to minimize overall transportation cost. This article considers the Uncapacitated Single Allocation p-Hub Median Problem(USApHMP). Well-recognized metaheuristics are proposed for this solving NP-hard problem. The performance of the algorithms with respect to solution quality and CPU times are compared using the AP data set.

■ TB34

C - Room 7, Level 3

Computational Advancements in Integer Programming

Sponsor: Computing Society
Sponsored Session

Chair: Todd Easton, Associate Professor, Kansas State University, 2037 Durland Hall, Manhattan, KS, 66503, United States of America, teaston@ksu.edu

1 - Computational Advances in High-dimensional Facial Structures for Solving Difficult MIPs
Eva Lee, Professor & Director, Georgia Institute of Technology, Center for Operations Research in Medici, Industrial & Systems Engineeriing, Altanta, GA, 30332-0205, United States of America, eva.lee@gatech.edu, Vishal Surana

In the past few years, we have identified several classes of hypergraphic facial structures generated from MIP instances. Our current work expands these results to include CG-ranks in odd anti-holes, webs, stars and wheels. We will also introduce the concept of multi odd-holes and clique-holes. Separation algorithm for efficient generation of hypergraphs will be analyzed. Computational results on some difficult MIP Instances will be demonstrated.

2 - Selecting Disjunctions for Solving MILPs
Ashutosh Mahajan, Post Doc, MCS Division, Argonne National Lab, 9700 S Cass Avenue, Argonee, IL, 60527, United States of America, mahajan@mcs.anl.gov, Ted Ralphs

Both branch-and-bound and cutting-plane algorithms are based on the concept of disjunction. In this talk, we consider the problem of selecting an optimal disjunction for solving a given MILP.

3 - Branching for Cutting Planes in Branch and Bound
Jin Lee, Kennesaw State University, 1000 Chastain Road, Kennesaw, GA, United States of America, jhl5777@ksu.edu, Todd Easton

This talk describes an alternate branching version of branch and bound. Branching on complex hyperplanes enables cutting planes to be generated as part of the branching structure. Theoretical results demonstrate that this branching method has significantly more integer points than standard or single variable branching. Some computational results demonstrate that this branching scheme is superior to standard branch and bound.

■ TB35

C - Room 8A, Level 3

Contemporary Topics in the Analysis of Queues

Sponsor: Applied Probability
Sponsored Session

Chair: Esma Gel, Associate Professor, Arizona State University, Industrial Engineering, SCIDSE, Tempe, AZ, 85281, United States of America, Esma.Gel@asu.edu

1 - Simulation-based ADP Approaches for Operations Optimization in Re-entrant Line Manufacturing Models
José Ramìrez-Hernandez, PhD Candidate, University of Cincinnati, 2311 Bunny Run Lane #928, Arlington, TX, 76006, United States of America, ramirejs@mail.uc.edu, Emmanuel Fernandez

We present the application of simulation-based Approximate Dynamic Programming (ADP) approaches for optimizing operations, e.g., Job Scheduling (JS) and Preventive Maintenance (PM), in Re-entrant Line Manufacturing (RLM) models. As an illustrative example, we present results from simulation experiments demonstrating the applicability of our simulation-based ADP algorithms for the optimization of JS and PM operations in a benchmark RLM model representing a semiconductor manufacturing facility.

2 - Investigating Two-Machine Dynamic Flow Shops Based on Queueing and Scheduling

Daria Terekhov, Department of Mechanical and Industrial Engineering, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, dterekho@mie.utoronto.ca, Douglas Down, Tony T. Tran, J. Christopher Beck

We study a two-machine dynamic flow shop and a polling system with a flow shop server. Based on analysis and experiments, and using ideas from both queueing theory and scheduling, we obtain new insights regarding the solution of dynamic scheduling problems by a periodic scheduling approach. Further research in this direction includes obtaining more general results about the effect of various scheduling approaches on the stability of the two systems.

3 - Strong Approximations for Transient Analysis in Non-stationary Multi-server Queues

Young Myoung Ko, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ymko@tamu.edu, Natarajan Gautam

We develop strong approximations that are not only asymptotically exact but also promising in non-asymptotic regimes for analysis of queues. The method to develop these approximations is somewhat orthagonal to the more well-established techniques, however the results are promising. An application to analysis of call centers with large number of servers will be presented.

4 - Expected Tardiness Computations in Multi-class Priority M/M/c Queues

Baykal Hafizoglu, Arizona State University, Industrial Engineering, SCIDSE, 699 S. Mill Ave., #501, Tempe, AZ, 85281, United States of America, baykal@asu.edu, Esma Gel, Pinar Keskinocak

We discuss the evaluation of expected tardiness of an order at the time of arrival in an M/M/c queue with N priority classes, considering both non-preemptive and preemptive cases. The expected tardiness of the order is formulated by Laplace transforms, and evaluated using a recursive numerical integration algorithm obtaining the inverse transforms, where a closed-form expression is provided for the single class case.

■ TB36

C - Room 8B, Level 3

Communication Instructional Tools From Georgia Tech and Texas Tech

Sponsor: INFORM-ED
Sponsored Session

Chair: Judith Norback, Stewart School of Industrial & Systems Engineering, Georgia Tech, Atlanta, GA, 30332, United States of America, jnorback@isye.gatech.edu

1 - Communication Instructional Tools Used by Georgia Tech and Texas Tech

Judith Norback, Stewart School of Industrial & Systems Engineering, Georgia Tech, Atlanta, GA, 30332, United States of America, jnorback@isye.gatech.edu

In this session, two engineering schools with ongoing communication instruction will share with you the development of the tools, their current use, and results they have from their instruction, to date. Adequate time will be allowed for discussion with individual audience members about replicating the instruction in their own settings. Adequate time will be allowed for discussion with individual audience members about replicating the instruction in their own settings.

2 - Developing the Professional Communications for Engineers Course at Texas Tech University: Service Learning and Engineering Communication

Dean Fontenot, Director, Texas Tech University, Texas Tech T-STEM Center, Lubbock, TX, United States of America, Dean.fontenot@ttu.edu

Because of the concern that students were not graduating from the College of Engineering with good communication skills, I was asked to develop and deliver a course that would not only address ABET criteria but would help engineering students become better oral, written, and internet communicators. This presentation will discuss the development and delivery of this service learning course, how it addresses accrediting boards' criteria, fits into the core curriculum, and how we are investigating ways to replicate the course in order to serve the large number of engineering students at Texas Tech University.

3 - Using a Scoring Rubric Based on Executive Input to Teach Engineering Communication at Georgia Tech

Judith Norback, Stewart School of Industrial & Systems Engineering, Georgia Tech, Atlanta, GA, 30332, United States of America, jnorback@isye.gatech.edu, Tris Utschig

With funding from the Engineering Information Foundation, communication and assessment professionals at Georgia Tech have built a scoring rubric for undergraduate engineering presentations, based on executive input and modified by faculty input. The rubric and supplementary teaching guidelines have been used to enhance capstone design students' presentation skills. The rubric includes 19 competencies such as 1) Graphics are visually appealing, easy to understand, and include helpful labeling, 2) Presenter adapts tone, volume and pace to emphasize key points, 3) Presenter links different parts of the presentation and uses appropriate transitions, and 4) Presenter adeptly accepts and satisfactorily answers audience questions. The rubric and guidelines were pilot tested in two semesters of capstone design; results will be reported. The rubric and supplemental teaching guidelines will be shared and discussed with the audience so they may replicate the instruction in their own settings.

■ TB37

C - Room 8C, Level 3

Advances in Learning and Dynamic Optimization II

Sponsor: Applied Probability
Sponsored Session

Chair: Vivek Farias, Massachusetts Institute of Technology, Sloan School, 50 Memorial Drive, Cambridge, MA, United States of America, vivekf@mit.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 - Adaptive Basis Function Selection using Simulation in Approximate LP

Michael Veatch, Gordon College, Department of Mathematics, 255 Grapevine Road, Wenham, MA, 01923, United States of America, Mike.Veatch@gordon.edu

Differential cost approximations are used for average cost approximate linear programming. We propose an algorithm that iteratively adds basis functions from a predefined set to the approximation based on simulation and test it on queueing networks. Simulation is also used to generate columns when solving the (dual) LP.

2 - Optimal Stopping with Bayesian Learning in Revenue Optimization

Huseyin Topaloglu, Associate Professor, Cornell University, School of OR&IE, Ithaca, United States of America, ht88@cornell.edu, Paat Rusmevichientong, Chao Ding

We consider a multi-dimensional Bayesian learning model that detects failures in a product, and decides whether or not to continue selling the product in the market. We establish structural properties of the optimal policy, and provide bounds for the value function. Numerical results indicate that our approximations perform well.

3 - An Equivalence Between AdaBoost and RankBoost

Cynthia Rudin, Assistant Professor, MIT Sloan, Sloan School of Management, MIT, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, rudin@mit.edu, Robert Schapire

"Classification" and "bipartite ranking" are distinct. Classification algorithms involve a decision boundary, whereas ranking algorithms rank positives above negatives. We prove an equivalence as follows: the classification algorithm AdaBoost (Freund & Schapire 97) achieves a ranking error equally as good as that produced by the ranking algorithm RankBoost (Freund et al 03). Also, the solution of RankBoost can be trivially altered to produce a classification result as good as that of AdaBoost.

4 - Mean Field Analysis of Stochastic Games

Sachin Adlakha, Stanford University, Electrical Engineering, Stanford, CA, 94305, United States of America, adlakha@stanford.edu, Ramesh Johari, Gabriel Weintraub

We study stochastic games with a large number of interacting players. A scheme for approximating Markov perfect equilibria in such games has recently been proposed via a solution concept we call mean field equilibrium (MFE). In a MFE, strategies of players depend on the long run average state of players. Our paper studies two fundamental questions: first, when is an MFE guaranteed to exist? And second, when is an MFE a good approximation to a finite system?

■ TB38

C - Room 9A, Level 3

Complementarity Problems and Algorithms

Sponsor: Optimization/Linear Programming and Complementarity (Joint Cluster ICS)
Sponsored Session

Chair: Angelia Nedich, University of Illinois at Urbana-Champaign, 104 S. Mathews Avenue, Urbana, United States of America, angelia@illinois.edu

1 - Nonconvex Non-cooperative Games with Side Constraints and Price Equilibration

Jong-Shi Pang, Professor, University of Illinois at Urbana-Champaign, 117 Transportation Building, 104 South Mathews Avenue, Urbana, IL, 61822, United States of America, jspang@illinois.edu, Gesualdo Scutari

This paper develops a novel optimization-based theory for the existence, uniqueness, and distributed computation of equilibria of a non-cooperative game wherein the selfish players' optimization problems are nonconvex and there are side constraints with associated price clearance to be satisfied by the equilibria.

2 - Link-Node Complementarity Model and Solution Algorithm for Dynamic User Equilibrium

Xuegang Ban, Assistant Professor, Rensselaer Polytechnic Institute, 110 8th St, JEC 4034, RPI, CEE, Troy, NY, 12180, United States of America, banx@rpi.edu

We present a link-node based nonlinear complementarity formulation for dynamic user equilibrium (DUE). The proposed model considers explicitly the exact flow propagation which was approximated by most previous analytical DUE models. The paper establishes the solution existence condition of the model under certain conditions. A heuristic algorithm is also proposed in the paper to solve the model. Numerical results are provided on a small size network.

3 - On a Flow Adjusting User Equilibrium Problem with Elastic Demand

Lanshan Han, Purdue University, United States of America, han144@purdue.edu, Henry Liu, Jong-Shi Pang, Xuegang Ban

We study a flow adjusting process which is formulated as a differential variational inequality. This flow adjusting process can lead to user equilibrium in a transportation network with elastic demand. Various properties such as solution existence, trajectory nonnegativity, and stability are explored.

4 - The Abstract Equilibrium Problem

Siegfried Schaible, Department of Applied Mathematics, Chung-Yuan Christian University, Chung-Li 32023, Taiwan - ROC, schaible2008@gmail.com

A unifying model of optimization problems and classical problems in nonlinear analysis is the abstract equilibrium problem. We present eight realizations of this rather general model and point out some applications through these special cases. The classical assumptions of convexity and monotonicity can be relaxed to generalized convexity and generalized monotonicity to establish major results.

■ TB39

C - Room 9B, Level 3

Advances in Mixed Integer Programming I

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Santanu Dey, Assistant Professor, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, santanu.dey@isye.gatech.edu

1 - A Progressive Reformulation Linearization Technique for General Mixed Integer Linear Programs

Simge Kucukyavuz, Ohio State University, 1971 Neil Ave, Columbus, OH, United States of America, kucukyavuz.2@osu.edu, Dinakar Gade, Suvrajeet Sen

We propose a progressive reformulation linearization technique (PRLT) in which partial convex hull approximations are developed sequentially. This method is applicable to MIPs with general integer variables, and is finitely convergent. Computational results with alternative PRLT implementations will be presented using MIPLIB instances.

2 - Issues with Symmetry in Job Scheduling

Jim Ostrowski, Department of Management Sciences, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada,jostrows@engmail.uwaterloo.ca, Miguel Anjos, Anthony Vannelli

In this talk we will discuss how to exploit exploit symmetry in job scheduling problems. There are many different strategies for exploiting symmetry in these problems, either by generating symmetry-breaking constraints or by using algorithms such as orbitopal fixing, isomorphism pruning, and orbital branching. Each method has its advantages, but proper implementation is very important. In this talk we will compare these methods and discuss what is necessary for each method to be effective.

3 - Lifted Inequalities for 0-1 MIPs From Multiple Constraints

Jean-Philippe Richard, Associate Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, richard@ise.ufl.edu, Bo Zeng, Ilksen Icyuz

In this talk, we describe different techniques to generate valid inequalities for 0-1 MIPs using the information contained in several of their constraints. In particular, we describe how to perform lifting in knapsack and flow models with sides constraints. We evaluate the strength of the resulting inequalities on families of randomly generated 0-1 mixed integer programs.

4 - Intersection Cuts with Infinite Split Rank

Amitabh Basu, Carnegie Mellon University, Pittsburgh, PA, United States of America, abasu1@andrew.cmu.edu, Francois Margot, Gerard Cornuejols

We consider mixed integer linear programs where free integer variables are expressed in terms of nonnegative continuous variables. When this model only has two integer variables, Dey and Louveaux characterized the intersection cuts that have infinite split rank. We generalize this result to any number of integer variables, characterizing when the split rank of an intersection cut generated from a bounded convex set P is finite.

■ TB40

C - Room 9C, Level 3

Decomposition in Linear and Stochastic Programming

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: Alan King, IBM Research, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, kingaj@us.ibm.com

1 - Expected Utility Maximization in Large-scale Portfolio Optimization

Gerd Infanger, Consulting Professor, Stanford University, Stanford, CA, 94305, United States of America, infanger@stanford.edu

Expected utility based portfolio optimization in conjunction with a factor model representation of asset returns is introduced and an equilibrium pricing model of asset returns based on an expected utility and factor based portfolio model calibrated to the market is presented. Numerical results showing significant advantages of expected utility and factor based portfolio optimization (large-scale, long- only, long-short) compared to mean-variance portfolio optimization are presented.

2 - Linearization Methods for Structural Estimation Problems

John Birge, University of Chicago, Booth School of Business, Chicago, IL, 60637, United States of America, John.Birge@gsb.uchicago.edu

Structural estimation problems attempt to determine the structural parameters of an underlying model based on observations of an agent's actions. The resulting mathematical structure poises challenges for computation, particularly in higher dimensions. This talk will discuss properties of the problem where linearization methods can be applied and alternative relaxations for more general problems that preserve convexity.

3 - Two-stage Stochastic Linear Programs with Conditional Value at Risk (CVaR) constraints

Dharmashankar Subramanian, Research Staff Member, IBM Research, 1101 Kitchawan Rd, Rte 134, Yorktown Heights, NY, 10598, United States of America, dharmash@us.ibm.com, Pu Huang

We consider a two stage stochastic programming problem with unresolved uncertainty that remains at the end of the second stage. We capture risk aversion by imposing a constraint on the two-stage composition of the CVaR risk measure. We present a decomposition algorithm for the above problem in a special case, where the induced risk-neutral version, i.e. the above formulation without the risk aversion (composed CVaR) constraint, can be tractably solved in its extensive (i.e. monolithic) form.

4 - Adventures in Stochastic Programming
Alan King, IBM Research, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, kingaj@us.ibm.com, Gyana Parija

We discuss how nested parallel decomposition was implemented in OSL Stochastic Edition, and prospects for new adventures in COIN-OR.

■ TB41

C - Room 10A, Level 3

Nonlinear Programming II

Contributed Session

Chair: Harold Benson, Professor, University of Florida, Department of Info Systems & Oper.Management, 351 Stuzin Hall, Gainesville, FL, 32611, United States of America, harold.benson@warrington.ufl.edu

1 - A Two-stage Optimization Model for Uniform-price Electricity Auctions with Step-function Offers
Dali Zhang, Research Fellow, National University of Singapore, E1A-05-19, SMAL Lab, ISE Department, Department of Industrial and Systems Eng, Singapore, 117576, Singapore, isezd@nus.edu.sg, Sujin Kim

We propose a stochastic equilibrium program with complementarity constraints for generators' bidding problem in the day-ahead electricity market. We characterize the generators' competition by using a uniform price auction with step-function offers, and present a bilevel equilibrium model to study the interaction between generators' offers and the market clearing mechanism. Numerical experiments are carried out to illustrate how the proposed method can be used in real power transaction markets.

2 - Monotone Irreversible Dynamic Pricing in the Face of Product-form Demands
Jian Yang, Associate Professor, New Jersey Institute of Technology, 323 Martin Luther King Jr. Blvd., Newark, NJ, United States of America, yang@njit.edu, Yifeng Liu

We consider a dynamic pricing model in which the concerned firm can consecutively charge a decreasing or increasing sequence of prices. Demand arrives as a Poisson process whose instantaneous rate is a product of two terms, one dependent on the current price and the other on the present time. We establish the optimality of threshold policies. We also develop efficient algorithms for computing threshold points.

3 - Concave Cost Supply Management Problem: Branch & Bound Method w/ Subproblems Solvable by Inspection
Harold Benson, Professor, University of Florida, Department of Info Systems & Oper.Management, 351 Stuzin Hall, Gainesville, FL, 32611, United States of America, harold.benson@warrington.ufl.edu, Selcuk Erenguc

The concave cost supply management problem (P) is a global optimization problem seeking to minimize a concave cost function over a disconnected set. We give a branch & bound algorithm for globally solving (P). The algorithm's advantages are: Its LP subproblems can be solved by inspection; it either finds an exact global optimal solution or shows that (P) is infeasible; it's finite; it needs no special assumptions on the data of (P); no optimizations required to implement it.

■ TB42

C - Room 10B, Level 3

Algorithms and Applications for Stochastic Programming

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Yongpei Guan, University of Florida, 303 Weil Hall, Gainesville, United States of America, guan@ise.ufl.edu

1 - Two-stage Min-Max Regret Robust Unit Commitment Problem
Muhong Zhang, Assistant Professor, Arizona State University, 699 S. Mill Avenue, Suite #553, Tempe, AZ, 85281, United States of America, Muhong.Zhang@asu.edu, Yongpei Guan

As an energy market transforms from a regulated market to a deregulated one, the demands for a power plant are highly uncertain. We study a two-stage robust optimization formulation with min-max regret and provide a tractable solution approach for the problem. The computational experiments show the effectiveness of our approach.

2 - A Chance-constrained Two-stage Stochastic Program for Unit Commitment with Uncertain Wind Generation
Qianfan Wang, PhD Student, University of Florida, qfwang@ufl.edu, Yongpei Guan, Jianhui Wang

The Unit Commitment problem with uncertain wind power is formulated as a stochastic program. The chance constraint is incorporated to assure the lowest usage of wind power at a certain risk level; and the two-stage formulation introduces outsourcing policy against the shortage. We solve this mixed model using the Sample Average Approximation (SAA) approaches. Computational results are reported at the end.

3 - An O(N^2) Time Algorithm for the Stochastic Uncapacitated Lot-Sizing Problem with Random Lead Times
Ruiwei Jiang, PhD Student, University of Florida, ruiweijiang@gmail.com, Yongpei Guan

In this paper, we develop a dynamic programming algorithm for the scenario-tree-based stochastic uncapacitated lot-sizing problem with random lead times. Our algorithm runs in O(N^2) time, where N is the input size of the scenario tree, and improves the recently developed algorithm that runs over O(N^3) time.

4 - A Case Study for Portfolio Optimization with Second Order Stochastic Dominance Constraints
Neslihan Fidan, Research and Teaching Assistant, Istanbul University, Istanbul University, Faculty of Business Adm., Avcilar Campus 34320 Avcilar, Istanbul, Turkey, neslihan.fidan@gmail.com, Stan Uryasev, Viktor Kuzmenko

The second-order stochastic dominance is an important criterion in portfolio selection. This case study finds a portfolio with return dominating the market index return in second order. We compare our results with of that in Fabian et. al. (2010). In additional, we create a new set of linear constraint via SSD constraints and try to find out actual composition of market index which it is not possible to be dominated by another portfolio. The case study is conducted by the Portfolio SafeGuard.

■ TB43

C - Room 1, Level 2- Mezzanine

Capacity Planning in Health Care Delivery Systems

Sponsor: Health Applications
Sponsored Session

Chair: Diwakar Gupta, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, guptad@me.umn.edu

1 - Appointment Scheduling with Potential Call-In Patients
Lawrence Robinson, Cornell University, Johnson Graduate School of Management, Ithaca, NY, 14850, United States of America, lwr2@cornell.edu, Rachel Chen

We consider a hybrid system appointment scheduling system which accomodates both traditional patients who book well in advance and same-day patients with acute needs who call that morning for an appointment. Our model determines which appointment times should be reserved for these potential same-day patients, and which times should be reserved for traditional patients be booked. Our model includes random service times, no-shows, overtime, and auxiliary physician tasks.

2 - Service Facility Network Design with Congestion: Optimal-Choice versus Probabilistic-Choice
Yue Zhang, Assistant Professor, The University of Toledo, 2801 West Bancroft Street, Toledo, OH, 43606, United States of America, Yue.Zhang@sauder.ubc.ca, Oded Berman, Vedat Verter

This talk describes two models for designing the network of service facilities so as to maximize expected total demand, each associated with a different assumption about client choosing behavior. Facility locations and capacities are the main determinants of the configuration of the facility network. We develop accurate and efficient heuristic algorithms to solve the problems. Two illustrative examples and a few interesting results are also discussed.

3 - Elective Surgery Scheduling
Vikram Tiwari, Assistant Professor, University of Houston, 2200 Business Center Dr, Apt 5104, Pearland, TX, 77584, United States of America, vtiwari@Central.UH.EDU, David Berger

An elective surgery scheduling procedure is developed that trades off Operating Rooms overtime and idle costs. The procedure accommodates multiple surgeries held sequentially, each having a stochastic duration. Using data collected from a large teaching hospital, the results of the implementation of this methodology for scheduling surgeries is also presented. Benefits include increased number of surgeries, as well as, reduced overall costs.

4 - Operating Room Capacity Management
Diwakar Gupta, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, guptad@me.umn.edu

Developing models for managing operating room (OR) capacity requires understanding of the perspectives of OR Directors, Service Managers, and Nursing Directors. This talk will present a data-driven approach for understanding these perspectives and attempts to address the following questions. What is the total amount of time that ORs should be staffed? What is the optimal number of exclusive-use minutes for each service or surgeon group? How should these be split into individual blocks?

■ TB44

C - Room 2, Level 2- Mezzanine

Pierskalla Finalists IV

Sponsor: Health Applications
Sponsored Session

Chair: Mariel Lavieri, Assistant Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, lavieri@umich.edu

1 - An Interior Point Constraint Generation Algorithm for Semi-infinite Optimization with Healthcare Application
Hamid Ghaffari, PhD Candidate, University of Toronto, 5 King's Collage Road, Toronto, ON, M5S 3G8, Canada, ghaffari@mie.utoronto.ca, Mohammad R. Oskoorouchi, Tamàs Terlaky, Dionne Aleman

A linear approximation of the original problem is generated by calling an oracle to approximate the optimal solution. This approach generally can be used to solve any convex optimization problem with piecewise differentiable functions. We model the sector duration optimization in Gamma Knife Perfexion treatment planning into semi-infinite approach and compare our approach with projected gradient method. Numerical results are also included in this presentation.

2 - Controlling Dose with gEUD-type Constraints Within Convex Radiotherapy Optimization Framework
Yuriy Zinchenko, University of Calgary, Calgary, Canada, yzinchen@ucalgary.ca, Tamàs Terlaky, Tim Craig, Harry Keller, Michael Sharpe

Radiotherapy is an important modality for treating various cancers. A fundamental question in treatment planning "can we produce better plans relying on the existing technology?" still remains unanswered, in large part due to the underlying computational complexity of the problem, which often stems from optimization models being non-convex. We investigate the possibility of including biologically relevant dose prescriptions within convex optimization framework to overcome this difficulty.

3 - A POMDP Approach to Personalize Mammography Screening Decisions
Turgay Ayer, PhD Candidate, University of Wisconsin-Madison, 1513 University Ave., 3233 ME Building, Madison, WI, 53706, United States of America, tayer@wisc.edu, Natasha K. Stout, Oguzhan Alagoz

The existing mammography screening guidelines consider only age, which is just one of the risk factors for breast cancer. We propose a personalized mammography screening policy based on personal risk characteristics of women and their prior screening history. Our results show that the proposed personalized screening policy outperforms the existing guidelines with respect to the total expected quality-adjusted life years, while significantly decreasing the number of recommended mammograms.

4 - Optimization of PSA-based Screening Decisions for Prostate Cancer Detection
Jingyu Zhang, North Carolina State University, 375 Daniels Hall, 111 Lampe Dr, North Carolina State University, Raleigh, NC, 27695, United States of America, jzhang2@ncsu.edu, Brian T. Denton, Hari Balasubramanian, Nilay Shah, Brant Inman

We report on a non-stationary infinite-horizon POMDP model for prostate biopsy referral decisions to maximize expected quality-adjusted life years. Parameters are from Mayo Clinic and medical literature. We prove structural properties including the existence of a control-limit type policy and sufficient conditions under which PSA screening should be discontinued. Results demonstrate a non-decreasing belief threshold in age. Benefits of screening are estimated and sensitivity analysis is done.

5 - Decision Making with Prostate Cancer: A Multiple-Objective Model with Uncertainty
Jay Simon, Assistant Professor, Defense Resources Management Institute, Naval Postgraduate School, 699 Dyer Rd, Room 231, Monterey, CA, United States of America, jrsimon@nps.edu

When diagnosed with prostate cancer, a patient has a difficult decision to make. There are several different treatment alternatives available, with varying cure rates and probabilities of side effects over a period of many years. Preferences and physical characteristics of the patient play an integral role in the evaluation of alternatives. This paper describes a personalized model for comparing treatments and helping the patient make the best possible decision.

■ TB45

C - Room 6, Level 2- Mezzanine

Improving Patient Flow

Sponsor: Health Applications
Sponsored Session

Chair: Michael Magazine, University of Cincinnati, Dept of QAOM, Cincinnati, United States of America, MAGAZIM@ucmail.uc.edu

1 - Who Should Emergency Physicians See Next?
Yann Ferrand, University of Cincinnati, Cincinnati, 45220, United States of America, ferrany@mail.uc.edu, Michael Magazine, Uday Rao

To improve patient flow in an emergency department, we propose different ways of pairing physicians and patients, and prioritizing patients to see next. Pre-assigning physicians to patient acuity levels allows better control of maximum wait time, but reduces capacity. Dynamically prioritizing patients increases flexibility, but is more complex. We use discrete event simulation to compare our approaches in terms of patient "door-to-doc" time and length of stay, and physician idleness.

2 - Appointment Scheduling: Evaluating the Robustness of Models
Stephen Lawrence, Associate Professor of Operations Management, Leeds School of Business, University of Colorado at Boulder, UCB 419, Boulder, CO, 80309, United States of America, Stephen.Lawrence@Colorado.EDU, Linda Laganga

Appointment scheduling models make assumptions about system operating characteristics. We survey providers from several different kinds of practices to evaluate the accuracy of assumptions such as punctuality of patients, constancy of service times, and double-booking practices. We conduct sensitivity analysis to determine the tolerance of model constructions for operations that don't conform to assumptions, and we recommend modeling techniques to improve scheduling evaluation and performance.

3 - Fixing Outpatient Clinic Flow by Changing Behavior and Reducing Service Variance
Craig Froehle, Assoc. Professor, University of Cincinnati, 2925 Campus Green Dr, Cincinnati, OH, 45221-0130, United States of America, craig.froehle@uc.edu, Denise White

Many outpatient clinics are managed idiosyncratically; physicians drive schedules unaware of their behavior's effects. In this research, we examine operating performance effects of variance reduction policies. Specifically, we estimate the effects of holding physicians and providers to scheduled activity durations vis-‡-vis baseline models with non-truncated service distributions. We also discuss the behavioral/reward system changes needed for physicians and staff to support such a policy.

4 - Six Sigma in Healthcare Delivery
Matthew Liberatore, Professor, Villanova University, 800 Lancaster Avenue, Villanova, PA, 19085, United States of America, matthew.liberatore@villanova.edu

Based on a review and assessment of the literature, we identify those health care processes and procedures that have witnessed substantial improvement with the application of six sigma and investigate the benefits obtained, including the specific metrics targeted.

■ TB46

C - Room 7, Level 2- Mezzanine

Panel Discussion: Operations Research/Management Science in Business Schools

Cluster: Invited Panels on Professional Issues
Invited Session

Moderator: Jeff Camm, Professor, University of Cincinnati, QAOM Dept, Mail Location 0130, Cincinnati, OH, 45221, United States of America, jeff.camm@uc.edu

1 - Operations Research/Management Science in Business Schools

Panelists: Jeff Camm, Professor, University of Cincinnati, QAOM Dept, Mail Location 0130, Cincinnati, OH, 45221, United States of America, jeff.camm@uc.edu, Matthew Liberatore, Professor, Villanova University, 800 Lancaster Avenue, Villanova PA 19085, United States of America, matthew.liberatore@villanova.edu, Jeffrey Ohlmann,University of Iowa, S210 John Pappajohn Business Building, Iowa City IA 52242, United States of America, jeffrey-ohlmann@uiowa.edu, Stephen G. Powell, Professor, Dartmouth College, Tuck School, Dartmouth College, Hanover NH 03748, United States of America, Stephen.G.Powell@tuck.dartmouth.edu, Charles Sox, Professor, The University of Alabama, 300 Alston Hall, Tuscaloosa AL 35406, United States of America, csox@cba.ua.edu, John Semple, Professor, Southern Methodist University, Cox School of Business, Dallas TX, United States of America, jsemple@mail.cox.smu.edu

In this panel we will discuss the state of OR/MS in business schools. The discussion will include topics such as the impact of the business analytics movement on curriculum, spreadsheet analytics, new types of courses, and the consolidation of OR and statistics.

■ TB47

C - Room 8, Level 2- Mezzanine

Modeling and Analysis of Real-World Large Scale Networks

Cluster: Complex Systems
Invited Session

Chair: LiYing Cui, Reserach Assistant, Penn State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, luc5@psu.edu

Co-Chair: Soundar Kumara, Pearce Chair Professor, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, skumara@psu.edu

1 - Large-scale Service Composition Based on Networks

LiYing Cui, Reserach Assistant, Penn State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, luc5@psu.edu, Soundar Kumara

Services are booming in the current era, and many of them are offered via the Internet platform. The current service composition methods do not study large scale service composition. In this work, we address the large-scale service composition problem based on network science. We first study the network structure of current web services available online, and then give a novel composition method based on the network structure.

2 - The Structure of Cascade-Resilient Networks

Alexander Gutfraind, Postdoctoral Fellow, Los Alamos National Laboratory, Theoretical Division, Mail Stop B284, Los Alamos, NM, 87545, United States of America, gfriend@lanl.gov

Most complex networks need resilience to cascades - to prevent the failure of a single node from causing a far-reaching domino effect. We introduce an optimization method for designing networks with high structural cascade resilience. We find that star-like subgraphs and cells endow networks with resilience. Surprisingly, there are conditions where networks should not be modified to stop cascades. These findings can help design and upgrade networks for high cascade resilience.

3 - Game Theory with Multiple Objectives for Multi-agent Problems

Jeffrey Weinschenk, Research Engineer, Pennsylvania State University, 0165 ARL Building, University Park, PA, 16802, United States of America, jjw15@arl.psu.edu, Alvaro Amador

Multi-agent problems often involve a long series of complex decisions, which limits the practical application of game theoretic methods. Even moderate-sized decision sets and a small number of agents result in exponential explosion of the associated game tree. In this paper we present a method to decompose multi-agent problems into smaller n-move look-ahead games with a rolling horizon. In order to assess the partial progress of the agents, a set of heuristic performance metrics is formulated and weighted according to an optimization procedure that maximizes long-term performance relative to the mission objective. This approach provides a critical step toward the practical application of game theory to large multi-agent games, allowing the computation of optimal (equilibrium) tactics.

4 - Networks, Communities and Kronecker Products

Jure Leskovec, Stanford University, Stanford, CA, United States of America, jure@stanford.edu

Emergence of the web and online computing applications gave rise to rich large scale social activity data. One of the principal challenges then is to build models and understanding of the structure of such large social and information networks. I will present our work on clustering and community structure in large networks, where clusters are thought of as sets of nodes that are better connected internally than to the rest of the network. We find that large networks have very different clustering structure from well studied small social networks and graphs that are well-embeddable in a low-dimensional structure. In networks of millions of nodes tight clusters exist at only very small size scales up to around 100 nodes, while at large size scales networks becomes expander like. A network model based on Kronecker products efficiently models such core-periphery network structures. The results suggest broader implications for data analysis and machine learning in sparse and noisy high-dimensional social and information networks, where intuitive notions about cluster quality fail.

■ TB48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - Frontline Systems, Inc. - Beyond the Excel Solver: Teaching and Practicing Management Science

Daniel H. Fylstra, Frontline Systems, Inc., P.O. Box 4288, Incline Village, NV, 89450, United States of America, dfylstra@frontsys.com

Learn how you can use Frontline's Risk Solver Platform for management science education and practice, with new textbook editions by Ragsdale and Powell & Baker. Save classroom time with one easily learned package for linear and nonlinear optimization, risk analysis and Monte Carlo simulation, sensitivity analysis and decision trees, while smoothly handling old and new versions of Windows and Excel.

2 - Maximal Software - Why is Maximal Now Giving Away Free Development Copies of MPL for Windows and MPL for Python?

Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

We at Maximal have now decided to fundamentally change how we sell our software, by greatly reducing how much you pay for development copies of MPL, in many cases bringing the actual cost down to zero. We will explain several new programs: "Pay Maintenance Only," "Subscription-Based Pricing," "Free Development Copies of MPL" and "Free Software for Academics." In the second part of the tutorial, we will introduce "MPL for Python," a new scripting and library interface for the MPL Modeling Language that takes full advantage of the many powerful features of Python.

■ TB49

C -Room 10, Level 2- Mezzanine

On-line Markets

Sponsor: Information Systems
Sponsored Session

Chair: Vallabh Sambamurthy, Michigan State University, College of Business, East Lansing, India, sambamurthy@bus.msu.edu

1 - Reputation and Uncertainty in On-Line Markets: An Experimental Study

Sarah Rice, University of Connecticut, 2100 Hillside Road, Storrs, United States of America, Sarah.Rice@business.uconn.edu

We employ a modified investment game to study how on-line reputation ratings are assigned and thus, how electronic reputations are formed in transactions where buyers and sellers interact anonymously. Of particular interest are the important questions of how reputations evolve and how specific reputation information is interpreted by market participants.

2 - The Moral Hazard Problem of Click Fraud Detection - Advertiser versus Online Search Provider

Min Chen, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080, United States of America, min.chen@utd.edu, Suresh Radhakrishnan, Young Ryu, Varghese Jacob

Online search providers (OSP) and advertisers often enter into a pay per click method of payment for advertisements on the search site. Click fraud is a critical problem in such scenarios. Since the OSP is better off with a high number of clicks (whether fraudulent or not) and the advertiser is worse off if many of the clicks are fraudulent, the incentives for fraud detection are not aligned. We study this problem in a principal-agent setting and characterize the equilibrium solution.

3 - Online Gambling Behavior: A Multilevel Dynamic Panel Data Analysis

Sung Kim, UW-Madison, 975 University Ave., Madison, United States of America, skim@bus.wisc.edu, Seung Hyun Kim, Xiao Ma

The objective of this study is to understand how prior use (e.g., regular use and integrative use) as well as prior outcomes (e.g., cumulative and recent outcomes) influence online gambling behavior. In order to test research hypotheses, we employed longitudinal panel data collected over eight months from actual users of a gambling website. Overall, our results suggest that an understanding of online gambling is incomplete unless both prior use and prior outcomes are taken into account.

■ TB50

C -Room 11, Level 2- Mezzanine

Joint Session Cloud/MIF: Stochastic Models for Cloud Computing

Cluster: Cloud Computing/ Minority Issues
Invited Session

Chair: Robert Hampshire, Professor, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, hamp@andrew.cmu.edu

1 - Optimal Routing Policies for Heterogeneous Server Farms

Varun Gupta, Computer Science Department, Carnegie Mellon University, Pittsburgh, United States of America, varung@cmu.edu, Mor Harchol-Balter

We look at the problem of finding optimal routing policies in server farms with heterogeneous servers. Job sizes are Exponentially distributed, and jobs must be dispatched to a server on arrival. We present the first non-trivial light and heavy-traffic analysis of various shortest-queue routing variants in a 'many-servers limit', and prove that the Minimum Expected Delay routing is suboptimal with respect to minimizing mean sojourn time.

2 - Nonstationary Loss Networks

Robert Hampshire, Professor, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, hamp@andrew.cmu.edu

This presentation introduces an approximation for nonstationary Loss networks. The approach combines the standard Erlang fixed point formula with the modified offered load approximation. This approach is accurate and is more computationally tractable than existing methods in the literature. The resulting loss probabilities are compared to results in literature and simulation of the loss network. Additionally, bounds are provided for the accuracy of the approximation technique.

3 - Optimal Capacity Planning of Stochastic Loss Networks Under Service Level Constraints

Cathy Xia, Associate Professor, The Ohio State University, 210 Baker Systems Engineering Bldg, 1971 Neil Ave, Columbus, OH, 43210, United States of America, xia.52@osu.edu, Amit Gera

Motivated from the resource provisioning problem for firms who provide cloud computing as a service, we consider the optimal capacity planning of loss networks where the blocking probabilities are subject to stringent service level constraints. We propose efficient algorithms to search for the optimal solution and derive various asymptotic properties.

■ TB51

C -Room 12, Level 2- Mezzanine

National Security Research at RAND I

Sponsor: Military Applications
Sponsored Session

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

1 - Relating Repair Network Resources to Military Capabilities

Ben Van Roo, Associate Researcher, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90407, United States of America, vanroo@rand.org

Senior Air Force logistics leaders asked RAND to analyze the logistics enterprise to identify the basic issues and premises on which the Air Force plans, organizes, and operates its logistics enterprise from a total force perspective. Our presentation describes an analysis of repair network options to support three weapon systems: C-130, KC-135, and F-16. We evaluate the efficiency and effectiveness impacts of consolidating certain network activities to centralized repair facilities.

2 - The Army's Global Posture

Paul Dreyer, Mathematician, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90401, United States of America, dreyer@rand.org, Thomas Szayna, Lisa Saum-Manning, Derek Eaton

In this talk, we recommend ways to improve future Army responsiveness and effectiveness by restructuring basing locations outside the United States. We will discuss both the methods used to filter down the set of potential locations, as well as the optimization model used to determine a "robust" set of bases to deliver materiel to a set of contingencies around the globe in a timely fashion.

3 - Creating Parts Groups for Inventory Management

Jeffrey Tew, Sr. Operations Researcher, RAND Corporation, 1776 Main St., Santa Monica, CA, 90407, United States of America, jtew@rand.org

The ARMY has tens of thousands of types of parts in it's managed inventory system. Having such a broad array of part types creates difficulties in demand forecasting and overall inventory management. In this presentation, we outline various methodologies or algorithms that have been proposed in the recent literature and offer critiques of each. We also propose a unique parts classification or grouping algorithm that is both easy to implement and effective for large scale inventory systems.

■ TB52

C -Room 13, Level 2- Mezzanine

Challenges in Defending Interdepedent Infrastructure Systems

Cluster: Homeland Security and Defense
Invited Session

Chair: David Alderson, Assistant Professor, Naval Postgraduate School, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, 93943, United States of America, dlalders@nps.edu

1 - A Bi-Level Stochastic Program for Strategic Infrastructure Investment for Disasters

Srinivas Peeta, Professor of Civil Engineering, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47907-2051, United States of America, peeta@purdue.edu, Lili Du

This study develops a bi-level stochastic program to identify the components of the transportation infrastructure to strengthen in the context of pre-disaster planning. Thereby, through investment, we seek to reduce the response time in transportation networks for associated risk factors across various disaster scenarios. A heuristic algorithm is developed to iteratively solve the models to obtain "good" feasible solutions. The associated insights for the key factors are also presented.

2 - Accounting for Temporal Dynamics in Network Vulnerability Assessment

Timothy Matisziw, Assistant Professor, University of Missouri, Department of Civil & Environmental Eng, Columbia, MO, 65211, United States of America, matisziwt@missouri.edu, Junyu Guo, Tony Grubesic

Identifying vulnerabilities in networked systems is central to safeguarding against threats. However, one complicating factor is that a network's utilization can be temporally dynamic and as such, so can it's vulnerability. To address this issue, a mathematical program for efficiently generating bounds on network vulnerability is proposed. The developed methodology is applied to a large, real-world network to highlight the significance of temporal dynamics in vulnerability assessment.

3 - Trust as a Driver of Functional Dependency Networks for Response and Strategic Preparednesss

Michael Vedomske, University of Virginia, 151 Engineers Way, Room 112, Post Office Box 400736, Charlottesville, 22904, United States of America, mav7t@virginia.edu, Kenneth Crowther

A naturally occurring, or trust-based, regional infrastructure protection information sharing network architecture exists and is resorted to over formal architectures in response to infrastructure system disruptions. Understanding the formulation and structure of trust is requisite to adequately prepare and leverage these natural functional dependencies and may lead to the design of risk related information sharing architectures for strategic preparedness that are both secure and efficient.

■ TB53

C -Room 14, Level 2- Mezzanine

Marketing Models of Boundedly Rational Consumers

Sponsor: Marketing Science
Sponsored Session

Chair: Raghunath Rao, University of Texas at Austin, 1 University Station B6700, Department of Marketing, Austin, TX, 78712, United States of America, Raghunath.Rao@mccombs.utexas.edu

1 - Marketing of Vice Goods

Sanjay Jain, Professor, Texas A&M University, Mays Business School, College Station, 77843, United States of America, sjain@tamu.edu

Consumers often are unable to resist the temptation of over-consuming certain products such as cookies, crackers, soft drinks, alcohol etc. In order to control their consumption, some consumers abstain from purchasing the product or buy small packages. We use the literature on hyperbolic discounting to model consumers' self control problems and examine how such self-control problems can alter the nature of competition between firms.

2 - Identifying Preferences and Expectations About Others in Strategic Interactions: Role of Projection

Yesim Orhun, Assistant Professor, University of Chicago, 5807 S Woodlawn Ave, Chicago, United States of America, yesim.orhun@chicagogsb.edu

I show a relationship between an individual's own preferences for altruism and the (implicit or explicit) expectations of others' actions in modified dictator games, violating the assumption of mutual consistency in expectations. In modified lost-wallet games, where strategic actions depend on trust in the other person's altruism along with an individual's own preference for altruism, considering the impact of systematically different beliefs resolves alleged preference-intransitivities.

3 - Loss Aversion in Durable Goods Markets with Resale

Raghunath Rao, University of Texas at Austin, 1 University Station B6700, Department of Marketing, Austin, TX, 78712, United States of America, Raghunath.Rao@mccombs.utexas.edu, Om Narasimhan, George John

We analyze a model of a durable goods market whereby new goods are under a producer's control but there coexists an outside resale market. Consumers are reference-dependent but sophisticated and reference points are endogenous. Our model produces an effect akin to endowment effect and suggests a surprising outcome that the reference-dependence of consumers decreases firm profits. We relate this loss of profits to the impact of reference-dependence on well-known resale and substitution effects.

■ TB54

C -Room 15, Level 2- Mezzanine

KLIC: Management and Evolution of Knowledge

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: David Moore, klicnet.org, 16312 SE 4th Street, Bellevue, WA, 98008, United States of America, dmoore@klicnet.org

1 - How Flying Got Smarter: 5 Stages of Control Knowledge

Roger Bohn, Professor, UC San Diego, IR/PS 0519, 9500 Gilman Drive, La Jolla, CA, 92093-0519, United States of America, Rbohn@ucsd.edu

Flying, like many other technologies, started as a craft activity based on personal skill. It is now "scientific," including highly standardized, procedural, and predictable. Control in flying evolved through five stages of knowledge: Craft, Rules + Instruments, Standard Procedures, Automation, and Computer Integrated Flight. Each was a different paradigm and required unlearning previous control behavior. However, older stages are still used for some activities.

2 - A Dynamic Model of Individual and Group Learning Amid Disruption

Kyle Lewis, Professor, University of Texas at Austin, Austin, TX, United States of America, Kyle.Lewis@mccombs.utexas.edu, Edward Anderson

Using the system dynamics methodology, we model the relationship between disruptive events and learning and productivity in organizations by leveraging the theories of learning-by-doing and transactive memory systems to model the interplay between learning at the group and individual levels. We then simulate the impact of various disruptive events, such as employee turnover, innovation, reorganization, and extreme events on productivity. Implications of this research are then discussed.

3 - Organizational Knowledge and the Effects of Turnover

Anne Woolstenhulme, PhD Candidate, DESB, University of Utah, 1645 E. Campus Center Drive, Salt Lake City, UT, 84105, United States of America, anne.woolstenhulme@business.utah.edu

The inertness of collective organizational knowledge is frequently invoked in the knowledge-based view to explain persisting differences in capabilities and performance among firms. This paper reflects on organizational knowledge in the context of research frameworks that unpack structural mechanisms of collective cognition in order to consider the effects of turnover on firm knowledge.

4 - Operating on the Learning Curve: Leveraging Modularity and Influence to Improve Surgery Performance

David Moore, klicnet.org, 16312 SE 4th Street, Bellevue, WA, 98008, United States of America, dmoore@klicnet.org

Surgery has a scientific basis, yet surgeons also employ discretion and skill in non-standard, artful arrangements. Experienced surgeons develop and refine custom routines. Eventually, performance improvements can stem more from changes in case mix, surgical team composition and upstream/downstream care units than from a surgeon's individual improvement. A surgeon must then learn how to leverage personal influence to further improve performance. Hospital field study findings will be shared.

■ TB55

C -Room 16, Level 2- Mezzanine

Incentives and Organizational Issues in R&D and Product/Service Design

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Yi Xu, University of Maryland, 4312 Van Munching Hall, College Park, MD, 20742, United States of America, yxu@rhsmith.umd.edu

1 - Stakeholders' Influence on Product Design Decision with Exogenous Uncertainty

Zhijian Cui, PhD Candidate, INSEAD, Constance de Blvd, Fontainebleau, France, Zhijian.CUI@insead.edu, Christoph Loch

With inaccurate information of uncertainty (e.g. market shock), stakeholders lack consistent and "objective" interpretation of a commonly shared target. It is not clear from the literature how stakeholders' strategic interactions infuence product design in such environment. This research tries to open the "black box" of R&D organizations by comparing design outputs in various situations of decision power distribution and task priorities. Simple test supports some of the insights.

2 - Integrating Social Network Effects in Product Design

Dilek Gunnec, PhD Candidate, University of Maryland, R.H.Smith School of Business, College Park, MD, United States of America, dgunnec@rhsmith.umd.edu, S. Raghavan

We propose to incorporate social network effects in customers' purchasing decisions by including it in the share-of-choice problem. We describe a genetic algorithm approach for this NP-hard problem. We also introduce a secondary problem of determining the least expensive way of influencing individuals in a social network. This problem addresses contagion models and the issue of determining influential nodes, which are of significant interest in marketing and epidemiological settings.

3 - Designing Experiential Services: The Customer Journey Perspective

Stylianos Kavadias, Associate Professor, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, United States of America, Stylianos.Kavadias@mgt.gatech.edu, Ioannis Bellos

We explore the design challenges of an organization that develops an experiential service, i.e. consumers value both the functional utility and their holistic experience. Past literature (e.g. IDEO) advocates the value of the "customer journey": services are (coproduction) touchpoints between the consumer and the service provider. We identify the non-monotonic effects of the coproduction losses and the service complexity on the design decisions, i.e. price, and touchpoints she controls.

4 - The Impact of Royalty Contract Revision in a Multi-stage Strategic R&D Alliance

Yi Xu, University of Maryland, 4312 Van Munching Hall, College Park, MD, 20742, United States of America, yxu@rhsmith.umd.edu, Wenqiang Xiao

In a R&D alliance, firms often revise pre-agreed royalty contract. We study how the potential for royalty contract revision impacts incentives, contract design, and profits in a two-stage (R&D stage and marketing stage) alliance. We find that royalty contract revision is beneficial in a R&D alliance with low technical uncertainty and high market uncertainty, and low degree of information asymmetry.

■ TB56

C - Room 1, Level 1

Efficient Monte Carlo Methods with Applications to Risk and Finance

Sponsor: Simulation Society
Sponsored Session

Chair: Jose Blanchet, Columbia University, 500 W 120th Suite 340, New York, NY, United States of America, jose.blanchet@columbia.edu

1 - Efficient Simulation and Conditional Functional Limit Theorems for Ruinous Heavy-tailed Random Walks

Jingchen Liu, Columbia University, 1255 Amsterdam Ave, Room 1030, New York, NY, 10027, United States of America, jcliu@stat.columbia.edu, Yixi Shi

In this talk, we consider the ruin problem, for which we constructed a strongly efficient estimator based on importance sampling, explained explicitly for what situation the proposed algorithm possesses lower computation cost than the zero variance change of measure. In addition, the change of measure approximates the conditional random walk in total variation which allows us to derive conditional limit theorems given ruin.

2 - Simulation Evaluation of Systemic Risk in an Insurance Network

Yixi Shi, Columbia University, New York, NY, United States of America, ys2347@columbia.edu, Jose Blanchet

We discuss a network model for the insurance market in which a centralized reinsurer takes up residual heavy tailed risks from a group of insurance companies. We model claims following a linear factor model with regularly varying common and idiosyncratic factors. We study and evaluate a macro-level risk measure called "Systemic Risk Index" (SRI). This index captures the expected losses the system bears conditional on the bankruptcy of a subset of the agents.

3 - Regression Algorithms for Nested Simulation of Risk

Yiping Du, Columbia University, 500 West 120th Street, New York, 10027, United States of America, yd2166@columbia.edu, Ciamac Moallemi, Mark Broadie

We analyze the computational problem of estimating financial risk in a nested simulation. We compare a regression-based approach, which seeks to extrapolate estimates of portfolio loss across scenarios, to the standard multi-stage Monte Carlo estimator. We illustrate these approaches with theoretical results and numerical experiments.

4 - Bootstrap and Importance Resampling for Computing Large Deviations for Markov Chains

Xiaowei Zhang, Stanford University, 380 Panama Way, Stanford, CA, United States of America, xiaoweiz@stanford.edu, Peter Glynn, Jose Blanchet

One existing method to efficiently compute large deviations of additive functionals of Markov chains involves solving an associated eigenvalue problem and sampling from the "exponentially twisted" transition kernel, both of which are challenging from the implementation prospective when the state space is large or continuous. We propose a bootstrap approach combined with importance resampling to address the above two issues by exploring the regenerative structure of the Markov chains.

■ TB57

C - Room 2, Level 1

Problems 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 - Log-Robust Portfolio Management with Parameter Ambiguity

Ban Kawas, Lehigh University, 200 W Packer Ave, Bethlehem, PA, 18015, United States of America, bhk206@lehigh.edu, Aurelie Thiele

We present a scenario-based approach to log-robust portfolio management in which the model parameters have several possible estimates. We discuss both the independent and correlated assets models. For the independent assets case, we derive a tractable convex problem which can be solved efficiently for a large number of assets. For the correlated assets case, we suggest a tractable heuristic that utilizes the theoretical insights derived in the independent assets case. Results are encouraging.

2 - Learning to Bid: The Design of Auctions Under Uncertainty and Adaptation

Michael Rebello, Professor, University of Texas at Dallas, mrebello@utdallas.edu, Thomas Noe, Jun Wang

We examine auction design in a context where symmetrically informed agents with common valuations learn to bid for a good. We show that bidder strategies, even in the long run, do not converge to the Bertrand-Nash equilibrium strategies. Although individual agents learn Nash bidding in isolation, the learning of each agent, by flattening the best reply correspondence of other agents, blocks common learning.

3 - Empirical Analysis of Tick Sizes and Exchange Efficiency

Benjamin Van Roy, Associate Professor, Stanford University, Terman 315, Stanford University, Stanford, CA, 94305, United States of America, bvr@stanford.edu, Waraporn Tongprasit

We discuss empirical methods for analysis of exchange efficiency and their application to a study of tick size changes in the Stock Exchange of Thailand. Contrary to conventional wisdom that these changes enhanced efficiency, our analysis suggests that efficiency significantly decreased for some stocks.

4 - A Heavy Traffic Approach to Emerging Cost Analysis in Insurance Risk Management

Henry Lam, PhD Candidate, Harvard University, Department of Statistics, Cambridge, MA, United States of America, khhlam@gmail.com, Jose Blanchet

Insurance companies run scenario simulation, or emerging cost analysis, to handle mortality and financial risk of their insurance products. Such analysis is often performed on each individual account, ignoring the massive and dynamic nature of the portfolio of policyholders. Here we model policyholders as an infinite-server queueing system, and propose a new importance sampling scheme to efficiently compute the tail of the aggregate cash flow represented as a functional of the system state.

■ TB58

C - Room 3, Level 1

Financial Engineering: Models and Computation

Cluster: Quantitative Finance
Invited Session

Chair: Steven Kou, Professor, Columbia University, 312 Mudd, Department of IEOR, New York, NY, 10027, United States of America, sk75@columbia.edu

1 - A New Derivative Estimator for Discontinuous Payoff Functions with Financial Applications

Yongqiang Wang, University of Maryland, College Park, 3182 AVW, College Park, MD, United States of America, yqwang@umd.edu, Michael Fu, Steven Marcus

We derive a new unbiased derivative estimator for a class of discontinuous payoff functions that arise in many options pricing settings from finance. Our method includes IPA and the LR method as special cases and can be applied to functions of more general forms containing indicator functions. This new estimator can be computed from a single sample path or simulation, whereas existing estimators in the literature require additional simulations.

2 - A Two-Factor Model for Electricity Spot and Futures Prices
Ning Cai, Hong Kong University of Science & Technology, Kowloon, Hong Kong - PRC, ningcai@ust.hk, Steven Kou, John Birge

We propose a model for the on-peak electricity spot and futures price. More precisely, we model the logarithm of the scaled peak demand using two independent mean reverting affine (jump) diffusion processes, which describe different mean reversion structures of normal peak demands and spikes of demands separately, and then derive a model for the on-peak spot price based on the minimum Nash equilibrium for the demand-and-price function. Several advantages relating to our model are discussed.

3 - Online Resource Allocation Problems
Patrick Jaillet, Massachusetts Institute of Technology, 77 Massachusetts Ave, Cambridge, MA, United States of America, jaillet@mit.edu, Xin Lu

Inspired by applications where dynamic resource allocations arise naturally, such as in sponsored search auctions, we formulate an online general assignment problem that captures aspects of these applications. We then consider the design and analysis of online algorithms for these problems, from either greedy principles or primal dual techniques. (Research funded in part by ONR, grant N00014-09-1-0326.)

4 - Pricing Asian Options Under a General Jump Diffusion Model
Steven Kou, Professor, Columbia University, 312 Mudd, Department of IEOR, New York, NY, 10027, United States of America, sk75@columbia.edu, Ning Cai

We obtain a closed-form solution for the double-Laplace transform of Asian options under a hyper-exponential jump diffusion model. Similar results are only available previously in the special case of Black-Scholes model (BSM). Even in the case of BSM, our approach is simpler as we essentially use only the Ito's formula and do not need more advanced results such as Bessel processes and Lamperti representation. Numerical results indicate that our pricing method is fast, stable, and accurate.

■ TB59

H - Salon A, 4th Floor

Research and Development

Contributed Session

Chair: Ali Yassine, Associate Professor, American University of Beirut, Bliss Street, Beirut, Lebanon, ay11@aub.edu.lb

1 - An Optimal Model for Improving Reliability and Validity of Internet-based Survey Research
Xishu Li, Southwestern University of Finance and Economics, Street Guanghuacun 55, Chengdu, 610074, China, lisr@swufe.edu.cn, Shaorui Li

Reliability and validity are critical to Internet-based survey research. This study develops an optimal model to maximize the total weighted contributions of respondents under the precondition of maximal response rate. And the maximal response rate is achieved by employing a nonmyopic strategy and a response-inducement method in batches of surveies. The computational experiments using benchmark data indicate our approach is both effective and efficient.

2 - Effects of Lifting Unexpected Loads on Human Postural Control
Dingding Lin, IBM Chinese Research Laboratory, Building 19, Zhongguancun Software Park, 8 Dongbeiwang West Rd, Haidian District, Beijing, 100193, China, ddlin@cn.ibm.com

Manual material handling tasks can challenge postural control and are linked to increased falling risk. This experimental study evaluated the effects of lifting unexpectedly heavy and light objects on human postural control performance. Each of 16 participants was exposed to both expected and unexpected lifting loads. The results indicated that lifting an unexpected load compromised postural control, with a more substantial effect found in the unexpectedly light condition.

3 - Systemic Processes of Evolutionary Knowledge Organization in Pharmaceuticals
Carl Henning Reschke, Researcher, Member of the Board, IMFK - Institute for Management Research Cologne, Mainzer Str. 80, Cologne, 50678, Germany, carlhenning.reschke@imfk.de

The paper explores how a view of evolution as a knowledge generating process and mathematically related perspectives can contribute to an integrated perspective on the evolution of complex information organization linking perspectives from biology and the social sciences. I use the example of punctuation patterns in the history of pharmaceutical innovations to discuss models with respect to their suitability for an integrated perspective on information organization in natural and social systems.

4 - Patent License Arrangements and Contracts: A Option Game Approach
Kei Takahashi, PhD Student, Waseda University, 3-4-1 Okubo, Shinjuku-ku, Tokyo, 169-8555, Japan, takahashi@toki.waseda.jp, Takahiro Ohno, Kazutoshi Kumagai

In this paper we propose a framework for patent license contracts between licensers and licensees with a real option game approach. In this game, licensers maximize their utilities by choosing terms of contracts such as fixed fees and royalties. On the other hand, licensees maximize their profits from licenses by choosing their initial contract timings. Comparing many strategies about contract terms, we disclose Pareto improvement domains from a strategy only using fixed fees.

5 - Optimal Information Exchange Policies in Integrated Product Development
Ali Yassine, Associate Professor, American University of Beirut, Bliss Street, Beirut, Lebanon, ay11@aub.edu.lb, Bacel Maddah, Nabil Nehme

We consider information exchange in an integrated product development (IPD) environment. We first formulate a DP model to capture upstream partial information flow in a 2-activity IPD process. We derive a threshold policy to aid the downstream activity in deciding whether to consider or ignore this information as a function of information quality and rework cost. We expand this formulation to a 3-activity IPD process and present simulation results to illustrate the superiority of IPD practices.

■ TB60

H - Salon B, 4th Floor

Portfolio Decision Analysis III

Sponsor: Decision Analysis
Sponsored Session

Chair: Alec Morton, LSE, Houghton St, London, United Kingdom, a.morton@lse.ac.uk

1 - Decision Analysis as a Socio-technical System for Decision Support
Lawrence Phillips, London School of Economics & Political Science, Department of Management, Houghton Street, London, WC2A 2AE, United Kingdom, larry_phillips@msn.com

Key features from seven social-science topics that contribute to successful applications of decision analysis in organizations are summarized in this talk. The topics are: (1) individual and group decision making, (2) the goal-directedness of behavior, (3) strategic thinking and management, (4) group dynamics and team-working, (5) the structure of organisations, (6) relationships between people in organisations, (7) and facilitation and process consultancy skills.

2 - Portfolio Decision Analysis for Population Health
Mara Airoldi, LSE, London, United Kingdom, m.airoldi@lse.ac.uk

We outline the challenges facing the application of Portfolio Decision Analysis to population health drawing from our extensive work with local healthcare planners in England. Healthcare planning is dominated by two communities of analytic professionals. Public health analysts attempt to understand the extent of disease which generates the need for healthcare; health economists focus on the cost-effectiveness of particular interventions. A key challenge is integrating these two perspectives.

3 - Facilitated Portfolio Analysis in Local Government
Gilberto Montibeller, London School of Economics and Political Science, Houghton St, London, United Kingdom, g.montibeller@lse.ac.uk, Alberto Franco

Many local authorities tend to look at decisions in departmental silos rather than whole portfolio of services. This approach typically leads to inefficiencies, as value for money is infrequently measured and the best allocation of scarce resources is not considered across different portfolio service areas. In this paper we discuss how such allocation may be improved in local government and illustrate our suggestions with several facilitated portfolio analysis projects that we have conducted.

4 - Behavioral Issues in Portfolio Decision Analysis
Barbara Fasolo, Lecturer, London School of Economics and Political Science, Department of Management, Houghton St, London, WC2A 2AE, United Kingdom, b.fasolo@lse.ac.uk, Alec Morton, Detlof von Winterfeldt

A considerable amount is known about the vagaries of judgement in choice under uncertainty and under multiple criteria. In this talk we review some behavioural literature on biases which arise in resource allocation setting. We complement this theoretic perspective with a discussion of behavioural issues observed in the field in several actual portfolio decision analyses, and suggest directions for future work in this area.

■ TB61

H - Room 400, 4th Floor

Operations Management II

Contributed Session

Chair: Bruce Wang, Assistant Professor, Texas A&M University, 3136 TAMU, Zachry Department of Civil Engineering, College Station, TX, 77843, United States of America, bwang@tamu.edu

1 - Advance-purchase-contracts with Retailer Promotional Efforts
Xiuli He, Assistant Professor, University of North Carolina-Charlotte, 9201 University City Blvd, BISOM Dept, Charlotte, NC, 28213, United States of America, xhe8@uncc.edu

We consider a supply chain in which the manufacturer allows the retailer to preorder before the selling season starts. Furthermore, the retailer may exert promotional effort before or during the selling season. We investigate the retailer's optimal ordering policy and the manufacturer's production decision with two ordering opportunities.

2 - Relief Operations Management for Earthquake in Bogotá
Diomar Norena, Graduate Assistant, Universidad de los Andes, Cra 1 Este # 19A-40, Bogotà, Colombia, dl.norena34@uniandes.edu.co, Raha Akhavan-Tabatabaei

We present an allocation model for one zone in the city of Bogotà to transfer injured people to temporary and permanent hospitals, through the use of operation research tools. The model takes into account a damage scenario, and uses some information such as hospital capacity and occupation rate as well as the number of ambulances in the zone, permanent and temporary hospitals, duration of routes, etc. The outcomes can be used as a tool by the government agencies to reduce the uncertainty impact.

3 - Dynamic Pricing Under Competition with Coupling Constraints
Ruxian Wang, Columbia University, 313, 500W, 120 St, New York, NY, United States of America, rw2267@columbia.edu

In this paper, we consider oligopoly pricing problems where player can sell their own capacity as capacity belonging to competitors. The players compete for customers and capacities by dynamically changing prices. We formulate this problem into a finite horizon differential game with coupling constraints and characterize the equilibrium.

4 - Supply Chain Scheduling with the Types of SLK\TWK Assignable Due Dates
Rui Zhang, PhD, McMaster University, 1280 Main Street West, Hamilton, Canada, zhangr6@mcmaster.ca, George Steiner

In this paper, our goal is to find a schedule minimizing the sum of the weighted number of tardy jobs and the batch-delivery costs with the SLK\TWK types assignable due dates. We first prove that the problems are NP-hard in the ordinary sense by presenting pseudo-polynomial algorithms. We then convert the algorithms into fully polynomial time approximation algorithms.

5 - Testing the Disney World Restaurant Revenue Management Models
Bruce Wang, Assistant Professor, Texas A&M University, 3136 TAMU, Zachry Department of Civil Engineering, College Station, TX, 77843, United States of America, bwang@tamu.edu, Yihua Li, Kai Yin, Lila Rasekh

Some optimization models for the Disney World restaurant table reservation system have been developed. These static models determine allocation of tables to customer requests with an objective to maximize the total revenue. The presentation will focus on the numerical performances and some analytical results of the models.

■ TB62

H - Room 402, 4th Floor

Software Demonstrations

Cluster: Software Demonstrations

Invited Session

1 - The MathWorks - Discrete Event Simulation with SimEvents
Anuja Apte, Product Marketing Manager, The MathWorks, 3 Apple Hill Dr., Natick, MA, 01760, United States of America, anuja.apte@mathworks.com

SimEvents is the discrete event simulator in MathWorks product family. This presentation will cover: (1) introduction to SimEvents - the integration of MATLAB, Simulink and other MathWorks tools in a typical SimEvents workflow; (2) process simulation with SimEvents - product demonstrations that illustrate the use of SimEvents for process simulation to analyze bottlenecks, processing delays and resource requirements.

2 - ac2 Solutions - Supply Chain Management for Service Operations: Workforce Management and Performance Optimization using ac2 AWO Portal
Turgut Aykin, President & CEO, ac2 Solutions, 12 Crown Plaza, Ste. 207, Hazlet, NJ, 07730, United States of America, taykin@ac2solutions.com

Advanced Workforce Optimization (AWO) Portal by ac2 Solutions offers (1) advanced forecasting models for multiple seasonal patterns found in service systems such call centers, hospitals, and back offices; (2) ILP-based schedule optimization (work/off days, daily shift and break times) for centers with 10 to 20,000+ agents and complex scheduling rules in both skills-based and non-skills based environments; (3) strategic planning; and (4) performance optimization using real-time re-optimization and re-forecasting, scorecards, dashboards and agent adherence. We will take an in-depth look at the various capabilities offered and how they are used in call centers to manage workforce and optimize performance.

■ TB63

H - Room 404, 4th Floor

Rare Events and Surprising States

Sponsor: Decision Analysis

Sponsored Session

Chair: Frank Koch, Decision Analysis Practice Leader, Chevron Project Resources Co., 1400 Smith Street, Houston, TX, 77002, United States of America, FGKO@chevron.com

1 - Managing Extreme Uncertainty: Example with Enhanced Oil Recovery
Larry Lake, The University of Texas- Austin, Department of Petroleum Engineering, Austin, TX, United States of America, larry_lake@utexas.edu, Robert Gilbert

A framework will be described to capture the effect of extreme uncertainty in making decisions. This framework establishes probabilities that maximize uncertainty in the decision at hand. These "non-informative" probabilities can be updated with any available information through Bayes' Theorem. The framework provides a sound basis for assessing probabilities, even when little or no information is available. It will be illustrated with a decision about implementing enhanced oil recovery.

2 - Common Errors That Lead to Variance Estimate Bias
John Lehman, Managing Director, SDG-Galway Energy Strategy Practice, 3050 Post Oak Blvd., Suite 1300, Houston, TX, 77056, United States of America, johnlehman@att.net

I will demonstrate how the misuse of several common estimation techniques results in narrow distributions. Specifically, I will address the application of "Swanson's Rule" and the use of discrete proxies for continuous distributions, assumptions of distributional symmetry and the misuse of correlation. Finally, I will consider the common problem of making decisions among output distributions where strict dominance doesn't apply, and the possible application of "economic capital" criteria.

3 - Expecting the Unexpected: Surprises in Past and Future Energy Forecasts
Max Henrion, Chief Executive Officer, Lumina Decision Systems, Inc, 26010 Highland Way, Los Gatos, CA, 95033, United States of America, henrion@lumina.com

Comparing the last 30 years of energy consumption and price forecasts with what happened helps identify some reasons for past surprises. Using these as inspiration, we apply the probabilistic ATEAM model to explore the effects of possible future surprises in transportation fuel and technology on the US vehicle fleet.

4 - Historical Cases Dealing with Rare Events
Jim Matheson, Chairman, SmartOrg, Inc., 855 Oak Grove Avenue, Suite 202, Menlo Park, CA, 94025, United States of America, jim@drak.com

In the erstwhile SRI Decision Analysis Group we treated several cases dealing with rare events. I will discuss a couple of notable ones, such as contaminating Mars with Earth organisms and Nuclear Reactor Safety. In addition I will review a few general approaches and tools for approaching rare event situations.

■ TB64

H - Room 406, 4th Floor

Health Care, Modeling and Optimization II

Contributed Session

Chair: Arun Chockalingam, Visiting Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, achockal@purdue.edu

1 - Using Bayesian Methods to Parameterise Distributions for Surgical Procedure Durations

Louis Luangkesorn, Visiting Assistant Professor, University of Pittsburgh, 1048 Benedum Hall, 3700 O'Hara St., Pittsburgh, PA, 15261, United States of America, lol11@pitt.edu, Zeynep Feliz Eren

As part of a study of scheduling at a surgical suite in an urban hospital we developed methods to determine probability distributions for the duration of surgical procedures, 84% of the procedures identified over a 4 year period occurred fewer then 10 times. We used data, expert estimates, and expert classification of procedures. We discuss the method employed as well as procedures used to validate the relationship between the classification of procedures and the surgery duration variance.

2 - World Wide Investigation of Tuberculosis Epidemics

Kathryn Hoad, Assistant Professor, Warwick Business School, University Road, Coventry, United Kingdom, kathryn.hoad@wbs.ac.uk, Christine Currie

There is a need to better understand TB disease in populations so that interventions can be targeted appropriately. This paper will analyse data from the World Health Organization for both age and time related TB incidence to categorise different TB epidemic 'shapes' and investigate the important drivers of these different 'types' of epidemics.

3 - Resource Distribution Strategies for Mitigation of Cross-regional Influenza Pandemics

Andres Uribe, Doctoral Student, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, auribe@mail.usf.edu, Alex Savachkin

Existing models for pandemic containment and mitigation lack dynamic decision support capabilities. We develop a simulation-based optimization model for generating dynamic resource distribution strategies over a network of regions exposed to a pandemic influenza. The model is implemented on a four-region outbreak in Florida and the resulting strategy is compared to two common distribution policies, pro-rata and myopic.

4 - A Dynamic Structural Learning Model of Mobile Technology Adoption

Haijing Hao, PhD Student, Carnegie Mellon Unviersity, 5000 Forbes Ave., Heinz College, Pittsburgh, PA, 15213, United States of America, haohaijing@cmu.edu, Rahul Telang, Rema Padman

We construct a Bayesian based dynamic structural model of consumers' adoption behavior of a new mobile technology application which was deployed within a community hospital in western Pennsylvania. Results indicate that one of the signals that may affect consumers' uncertainty about learning the technology is the effect of opinion leaders.

5 - Operational Management of Hospital Resources using Petri-nets and Stochastic Impulse Control

Arun Chockalingam, Visiting Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, achockal@purdue.edu, Mark Lawley, Krishna Jayakumar

Emergency Department (ED) overcrowding, a common problem in the US, presents a barrier to the safe and timely delivery of health-care. Hospitals divert ambulances to the nearest available hospital to counter this problem, but lose patients and revenue. We discuss a framework, utilizing Petri-nets and stochastic control theory, to develop optimal control policies which dictate when and how many resources should be added or removed from the ED to best avoid divert and maximize operational profit.

■ TB65

H - Room 408, 4th Floor

Inventory Management II

Contributed Session

Chair: Alp Akcay, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, aakcay@andrew.cmu.edu

1 - End-of-life Inventory Decisions with Remanufacturing Control Policy and Phase-out Returns

Morteza Pourakbar, Erasmus University Rotterdam, BurgOudlaan 50, Rotterdam, Netherlands, pourakbar@few.eur.nl, Rommert Dekker, Erwin van der Laan

We consider the problem of placing a final order quantity and controlling the remanufacturing operation of spare parts in the final phase of production. We characterize the structure of the optimal policy in terms of time and state dependent threshold policies.

2 - Optimal Risk Pooling for Raw Material Inventories: The Use of Substitution Flexibility

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 an inventory system with tailored flexibility, where each end item requires a dedicated (cost-efficient) raw material. A flexible (more expensive) material can be used as a substitute if the dedicated material stocks out. Through the use of tailored flexibility, we want to take advantage of the inherent trade-off between the reduction in safety stock (caused by risk pooling on the flexible material) and the increase in flexibility costs.

3 - Inventory-target Estimation in the Presence of Auto-correlated Demand Data

Alp Akcay, Carnegie Mellon University, Tepper School of Business, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, aakcay@andrew.cmu.edu, Bahar Biller, Sridhar Tayur

An important practical problem associated with the effective management of inventories is to set inventory targets in the absence of complete information about the demand distribution. We address this problem in a repeated newsvendor setting by using the concept of expected total operating cost and estimating the inventory target from limited auto-correlated demand data.

■ TB66

H - Room 410, 4th Floor

Logistics II

Contributed Session

Chair: Kemal Alaykiran, Gazi University, Gazi Universitesi Mühendislik-Mimarlik, Fakültesi Eti Mah. Yükselis sok. No 5, Ankara, Turkey, kalaykiran@gazi.edu.tr

1 - Analysis of Periodic Policies for the Inventory Routing Problem

Luca Bertazzi, Professor, University of Brescia, Contrada Santa Chiara 50, Brescia, 25122, Italy, bertazzi@eco.unibs.it, Lap Mui Ann Chan, M. Grazia Speranza

We study a distribution system where the sum of transportation and inventory costs is minimized. We show that the best fixed partition periodic policy has a tight asymptotic performance ratio of 3/2 with respect to the best possible policy, while the ratio is about 1.202 for the best partition based periodic policy. We also show that this ratio is the tight asymptotic upper bound for any feasible partition based policy. Finally, we test heuristic implementations of the analyzed policies.

2 - Vendor Managed Logistics: Dynamic Consolidation of Supplier Pallet Shipments

Milad Ebtehaj, University of Massachusetts-Amherst, 121 Presidents Drive, Amherst, MA, 01003, United States of America, mebtehaj@som.umass.edu, Agha Ali

Vendor managed logistics can occur in scenarios that require replenishment of product in pallets, such as in seasonal replenishment of supply or when mandated by large retailers. Dynamic consolidation of pallet shipments allows simultaneous improvement in total system miles and capacity utilization. We report computational experience with replenishment scenarios of up to six product families and hundreds of demand points to quantify the efficacy of dynamic consolidation.

3 - A Hybrid Algorithm for Location Routing Problem with Simultaneous Pickup and Delivery

Fulya Altiparmak, Gazi University, Ankara, 06570, Turkey, fulyaal@gazi.edu.tr, Ismail Karaoglan

This paper introduces a new algorithm which is a hybridization of particle swarm optimization and simulated annealing to solve the Location Routing Problem with Simultaneous Pickup and Delivery. The problem under investigation is characterized by a set of customers who have pickup and delivery demands, potential depots and homogeneous vehicles. The proposed algorithm is tested on several test problems derived from the literature and compared with the best solutions.

4 - Multi-pass Simulation-based Vehicle Routing Planning for Inbound Logistics in LCD Manufacturing

Jaehun Lee, Pohang University of Science & Technology, San 31 Hyoja, Pohang, Korea, Republic of, jaehun.leee@gmail.com, Kyungdoc Kim, Sunyoung Song, Hyunbo Cho

A careful vehicle planning for inbound logistics in the Toyota Production System is required to cope with inventory and quality problems, and lack of frequent model changes in manufacturing LCD products. A multi-pass simulation approach is proposed to support a dynamic and real-time nature of vehicle planning necessary to synchronize with production schedules.

5 - A Reverse Logistics Network Design for Multiple Recovery Options

Kemal Alaykiran, Gazi University, Gazi Universitesi Mühendislik-Mimarlik, Fakültesi Eti Mah. Yükselis sok. No 5, Ankara, Turkey, kalaykiran@gazi.edu.tr, Ertan Güner

The importance and popularity of reverse logistics has been increasing in recent years in both academic research area and practice. In this paper, a mathematical model is presented for establishing a reverse logistics network which considers two reuse options recycling and remanufacturing together and additionally elimination of hazardous waste which needs special treatment and outsourcing.

■ TB67

H - Room 412, 4th Floor

Economics II

Contributed Session

Chair: Noam Shamir, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, n-shamir@kellogg.northwestern.edu

1 - The Credits that Count: How Credit Growth and Financial Aid Inflate College Tuition and Fees

Katharina Ley, PhD Pre-candidate, University of Michigan Industrial and Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, katley@umich.edu, Jussi Keppo

We study the drivers of college supply and demand. Using a two-stage least squares model, we find that credit growth and job prospects raise demand. The credit effect is sizeable since the majority of US college students take on debt to pay for school. On the supply side, costs to colleges as well as tuition and non-tuition revenue are significant. Further, direct aid to schools decreases supply and is correlated with tuition costs, suggesting this aid is not lowering prices.

2 - Exploiting Myopic Learning

Mohamed Mostagir, Doctoral Student, California Institute of Technology, 1200 E. California Blvd., MC 228-77, Pasadena, CA, 91125, United States of America, mmostagir@yahoo.com

Can a principal exploit social learning in a population in order to implement outcomes that would not be possible under classical economic models? I provide a positive answer to this question when a large population learns in accordance with a replicator dynamic. The optimal policies resulting from the model provide a nice explanation to many empirically-observed phenomena, like the seemingly random crackdown cycles employed by a policing force to control crime.

3 - Modeling the Firm Size Distribution Including Real Option Games About Merger and Acquisition

Eiko Naito, Waseda University, 3-4-1, Okubo, Shinjuku-ku, Tokyo, 169-8555, Japan, naito-eiko@ruri.waseda.jp, Takahiro Ohno, Kei Takahashi

This research proposes incorporating real option games about merger and acquisition (M&A) in the firm size distribution. As a consequence, our objects of analysis develop from the micro one such as optimal actions of individual restructuring into the macro one such as industry-wide changes. Although the distribution of firm sizes has been interpreted as following the Pareto distribution, we consider whether the impacts by M&A make a difference of the Pareto distribution or not.

4 - Forecasting Aggregate US Retail Sales During Recessions: A Hybrid Method Based on EMD

Youqin Pan, Assistant Professor, Salem State University, 352 Lafayette Street, Salem, MA, 01970, United States of America, Youqin.Pan@salemstate.edu, Robert Pavur, Margie Tieslau

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 ARIMA was employed to predict retail sales right after the 2008 financial crisis and during the recessions of 1970s.Findings indicate that EMD-ARIMA can significantly improve forecasting performance during the periods that macroeconomic conditions are more volatile.

5 - The Role of Vertical Information Sharing in Facilitating Horizontal Tacit Collusion in Supply Chains

Noam Shamir, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, n-shamir@kellogg.northwestern.edu

I examine the incentives of retailers, looking to establish a cartel, to share information with their mutual manufacturer. Sharing information allows the cartel to coordinate on the optimal pricing scheme, but it also exposes the cartel to a possible anti-trust investigation. I show how the retailers are able to exchange information about the market condition by sharing information with their mutual manufacturer.

■ TB68

H - Room 415, 4th Floor

New Techniques for eBusiness Problems

Sponsor: eBusiness

Sponsored Session

Chair: Zhe Shan, Penn State University, 419A Business Building, University Park, United States of America, zheshan@psu.edu

1 - Board Composition, Board Monitoring Function and Information Security Management Effectiveness

Tawei Wang, National Taiwan University, No.85, Roosevelt Rd. Sec. 4, Taipei, 106, Taiwan - ROC, twang@ntu.edu.tw, Carol Hsu

We use the agency theory to develop hypotheses about the relationship between board composition and the possibility of information security breaches of the firm. Our findings shed lights on the characteristics of the board firms need to focus on in order to increase the effective of information security management.

2 - Integrated Service Adaptation - New Techniques for Adapter Creation in Business Process Composition

Zhe Shan, Penn State University, 419A Business Building, University Park, United States of America, zheshan@psu.edu, Akhil Kumar

Successful supply chain management integrates individual processes within organization or across difference parties. Our goal in this paper is to develop a framework and techniques for creating highly flexible, dynamic, general purpose adapters that can be written on-the-fly to mediate mismatch and incompatibility between multiple business processes.

3 - Bayesian Estimation and Optimization in Online Network Bidding

Shuohui Chen, Principal Statistician, DexOne Interactive, 275 Shoreline Dr, Room 520, Redwood City, CA, 94065, United States of America, shuohui@gmail.com, Rene Schaub, Nathan Janos

In this work, a real-world SEM network bidding framework for online leads supply chain process is studied. Bayesian statistical models are developed to estimate the uncertainty in the hierarchically structured data. A two-stage mathematical programming model is built for portfolio wise allocation and optimization by considering the uncertainties in the estimates.

■ TB69

H - Salon F, 6th Floor

Train Timetabling

Sponsor: Railway Applications
Sponsored Session

Chair: Xuesong Zhou, University of Utah, Department of Civil Engineering, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu

1 - Optimizing Train Priorities to Support Regulation of Train Services with Economic Constraints

Christian Sakowitz, Oliver Wyman, 212 Carnegie Center, Princeton, United States of America, Christian.Sakowitz@oliverwyman.com, Ekkehard Wendler

To achieve revenue maximization in the context of traffic regulation, railroads try to avoid delays and ensure scheduled connections. However, seemingly equal delays of different trains are often not equal in value from an economic viewpoint. Also, some connections between trains might have more economic importance than others. This research provides the train dispatcher a method for time-critical conflict resolution based on flexible train priorities with respect to the economic constraints.

2 - Comparison of Planning a Tonnage Based Railway Versus a Scheduled Based Railway

Marc Meketon, Oliver Wyman, 212 Carnegie Center, Princeton, NJ, 08540, United States of America, Marc.Meketon@oliverwyman.com, Carl VanDyke, David Hunt

Planning tools and real-time railroad operations control systems are strong with respect to scheduled railway operations, but much weaker with on-demand unit trains. Also, some products can exist in both worlds. This paper will explore modeling techniques for specifying and evaluating unit train and "tonnage" based operating plans, including the capability to shift traffic between unit trains and scheduled carload service. Comparisons of alternate operating strategies will also be explored

3 - Deterministic Scheduling Formulations for Train Pathing and Timetabling

Steven Harrod, Assistant Professor, University of Dayton, 1143 Ashburton Dr, Dayton, OH, 45459, United States of America, steven.harrod@udayton.edu

The author reviews deterministic scheduling formulations applicable to train pathing and timetabling. The author describes significant differences between European and North American practice. Formulations reviewed include sequencing, discrete time occupancy, and periodic event scheduling. Features and limitations of each formulation are discussed. A new classification for acyclic network models is presented.

4 - High-speed Passenger Trains on Freight Tracks: Modeling Issues on Train Timetabling and Dispatching

Xuesong Zhou, University of Utah, Department of Civil Engineering, Salt Lake City, UT, 84112, United States of America, zhou@eng.utah.edu

Operating high-speed passenger trains on existing freight rail lines is now considered as an economically viable option for the U.S. to initiate and accelerate its high-speed rail services. The existing optimization and simulation-based models are first reviewed in this talk from the perspective of operations research. We then discuss potential scheduling complexities between passenger train timetabling and on-demand freight train dispatching.

■ TB70

H - Salon G, 6th Floor

Panel Discussion: Collision Course?: The North Airfield Safety Study at Los Angeles International Airport (LAX)

Sponsor: Aviation Applications
Sponsored Session

Moderator: Arnold Barnett, Professor, Massachusetts Institute of Technology, E53-379 MIT, Cambridge, MA, 02478, United States of America, abarnett@mit.edu

1 - Collision Course?: The North Airfield Safety Study at Los Angeles International Airport (LAX)

Panelists: Arnold Barnett, Professor, Massachusetts Institute of Technology, E53-379 MIT, Cambridge, MA, 02478, United States of America, abarnett@mit.edu, Michael Ball, Professor, University of Maryland, Robert H Smith School of Business, College Park MD 20742, United States of America, mball@rhsmith.umd.edu, Mark Hansen, University of California, Berkeley, 114 McLaughlin Hall, Berkeley CA, United States of America, mhansen@ce.berkeley.edu, Amedeo Odoni, Professor, MIT, Rm 33-219, Cambridge MA 02139, United States of America, arodoni@mit.edu, George Donohue, Geroge Mason University, United States of America, Antonio Trani, Virginia Polytechnic Institute, United States of America

The LAX North Airfield Safety Study was undertaken by six operations researchers, working closely with colleagues at FutureFlight Central at NASA Ames. The primary aim of the study was "to estimate as specifically as possible the level of future safety associated with each of several alternate configurations of the LAX North Airfield." An auxiliary goal was 'to provide useful information about the capacity implications of the various configurations." The study took place amidst a intense long-term controversy about the future of the North Airfield, a controversy that involved community groups, the airport, airlines, regulators, city planners, and business interests. In this session, we offer a detailed presentation about the background of the study, the ways in which the risk analysis and capacity study were conducted,and the conclusions that were reached. We also describe the challenges in explaining both the analysis and its results to a wide variety of interested parties, and discuss some "lessons learned" by the study participants.

■ TB71

H - Salon H, 6th Floor

Networks and DEA

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Kaoru Tone, National Graduate Institute for Policy Studies, Japan, tone@grips.ac.jp

1 - DEA Models with Shared Resources

Yao Chen, University of Massachusetts at Lowell, Yao_Chen@uml.edu, Juan Du, H. David Sherman, Joe Zhu

In many real world scenarios, DMUs have a two-stage network process with shared input resources used in both stages of operations. These DMUs have not only inputs and outputs, but also intermediate measures that exist in-between the two-stage operations. The current paper develops a set of DEA models for measuring the performance of two-stage network processes with non splittable shared inputs. An additive efficiency decomposition for the two-stage network process is presented.

2 - Unoriented Two-stage DEA The Case of the Oscillating Intermediate Products

Sreekanth Mallikarjun, StonyBrook University, United States of America, Sreekanth.Mallikarjun@StonyBrook.edu, Herbert Lewis, Thomas Sexton

Data envelopment analysis (DEA) allows us to evaluate the relative efficiency of each of a set of decision-making units (DMUs). However, the methodology does not permit us to identify specific sources of inefficiency because DEA views the DMU as a "black box" that consumes a mix of inputs and produces a mix of outputs. Thus, DEA does not provide a DMU manager with evidence regarding the internal source of the organization's efficiency. Recent methodological developments have extended the basic DEA methodology to allow the analyst to "look inside" the DMU and model the network of production processes that comprise the organization. In such models, sub-DMUs consume inputs from outside the DMU and intermediate products from other sub-DMUs to produce outputs that flow out of the DMU and intermediate products that flow into other sub-DMUs. In this paper, we present an unoriented Two-Stage DEA model to measure efficiency in situations in which analysts seek to simultaneously reduce input quantities and increase output quantities.

3 - Dynamic DEA with Network Structure: A SBM Approach

Miki Tsutsui, Central Research Institute of Electric Power Industry, miki@criepi.denken.or.jp, Kaoru Tone

We propose a dynamic DEA model involving network structure of DMU within the framework of slacks-based measure approach. We have already published the network SBM and the dynamic SBM models separately. This article is a composite of these two models, which deals with multiple divisions connected by intermediate inputs and carry-over activities between two succeeding terms. This can evaluate (1) the overall efficiency over the observed term, (2) term efficiency, and (3) divisional efficiency.

■ TB72

H - Salon J, 6th Floor

Transportation Asset Management

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Wei Fan, Assistant Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd., Tyler, TX, 75799, United States of America, wfan@uttyler.edu

1 - A Strategic Optimization Framework Incorporating LCA Within the Bus Fleeting Problem

Elaine Croft McKenzie, Northwestern University, 2145 Sheridan Road, Evanston, IL, United States of America, elainecroft2011@u.northwestern.edu, Pablo Durango-Cohen

Strategic bus fleeting decisions have long-lasting implications for the sustainability and level of service of the transit operation. In order to fully understand the implications of the strategic bus fleeting problem, decision making models must be combined with models of life cycle assessment (LCA). We propose a framework for multi-dimensional optimization of the bus fleeting problem, and explore the tradeoffs between economic and environmental costs over the planning horizon.

2 - Stochastic Optimization for the Efficient Transportation Fleet Management

Wei Fan, Assistant Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd., Tyler, TX, 75799, United States of America, wfan@uttyler.edu

This presentation addresses the Efficient Transportation Fleet Management Problem (ETFMP) in a carsharing context, in which the service operator needs to determine the optimal vehicle allocation in both time and space in order to maximize profits. A multistage stochastic optimization model that can account for demand uncertainties is formulated. A Monte Carlo sampling based technique is used to solving the ETFMP. Numerical results are discussed and insights into the ETFMP are presented.

3 - Integrated Transportation Network Maintenance and Expansion

Lu Gao, The University of Texas at Austin, 1 University Station C1761, austin, tx, 78712, United States of America, gaolu1504@gmail.com, Zhanmin Zhang, Chi Xie

The American Recovery and Reinvest Act (ARRA) of 2009 calls for a renewed effort to reinvest in the maintenance and expansion of transportation infrastructure facilities. This talk presents an integrated multi-period road network maintenance and expansion problem for long-term transportation infrastructure investment planning and scheduling. Our focus is on how to formulate, transform, and decompose this integrated optimization problem for efficient solutions.

4 - System-Wide Dynamic Rehabilitation Project Scheduling Considering Macroscopic Network Characteristics

Chendong Cai, University of Arizona, Tucson, Tucson, AZ, United States of America, ccdtz@email.arizona.edu, Yi-Chang Chiu, Mark Hickman

Planning and scheduling multiple transportation rehabilitation projects considering combined network performance degradation effects in a dynamic formulation has not been fully attempted in literature. In this talk, we present the macroscopic network characteristics and how such information is incorporated into system-wide dynamic rehabilitation project scheduling.

■ TB73

H - Salon K, 6th Floor

Emissions Modeling and Carbon Footprint Allocation in Logistics

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Anne Goodchild, Assistant Professor, University of Washington, 121E More Hall, Box 352700, Seattle, WA, 98195, United States of America, annegood@u.washington.edu

1 - Models for Emissions Reduction Evaluation in Urban Pickup and Delivery Systems: Three Case Studies

Anne Goodchild, Assistant Professor, University of Washington, 121E More Hall, Box 352700, Seattle, WA, 98195, United States of America, annegood@u.washington.edu, Felipe Sandoval, Erica Wygonik, Kelly Pitera

A time-dependant, VRP-TW model and a tabu search metaheuristic are developed to explore the trade-offs between cost, service quality, and emissions of urban pickup and delivery systems. Three distinct case studies, each involving a real fleet with different operational characteristics, are modeled using these vehicle routing tools. Analyses of different external policies and internal operational changes provide insight into the impact of these changes on cost, service quality, and emissions.

2 - Carbon Footprint Allocation in Logistics

Yue Geng, Northwestern University, 2145 Sheridan Road, Room C223, Evanston, IL, United States of America, yue-geng@northwestern.edu, Halit Uster, Diego Klabjan

Carriers and shippers are concerned about their carbon footprint. While the allocation of emissions is straightforward on a single lane for dedicated loads, the problem is challenging for less-than-truckload operations where loads are shared on a single vehicle and routes are intertwined. We propose possible allocation schemes.

3 - Modeling and Minimizing VRP and Fleet Replacement Costs and GHG Emissions

Miguel Figliozzi, Portland State University, P.O. Box 97207-0751, Portland, OR, United States of America, figliozzi@pdx.edu, Wei Feng

We present two kind of models aimed at incorporating GHG emissions into routing and fleet models: (a) The Emissions Vehicle Routing Problem (EVRP) that minimizes fleet costs and as well as CO2 emissions, distance traveled, and route durations in congested environments, and (b) A Vehicle Replacement Model with Emissions (VRME) that minimizes long-term purchase, maintenance, and operational costs of a fleet of vehicles. Models as well as results from case studies are presented and discussed.

■ TB74

H - Room 602, 6th Floor

Advances in Equilibrium Based Simulation Models

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Stephen Boyles, University of Wyoming, Laramie, WY, United States of America, sboyles@uwyo.edu

1 - Two Bush-based Methods for Equilibrium Sensitivity Analysis

Stephen Boyles, University of Wyoming, Laramie, WY, United States of America, sboyles@uwyo.edu

Equilibrium bushes can enable sensitivity analysis of link flows and costs to changes in travel demand through recursive solution of a system of linear equations. For a single origin-destination pair, a faster algorithm is possible in planar graphs using network transformations resembling those used in the analysis of resistive circuits. Both methods are presented, using sketch network planning as a demonstrative example.

2 - A Flow State Based Safety Control Model

Hilmi Berk Celikoglu, Istanbul Technical University, Maslak, Istanbul, Turkey, celikoglu@itu.edu.tr

Paper summarizes the findings of a scientific project proposed to setup an analytical model that can easily be integrated to an intelligent transportation systems (ITS) frame and provide accident occurrence prediction by sourcing real-time data. The proposed model helps to manage traffic flow and inform users throughout an existing road network. The most essential expected outcome of the study is to obtain a decrease in the number of accidents that result in deaths and personal injuries. On the contrary to the existing pure soft computing models, i.e., neural network models, fuzzy logic models, and genetic algorithm models, that provide prediction for the future with the help of past data, the integrate model structure runs in the presence of a ripe data set that is obtained after pre-processing with the appropriate multivariate statistical methods. First, the independent variables relevant to road, driver and vehicle and those have effect on safety are reduced and grouped with the above mentioned multivariate methods in order to form a realistic road safety index.

3 - Parallelization of Traffic Assignment Algorithms

N. Nezamuddin, University of Texas, Austin TX, United States,nezam@mail.utexas.edu, Travis Waller

Static traffic assignment (STA) algorithm and dynamic traffic assignment (DTA) simulation constitute subroutines which are amenable to parallel processing. For example, shortest-path tree for different origins can be computed concurrently in STA. For DTA, different components of the network can be simulated concurrently, followed by communication and synchronization among the components. Parallel processing was applied to the traffic assignment problem using OpenMP and MPI parallelization libraries to achieve faster convergence to the solution.

4 - Bounded Rationality and Irreversible Network Change

Xiaolei Guo, Department of Civil Engineering, University of Minnesota, Twin Cities, MI, United States of America, guoxl@umn.edu, Henry Liu

A network change is said to be irreversible if the initial network equilibrium cannot be restored by revoking the change. The phenomenon of irreversible network change has been observed in reality. To model this phenomenon, we develop a day-to-day dynamic model whose fixed point is a boundedly rational user equilibrium (BRUE) flow. The proposed model is applied to the Twin Cities network to model the flow evolution during the collapse and reopening of the I-35W Bridge.

■ Interactive Session

Tuesday, 12:30pm - 1:30pm

C - Exhibit Hall 3

Chair: Maciek Nowak, Assistant Professor, Loyola University Chicago, Graduate School of Business, 1 E. Pearson St., Chicago, IL, 60611, United States of America, mnowak4@luc.edu

Co-Chair: Sila Cetinkaya, Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States of America, sila@tamu.edu

1 - The Optimal Penalty Fee for Ticket Switching at Airlines

Foad Hassanmirzaei, PhD Student, Richard Ivey School of Business, 1151 Richmond Street North, London, ON, N6A 3K7, Canada, fhassanmirzaei@ivey.uwo.ca, Reza Mahjoub, Peter Bell

Many airlines permit passengers to change a purchased ticket by paying a penalty. Given that this penalty is a revenue item for the airline, the question that arises is what penalty should be set for switching? We consider a two period model in which some passengers switch from the first period to the second. Considering different accommodation policies in the second period, we investigate the optimal solution for the switching penalty.

2 - Spatial Information Theoretical Approach to Locating Sensors in Transportation Security Applications

Jeffrey Taylor, Graduate Research Assistant, University of Utah, Department of Civil Engineering, Salt Lake City, UT, 84112, United States of America, jeffrey.taylor.d@gmail.com, Jay Przybyla, Xuesong Zhou

This interactive session presents a theoretical model for sensor network performance analysis in transportation security applications based upon Kalman Filtering. By incorporating sensor error and spatial OD patterns, we examine multiple measures of information gain as sensor network performance metrics to compare coverage among mobile/fixed sensors and different sensor location strategies.

3 - A Multi-objective Mixed Optimization Model for POD to Distributed Emergency Supplies

Haochun Zhang, Univeristy of Louisiana at Lafayette, 200 Oakcrest, Drive, Apt. E358, Lafayette, LA, 70503, United States of America, x.ch.zhang85@hotmail.com, Ramesh Kolluru, Baker Kearfott, Raju Gottumukkala

We propose an optimization strategy for solving point of distribution problems (POD) for emergency supply distribution. First, we construct a dual objective mixed integer linear optimization, to both minimize the total cost and maximize convenience under source limitations and different budget constraints. Second, we develop a parallel branch and bound algorithm to solve our model. We do a case study in Lafayette Parish, Louisiana.

4 - A Spatial Queue-based Dynamic Flow Simulation and Rapid Response Model for Congestion Mitigation

Haizhong Wang, Research Associate, Jackson State University, P. O. Box 900, 1230 Raymond Rd, Jackson, MS, 39204, United States of America, wanghzhong@gmail.com, Xuesong Zhou, Feng Wang

The objective of this research is to quantify the benefits of different capacity-enhancing strategies (i.e., dynamic message sign, contraflow lane strategy) using sensitivity analysis based methods through a spatial queue-based dynamic traffic assignment simulation and rapid response model. The results from this research provide a ranking table based on delay change from simulation and analytical study in the context of an emergency evacuation situation.

5 - A Spoonful of OR Helps the Medicine Go Down: How Healthcare Can Benefit From Modeling and Analysis

Michael Hosking, NCSU, 436 Summerwalk Circle, Chapel Hill, NC, 27517, United States of America, mrhoskin@email.unc.edu

As an illustration, we specify a queuing model (M/D/c) of a representative drug treatment facility. The analysis of this model provides mathematical expressions for some of the key performance measures, such as average waiting time for admission. OR methodologies, particularly queuing theory, can be very useful in gaining deeper understanding of this complexity and exploring the potential effects of proposed changes on the system without making any actual changes.

6 - Use of a Dynamic Simulation to Examine Interventions That Improve Access to Colorectal Cancer Care

Michael Hosking, NCSU, 436 Summerwalk Circle, Chapel Hill, NC, 27517, United States of America, mrhoskin@email.unc.edu, Talisa Murray, Stephen Roberts, Reha Uzsoy

Colorectal cancer may be preventable through screening, but only a small part of the U.S. population takes advantage of available screening methods and preventative care. A combined discrete-continuous simulation model of the colon cancer screening system has been constructed to represent the dynamics among system components. Based on formal data sources that establish model credibility, the model is then used to examine the effectiveness of intervention schemes in improving screening rates.

7 - Impact of Staffing and Capacity Flexibility on Quality and Financial Outcomes in Hospitals

Adelina Gnanlet, Assistant Professor, California State University, Fullerton, 800 N. State College Blvd, Dept of Mgmt, Fullerton, CA, 92832, United States of America, agnanlet@fullerton.edu

To reduce costs and meet variable demand, service firms frequently cross-train employees and use flexible capacity in capital intensive industry. Higher cross-training is cost-effective but may not provide adequate quality of service due to learning effects. Flexible physical capacity may not be conducive to provide highest level of quality for certain demand segments. We determine the effects of staffing and capacity flexibility on service quality and financial performance of hospitals.

8 - A Serial Supply Chain Coordination Problem Under Centralized/Decentralized Decision Making

In-Jae Jeong, Associate Professro, Hanyang University, 17, Haengdangdong, Seongdonggu, Seoul, Korea, Republic of, ijeong@hanyang.ac.kr, Jorge Leon

In this research, we consider a serial supply chain where multiple decision makers are serially connected from the upstream to the downstream of the supply chain. Similar to the Newsvendor problem, we want to determine ordering quantities such that the expected benefit of entire supply chain is maximized. We propose optimal solutions under a centralized/decentralized decision making environment where complete/minimum information sharing is allowed among the supply chain.

9 - A Mixed Integer Nonlinear Program for Electric Generation Expansion with Energy and Capacity Pricing

Mehrdad Pirnia, Ph.D Student, UWaterloo, 200 University Ave. West, Waterloo, On, N2J2N9, Canada, mpirnia@uwaterloo.ca, David Fuller

We propose a new mechanism to give added incentive to invest in new capacities in deregulated electricity markets. An optimization problem to maximize long term social welfare includes binary variables for the building of new facilities and continuous variables for generation, i.e. the model is a mixed integer nonlinear program. The new mechanism also includes a new approach to calculate capacity prices in addition to the commodity prices.

10 - Minimum Cut Tree Games

Anne Schwahn, Department of Mathematics, University of Kaiserslautern, Paul-Ehrlich-Str. 14, Room 447, Kaiserslautern, 67663, Germany, a.m.schwahn@gmail.com

We introduce a new class of cooperative games on graphs where the value of a coalition of players is induced by the weight of a minimum cut tree in the coalition subgraph. Minimum cut trees are graph-theoretic structures with several applications, e.g., for the maximum reliable tree and the communication tree problem. We investigate several reasonable reward allocations for the resulting game, e.g., core, Shapley value and nucleolus.

11 - A Stochastic Approach to Search and Target Acquisition Based on Target Characterization and Time Limitations

Steven Yuhaski, Jr, Operations Research Analyst, Natick Soldier Research, Development and Engineering Center, 1 Kansas Street, Natick, MA, 01760, United States of America, steven.yuhaski@us.army.mil, Robert Auer

An efficient methodology is developed to scan for potential target positions within a finite region. Reaction times by both the agent and the targets are taken into account. Probabilities of successfully reacting to possible threats are determined as a function of target properties, individual scanning capability, the number and proximity of targets to the agent. The probabilistic effects of multiple scans are modeled as a recursive stochastic network, which terminates according to reaction time considerations.

12 - Risk Identification and Modeling in IT Service Management Projects using Influence Diagrams

Winnie Cheng, Research Staff Member, IBM T.J. Watson Research Center, 19 Skyline Dr, Hawthorne, NY, 10532, United States of America, wcheng@us.ibm.com, Shu Tao, Nikos Anerousis

Various risk factors can influence the health of an IT service management project. We explore the use of influence diagrams to capture these risk factors and their impact on project health. Through case studies, we discuss the challenges and practical considerations of applying influence diagrams in this context.

13 - Research Project REPKA - Regional Evacuation: Planning, Control, and Adaption

Katharina Gerhardt, Dr., University of Kaiserslautern, Paul-Ehrlich-Str. 14, Room 438, Kaiserslautern, 67663, Germany, gerhardt@mathematik.uni-kl.de

REPKA ties in with the results of building evacuation, thereby bridging an important security gap. In contrast to a building evacuation, a regional evacuation must adapt to continuously changing topology, particularly as a result of the emergency forces that generally make their way against the flow of the crowd.

14 - Periodic Location Routing Inventory Problem
S.Reza Sajjadi, Post- Doctoral Research Fellow, North Dakota State University, NDSU Department2485, 120A CIE, P.O. Box 6050, Fargo, ND, 58108-6050, United States of America, reza.sajjadi@ndsu.edu

Operations in a supply chain can be optimized through simultaneous decision on inter-dependent variables of the network. In this study, a mathematical model which integrates location routing problem (LRP) with inventory is proposed where multiple products are periodically served to fulfill customers' requests.

15 - Identifying the Leading Indicators of Software Development Cost Overruns
Victor Modic, Operations Research Analyst, U.S. Air Force, 1624 Eglin St., Bldg 1624, Hanscom AFB, MA, 01731, United States of America, vmodic@gmail.com

With decreased tolerance for software development cost overruns in acquisition contracts, decision makers are looking to Earned Value Management (EVM) analysis to highlight leading indicators of cost elevation risk. This project applies system engineering principles to create an EVM analysis road map that identifies those leading indicators.

16 - Impact of Twitter on Financial Markets
Jooyoung Jeon, University of Oxford, 2 Alan Bullock Close, St Clements, Oxford, United Kingdom, joo.jeon@smithschool.ox.ac.uk, Patrick McSharry

Recent years have witnessed an extraordinary surge of social networking and micoblogging services. The Twitter data stream allows access to tweets, timestamps and locations. Data streaming algorithms are required to process this high volume datafeed and provide real-time data analysis. We analyse the impact of tweets on financial markets.

17 - Monitoring Lifetime Profile With Censored Data
Ehsan Jafari Shirazi, Grad student, West Virginia University, 1431 Saratoga Ave, Apt#11, Morgantown, WV, 26505, United States of America, ejafaris@mix.wvu.edu

Monitoring censored lifetime data in which life has a univariate distribution has been investigated in the literature. Sometimes, life is dependent on some explanatory variables where it can be characterized as a linear function. In such situations, it is desired to monitor the linear function(profile) used for modeling the relationship between the explanatory variables and the response. In this work, two methods are presented for monitoring lifetime profile with censored data.

18 - Market Making in Mean Reversion Price Models
Tanmoy Chakraborty, PhD Student, University of Pennsylvania, 3330 Walnut Street, Philadelphia, PA, 19104, United States of America, tanmoy@seas.upenn.edu, Michael Kearns

We study the profitability of market making in price time series models. We provide an exact theoretical characterization of the profit obtained by a natural market making algorithm, and use the characterization to prove that market making is generally profitable on mean reverting time series. Finally, we simulate market making algorithms on trading data from U.S. equities markets and show that our theoretical characterization of profit bears strong correlations with the simulated profit.

19 - Technology Applications for Emergency Supply Chain Response
Patrick Jaska, Professor, University of Mary Hardin-Baylor, 900 College Street, Belton, TX, 76513, United States of America, pjaska@umhb.edu, Pedro Reyes

Technology can aid in the logistics and coordination of the supply chain for natural or artificial disasters that may occur anytime around the world. Many technologies are available to contribute to the coordination of emergency distribution from the point of origin to the point of destination. In this study, we review current technologies and then examine the use, challenges, and opportunities of new technologies to help in coordinating emergency supply and distribution.

20 - The Timing of a Project Takeover Decision in a Multi-server Queue with Uncertain Priority Service
Naoya Takezawa, nanzan university, School of Business Administration, 18 Yamazato-cho, Showa-ku, Nagoy-shi, Aichi-ken, 4668673, Japan, ntakezaw@nanzan-u.ac.jp, Hiroshi Toyoizumi

We consider a queue with two servers that operate under a revenue sharing agreement but only share the information on their service time parameters gradually over time. We examine the optimal takeover timing of the low priority server and its relation to the parameter uncertainty.

21 - "Go Paperless, Go Green": Incentives vs. Fees
Rajorshi Sen Gupta, Research Fellow, Texas A&M University, Dept. of Agricultural Economics, College Station, TX, 77840, United States of America, rajorshi@tamu.edu

Going paperless can lead to benefits for company, customers and environment.Although companies have been offering incentive payments to encourage paperless transactions, their customers have not responded favorably. Alternatively, we argue that a fee on customers for receiving paper documents can lead to increased enrollment and higher social welfare.

22 - A Market Oriented Approach to Resource Siting in Energy Grids
Mahdi Kefayati, The University of Texas at Austin, 1 University Station, Mail code: C0806, Austin, TX, 78712, United States of America, mkefayati@mail.utexas.edu

We consider a new firm entering an electricity market managed by an independent system operator (ISO). We formulate the problem of finding the optimal siting and propose algorithms for solving it from both ISO and firms perspective. Further, we analyze incentive compatibility between the firm and ISO and show that although in general incentives are not compatible, in absence of market power, the incentives are compatible and the placement algorithms simplifies.

23 - A Methodology for Selecting Projects When Offers Come in Over Time
Paul Kucik, Department of Systems Engineering, United States Military Academy, West Point, NY, 10996, United States of America, paul.kucik@usma.edu

Consider an organization with a relatively fixed capacity that receives project offers over time. If these offers expire after some relatively short period of time and an organization's decision to accept or reject a project cannot be changed without cost, then the organization must make accept/reject decisions without clear visibility over future project offers. This research seeks to develop a methodology to make accept/reject decisions while developing a portfolio of projects over time.

24 - A Travel-time Model for Order Batching and Picking in a Synchronized Zone Order Picking System
Li Pan, The University of Hong Kong, Department of Mathematics, Pokfulam, Hong Kong, Hong Kong - PRC, lipan@hku.hk, Sydney C.K. Chu, Joshua Zhexue Huang

Order picking is one of the most critical operations in warehouses. In this study, we propose an analytical approximation model based on probability and queuing network theory to analyze order batching and picking area zoning on the mean order throughput time in a synchronized zone picker-to-part order picking system.

25 - Foreign Direct Investment and Convergence: A Nonparametric Production Frontier Approach
Waner Gu, PhD Candidate, University of California, Riverside, 3111 Sproul Hall, University of California, Riverside, Riverside, CA, 92521, United States of America, waner.gu@email.ucr.edu, R. Robert Russell

We decompose labor productivity growth into technological change, technological catch-up, foreign capital deepening, domestic capital deepening, and human capital accumulation. We apply DEA production-frontier methods to a worldwide 1980-2005 panel and find that (1) foreign capital accumulation is the driving force for productivity growth and increased dispersion of productivity, (2) technological change is non-neutral, and (3) international polarization is brought about by efficiency changes.

26 - Information Based Tree Search
Rodolfo Carvajal, School of Industrial & Systems Engineering, Georgia Institute of Technology, 755 Ferst Drive NW, Atlanta, GA, 30332, United States of America, rocarvaj@gatech.edu, Gustavo Angulo, George L. Nemhauser

To reduce the number of nodes searched in branch-and-bound algorithms, Kilinç-Karzan et al. (2009) proposed a branching scheme that collects information during the search and uses it in a restart phase. We implement variants of this approach using multiple collection phases and online use of information and report computational results.

27 - Map Segmentation Problems for Geographic Resource Allocation
John Carlsson, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, jcarlsso@umn.edu

In a wide variety of practical problems, a geographic region must be segmented into smaller regions to allocate resources "fairly". This is often done using combinatorial devices that discard the underlying geometry of the problem. In this session we describe a geometric framework, map segmentation, for solving such problems and give several examples demonstrating the effectiveness of such approaches.

28 - Mutating Turing Machines
Anand Nair, University of South Carolina, Moore School of Business, 1705 College St., Columbia, SC, 29208, United States of America, nair@moore.sc.edu

This research considers interaction between two Turing machines. As a part of their interaction, the machines influence their counterpart's behavior by mutating their rule space. In particular, the machines use the mutation rule to transfer their own code at a specified location of the interacting machine's rule space. The results highlight that complexity can emerge from the interaction of simple programs.

29 - Open-Ended Projects for an Undergraduate Operations Research Class in a Mathematics Department

Mark Parker, Associate Professor of Mathematics, Carroll College, 1601 N. Benton Avenue, Helena, MT, 59625, United States of America, mparker@carroll.edu

We present a series of projects used in an undergraduate OR course. The projects span developing a rating metric, mathematical programming, stochastic processes, and simulation. The course covers both theoretical development of the topics as well as emphasizing modeling, implementation, and sensitivity. The projects make use of both spreadsheets and commercial software (Matlab, Simprocess, Xpress). Course information including syllabus, projects, and student work will be presented.

30 - Optimal Lot-sizing Policy for a Periodic-Review Inventory System with Quantity-Dependent Setup Cost

Yi Yang, PhD, The Chinese University of Hong Kong, Room 814, William, M.W. Enginerring Buil, Hong Kong, China, yangyi@se.cuhk.edu.hk

We consider a periodic-review, stochastic, inventory-control system in which a firm faces different fixed order costs depending on a specified contract volume C. Specially, if the order quantity is no more than C, then the setup cost is K1; otherwise, a setup cost K2 is incurred. We partially characterize the structure of an optimal policy and propose a heuristic policy which is fairly easy to implement and optimal in nearly all the numerical examples tested.

31 - Optimization of Spot Size and Contrast in Optical Data Storage

Matthew Ballan, Texas Tech University, 4313 32nd Street, Lubbock, TX, 79410, United States of America, m.ballan@ttu.edu

Current optical data storage technology is approaching optical limits on storage density. This project focuses on optimizing the intensity and profile of an Nd:YAG pulsed diode laser in order to minimize data spot sizes and contrast in a multilayered polymer film, resulting in significantly greater data storage densities.

32 - Optimizing Critical Data Reporting Locations for GPS Enabled Mobile Phones with Privacy Protection

Tao Xing, Graduate Research Assistant, University of Utah, Department of Civil Engineering, Salt Lake City, UT, 84112, United States of America, tao.xing@utah.edu, Jeffrey Taylor, Xuesong Zhou

Collecting location data from GPS enabled mobile phones provides valuable information for network-wide travel time estimation applications, but it also raises a constant concern about user privacy protection. This talk presents an information theoretic framework to quantify the information gain and privacy loss under different data reporting location plans.

33 - Preference Elicitation for Risky Prospects

Greg Hines, Cheriton School of Computer Science, University of Waterloo, 200 University Avenue West, Waterloo, Canada, ggdhines@cs.uwaterloo.ca, Kate Larson

Minimax-regret preference elicitation allows decisions to be made on behalf of people facing risky choices. Such methods currently assume that people follow expected utility theory (EUT). Cumulative prospect theory (CPT) is an alternative model to EUT which has been shown to be a better descriptive model. We show that the current minimax-regret preference elicitation methods can be incompatible with CPT. We develop a new method for preference elicitation that is applicable to CPT models.

34 - Pricing and Production Optimization in the Presence of Market Uncertainty

Vijay Narayanan, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30332, United States of America, vijay.narayanan@gatech.edu

We present our on-going work to optimize pricing and production decisions under uncertain market conditions. In particular, we consider the uncertainty in market-size. Market-size is the sum of demands of all competing products considered. We consider different outcomes for market-size during each time period in the planning horizon. Finally, we propose methodologies to model uncertainty and to solve the resulting mutli-stage stochastic optimization model.

35 - Recovery Strategies for Returnable Transport Items (RTI): A Comparative Study Based on MILP Models

Ruth Carrasco-Gallego, Lecturer, Technical University of Madrid (UPM), C/Jose Gutierrez Abascal 2, Madrid, 28006, Spain, ruth.carrasco@upm.es, Eva Ponce-Cueto, Simme Douwe Flapper

Returnable Transport Items (RTI), and also other types of reusable articles, are frequently loss or misplaced by customers or other supply chain partners. A variety of recovery strategies can be used to prevent RTI fleet shrinkage, such as the swapping policy. In order to compare the cost of two alternative versions of this policy in a customer-supplier system, we formulate two MILP models and study the consequences of using one recovery strategy or another for a number of different situations.

36 - Risk-Based Technology Assessment for Capital Equipment Decisions in Small Firms

Samuel Merriweather, PhD Student, Texas A&M University, Industrial Engineering, TAMU 3131, College Station, TX, 77843-3131, United States of America, s_merriweather@tamu.edu

Within this presentation we discuss a risk-based approach to capital equipment budgeting and acquisition of new equipment and/or technologies in small firms. The approach overcomes deficiencies in the capital budgeting process by connecting equipment use to projected cash flows via discrete-event simulation. A health care application is illustrated.

37 - Subsidies vs Diversification: Strategies for Supplier Disruption Management

Luz Caudillo-Fuentes, Umich, 4652 Middlebrook Rd., #Q, Orlando, FL, 32811, United States of America, fuentesl@umich.edu

We study the problem solved by a manufacturer who faces supplier disruptions. In order to understand the interactions between three strategies (subsidizing the supplier, supplier diversification, and the creation of back-up inventory), the problem is analyzed using a simple model with inventory storage costs and shortage penalties. We derive conditions when these strategies are appropriate, either in isolation or in combination and perform a sensitivity analysis.

38 - The Dilemma of Information Security: Building or Buying?

Kyungbae Park, Master of Science in Information Technology and Management, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080-3021, United States of America, kyungbae.park@student.utdallas.edu

This paper discusses managerial approaches to information security. Decisions regarding security investment remain questionable as (1) it is difficult to estimate the true costs of information security; and (2) firms cannot invest in security solutions indefinitely. Therefore, this paper attempts to identify factors that firms should consider when deciding on either on-premise solution or third parties involved.

39 - Topology Design and Capacity Assignment on a Network with Guarantees on Robustness and QoS

Emmanuelle Wallach, PhD Student, The Pennsylvania State University, 332 Carnegie Place, Pittsburgh, PA, 15208, United States of America, ejw.rgm@gmail.com

Consider a domain in the Internet and the strategic problem of designing its network, specifically, the capacities of the links so that the network is robust and quality of service (QoS) can be guaranteed. The optimization problem is such that the QoS constraint, in terms of the decision variables, can neither be expressed in closed-form nor is a convex function. The QoS performance of the solution to a deterministic approximation can be improved by adding complex stochastic constraints.

40 - Underground Re-scheduling for Maximizing the Use of Regenerative-braking Energy

Maite Pena-Alcaraz, Massachusetts Institute of Technology, 161A Pearl Street, Cambridge, MA, 02139, United States of America, maitepa@mit.edu, Andres Ramos, Antonio Fernandez, Asuncion P. Cucala

This project deals with the re-design of underground schedules for maximizing the use of regenerative-braking energy by means of synchronizing the slow-down of trains arriving at station with the speed-up of trains exiting from other station. Energy savings of 3.5% were achieved with respect to the previous schedule in Madrid underground system. The correlation between measured energy savings and the synchronization achieved is very significant, 75.2%.

41 - Forecasting PHEV Sales and Recharging Activities

Brittni Gutierr, Iowa State University, College of Engineering, Ames, IA, United States of America, bgutierr@iastate.edu, Lizhi Wang, Zhaoyang Duan

Sales of plug-in hybrid electric vehicles (PHEVs) and PHEV users' recharging behavior are two critical factors for studying the potential impact of PHEVs on electric power systems. We use novel approaches to making more accurate and revealing forecasts of these factors. We will forecast the sales of PHEVs as a function of several interacting sub-factors. We will forecast PHEV users' recharging behavior as a function of available recharging infrastructures.

42 - Designing Optimal Yard Layouts for Container Terminals

Leena Suhl, Professor, University of Paderborn, Warburger Str. 100, Paderborn, Germany, suhl@upb.de

In case of a port expansion project, a new or expanded terminal has to be designed. The design of a container terminal layout is an important aspect, as an efficient terminal layout allows a smooth operation of the container terminal. The contribution describes and compares different methods to design optimal layouts for given equipment. Variable block widths for yard layouts with transfer lanes and transfer points are considered.

43 - Indoor Location Analytics: Applying Web Analytics to Location-based Services

Sun K. Kim, Assistant Professor, Keio University, 1-1, Hiyoshi 4-chome, Kyoseikan SDM C6N15, Yokohama, 2238526, Japan, sunkim@sdm.keio.ac.jp, Hidekazu Nishimura, Jin-Wook Ro

As location-related technologies have become increasingly available, businesses based on location-context information are gaining much attraction. This paper describes Indoor Location Analytics (ILA), a service that helps store owners or building managers of a building or a shopping mall, to analyze the traffic information of people. Just as web analytics services benefit website managers, ILA benefit store owners, building managers, and shoppers by providing a common data platform service.

44 - Differential Equations Modeling of Patients Dynamics in Emergency Rooms

Jerome Ndayishimiye, Graduate Student, University At Buffalo, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jn43@buffalo.edu, Jun Zhuang

Arbitrary physician staffing contribute to overcrowding of patients in emergency rooms (ERs), a problem that may lead to poor quality care and may create problems in managing an influx of patients following major disasters. We propose using differential equations to analyze the dynamics of patients and physicians in ERs by performing the stability and bifurcation analysis and then using optimal control theory to obtain optimal physician staffing policies.

45 - Hybrid Defense Resource Allocations in the Face of Partially Strategic Attacker, and Comparison with Fully Endogenous and Exogenous Models

Xiaojun Shan, PhD Student, University at Buffalo, SUNY, 435 Bell Hall, Buffalo, United States of America, xshan@buffalo.edu, Jun Zhuang

The applicability of game theory to homeland security has been questioned, due to its strong assumption about rationality. Our work shows that defensive resource allocations based on game theory is much more "robust" or "conservative" (in the sense of incurring less expected loss) than the ones based on non-game theory.

46 - Measuring Partnership Efficacy in Haitian Disaster Recovery

John Coles, Texas A&M University, 241 Zachry, College Station, TX, johnbcoles@gmail.com, Justin Yates, Jun Zhuang

On January 12th 2010, a 7.0 magnitude earthquake struck close to Port-au-Prince, Haiti. A flexible cost-benefit ratio was implemented to assist agencies' in assessing partnership efficacy using the costs and benefits discussed in interviews with agency representatives working in Haiti. Guidelines for partnership selection were developed using the first-hand information to assist responding agencies in identification of the key factors that can make partnerships more effective.

47 - Modeling and Mitigating the Effects of Supply Chain Disruption on Wargames

Shilan Jin, SUNY at Buffalo, 435 Bell, SUNY at Buffalo, North Campus, Amherst, NY, 14260, United States of America, sjin6@buffalo.edu, Jun Zhuang, Zigeng Liu

We integrate supply chain risk management with a government-terrorist game in war zones. The equilibrium outcomes of wargames depend on the government's resources delivered through military supply chains, which are subject to disruptions. We study the government's optimal pre-disruption strategies, including inventory protection, capacity backup protection and the combination.

48 - A Dual-RAMP Algorithm for Resource Constrained Project Scheduling

Chris Riley, University of Mississippi, School of Business Administration, 320 Holman, University, MS, 38677, United States of America, criley@bus.olemiss.edu, Cesar Rego, Haitao Li

A Relaxation Adaptive Memory Programming (RAMP) algorithm is further developed to solve large-scale resource constrained project scheduling problems (RCPSP). The RAMP algorithm presented here utilizes a cross-parametric relaxation. Computational results obtained using the RAMP algorithm with various relaxations on a classical set of benchmark problems will be presented and discussed.

49 - Grey System Approach for EOQ and EPQ Models

Serpil EROL, Professor, Gazi University, Gazi University, Engineering Faculty, Industrial Eng. Department Maltepe, ANKARA, 06570, Turkey, serpiler@gazi.edu.tr, Erkan K÷SE, Izzettin TEMIZ

In this study, contrary to the classical EOQ/EPQ models unit holding and order cost parameters are included in the model as interval grey numbers and the grey prediction model has been used to forecast annual demand rate. To determine optimal order/production quantity, total cost function an interval grey number has been calculated by using grey number mathematical operations. The TCF has been whitenized first by using equal weight mean whitenization then fuzzy mathematical programming.

50 - Valuing Pricing of Genetically Modified Traits using Monte-Carlo Simulation: A Real Option Approach

Suamdhur Shakya, Graduate Student, UGPTI/NDSU, NDSU Dept. #2880 P.O. Box 6050, Room 209, Fargo, ND, 58102, United States of America, sumadhur.shakya@ndsu.edu, Bruce Dahl, William Wilson

Real Option methodology is used to model R&D of Genetically Modified traits using monte-carlo simulation and stochastic efficiency with respect to risk premiums. Risk attitude, risk premium, technology fees, adoption rate, planted acreage, probability of drought are treated as random in random on the model. This approach thus has advantage of providing full distribution of values of outcome instead of presenting one of the many scenarios. Traits :Drought Tolerance,NUE, Cold and All.

51 - Embedding Classical TSP Neighborhoods in a Single Ejection Chain Framework

Dorabela Gamboa, Associate Professor, Polytechnic of Porto, ESTGF-CIICESI-GECAD, Apt. 205, Felgueiras, 4610-156, Portugal, dgamboa@estgf.ipp.pt, Cesar Rego, Tabitha James, Fred Glover

The explicit exploration of classical k-opt TSP neighborhoods within Lin-Kernighan and other Ejection Chain methods is typically conceived at the first k levels of the chain. We show how k-opt and several other classes of traditional TSP neighborhoods can be explored in polynomial time for very high values of k.

52 - The Persistence of Hedge Funds Strategies in Different Economic Periods

Mahdi Nasereddin, Penn State University, Berks Campus, 2080 Tulpehocken Road, Reading, PA, 19610, United States of America, mxn16@psu.edu

This paper investigates the ability of a specific hedge fund strategy to always outperform the average market during different economic periods. Since the returns of hedge funds are non-normal (suffer from fat tails), ordinary least squares and other common statistical analysis may not reflect optimal results. Hence, this paper introduces the use of Support Vector Machine (SVM) to test the performance of hedge funds strategies. The paper compares the SVM results with neural networks.

53 - A Heuristic Method to Solve the Covering-routing Problem Considering Sensitive Areas

Danielle Araujo, Researcher Engineer, Institute for Advanced Studies - IEAv/DCTA, Rodovia dos Tamoios, km 5,5 Putim, São José dos Campos, SP, 12228001, Brazil, danielleaa@ieav.cta.br, Daniel Merli Lamosa, Monica De Marchi, Maria José P. Lamosa

This work treats a routing problem to cover a region that contains sensitive areas which must be revisited in a shortest time possible. Previously, we formulated the problem and proposed a greedy heuristic to solve it. In this work, we will present improvements in this heuristic and the obtained results.

54 - Unbiased Estimation and Confidence Intervals Comparison for Weibull Shape Parameter

Ye (Alice) Tian, Washington State University, 1445NE North Fairway dr. L45, Pullman, WA, 99163, United States of America, fieldtianye@gmail.com, Francis Pascual

Three approaches of estimation are used and compared for the shape parameter of the Weibull distribution. They are MLE, unbiased estimator based on Smallest Extreme Value sample range and simple unbiased estimator modified from literature. Unbiasing constants and variances are tabulated for both complete and type II right censored samples. Confidence intervals based on these estimators are generated and compared. All three estimators have well performed on engineering examples.

55 - Optimal Production Control and Labor Management in Lean Manufacturing

Yingjie Lan, Assistant Professor, Guanghua School of Management, Peking University, Beijing, 100871, China, ylan@pku.edu.cn, Lihua Chen, John Zhang

In this research, we develop a lean control model for a production line which can assemble multiple types of products. Our model finds the optimal production sequence and labor profile to minimize idle labor in a system with given TAKT and shift hour.

56 - Examination Staff Scheduling Model and its Application

Ertan Güner, Professor, Gazi University, Gazi Üniv. Müh.Fak. Eti Mah., Yükselis sok. No 5 Maltepe, Ankara, Turkey, erguner@gazi.edu.tr, Kemal Alaykiran, Alptekin Çoruhlu,

It is a difficult and time consuming task for the personnel to prepare schedules that takes into considerations the demands of the students, educators and the administrators in academic institutions. In this research, in a higher educational institution in which nearly four thousand students are educated, exam staff scheduling problem is studied.

Tuesday, 1:30pm - 3:00pm

■ TC01

C - Ballroom D1, Level 4

Investment Decisions in the Energy Sector

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Javier Contreras, Professor, University of Castilla - La Mancha, E.T.S. de Ingenieros Industriales, Ciudad Real, 13071, Spain, Javier.Contreras@uclm.es

1 - Analysis of Investments in Electricity Plants with Stochastic Bilevel Programming Techniques

Sonja Wogrin, Institute for Research in Technology, C/ Santa Cruz de Marcenado 26, Madrid, 28015, Spain, Sonja.Wogrin@iit.upcomillas.es, Efraim Centeno, Julián Barquìn

In this work bilevel programming techniques are applied to the generation capacity expansion problem in the electricity sector in order to carry out a game-theoretic market analysis to support the decisions that generation companies have to face in the electricity market in order to build new plants. A stochastic Mathematical Program with Equilibrium Constraints formulation of the generation capacity problem is compared to the non-stochastic model with a focus on the impact on model results.

2 - Stochastic Variational Inequality Models for Electricity Capacity Expansion

Yves Smeers, Professor, Université catholique de Louvain, CORE, Voie du Roman Pays 34, Louvain-la-Neuve, 1348, Belgium, yves.smeers@uclouvain.be, Andreas Ehrenmann

We reformulate the standard capacity expansion model into a stochastic equilibrium with endogenous discount factors. We model the systematic risk approach through CAPM/ APT where the discount rate depends on the covariance of the cash flow of the plants with a market index. We also model idiosyncratic risk through risk functions of different agents. We illustrate the results on a prototype example.

3 - Electricity Investment Under Climate Policy and Technological Uncertainties - A Real Option Approach

Lin Fan, Johns Hopkins University, 3400 N. Charles St., Baltimore, MD, 21218, United States of America, lfan@jhu.edu, Sabine Fuss, Catherine Norman, Jana Szolgayova, Benjamin Hobbs

We model the adoption of renewable technology in replacing fossil fuel generation facilities under uncertain carbon regulation and technological advancements. A real option model captures the value of postponing investment and waiting for information that affects cash flows. Simulations show that a failure to commit to regulations creates a barrier to adopting renewable technologies. Technological advancement itself may not necessarily expedite the investment.

4 - Multiarea Dynamic Transmission Expansion Planning

Javier Contreras, Professor, University of Castilla - La Mancha, E.T.S. de Ingenieros Industriales, Ciudad Real, 13071, Spain, Javier.Contreras@uclm.es, Alvaro Martìnez, José A. Aguado, Sebastiàn de la Torre

We present a multi-area dynamic transmission expansion planning model. We define a set of metrics to rate the effect of the expansion among generators and demands. Additionally, we use congestion and saturation indexes, measuring changes in nodal prices and line saturations, respectively. Our model is used to identify the most adequate individual and joint expansions for a multi-area system based upon the IEEE 24-bus RTS.

■ TC02

C - Ballroom D2, Level 4

Modeling LNG Value Chains

Cluster: Energy: Modeling the Interface Between Markets and Operations
Invited Session

Chair: Frode Romo, Research Director, SINTEF, S.P.Andersens Veg, Trondheim, 7465, Norway, frode.romo@sintef.no

1 - Comparative Analysis of Incumbent and Emerging Liquefied Natural Gas Regasification Technologies

Erkut Sonmez, Assistant Professor, Boston College, 140 Commonwealth Ave, Boston College, Fulton Hall 350D, Chestnut Hill, MA, 02467, United States of America, erkut.sonmez@bc.edu, Sunder Kekre, Nicola Secomandi, Alan Scheller-Wolf

In this paper, we develop and apply to data an integrated analytic framework to compare incumbent and emerging liquefied natural gas regasification technologies. We analyze the impact of process configuration and operational and financial performance on technology selection. Our analysis brings to light basic principles delineating when to deploy each technology and how to configure the emerging technology.

2 - Solving Operational and Tactical Problems in the LNG Value Chain

Truls Flatberg, Research scientist, SINTEF, P.O. Box 4760 Sluppen, Trondheim, 7465, Norway, Truls.Flatberg@sintef.no, Adrian Tobias Werner, Marte Fodstad, Oddvar Kloster, Arnt-Gunnar Lium, Vibeke Staerkebye Nörstebö, Frode Romo, Kristin Tolstad Uggen

Operating an LNG (liquefied natural gas) value chain is a complex problem involving both routing, inventory, contractual and market aspects. In this talk we will present a model for this problem, together with two solution approaches. The first is based on modeling the problem as a mixed programming problem while the other is a heuristic based on a constructive algorithm. We will also give examples on how these methods can be combined to solve realistic real world problems.

3 - LNG Planner - A Tool for Portfolio Optimization and Strategic Development of LNG Value Chains

Frode Romo, Research Director, SINTEF, S.P.Andersens Veg, Trondheim, 7465, Norway, frode.romo@sintef.no

SINTEF is developing a tool for portfolio optimization and strategic development of LNG value chains. The model makes decisions on how to expand the existing portfolio with potential investment opportunities in new LNG terminals, vessels and different types of purchase and sales contracts. The model horizon is typically in the range of 5-30 years. Since future energy prices are uncertain, the model has stochastic natural gas and LNG prices both in contracts and on spot markets.

■ TC03

C - Ballroom D3, Level 4

Economic Modeling and Analysis of US Bioenergy Policies

Sponsor: Energy, Natural Resources and the Environment//Forestry Sponsored Session

Chair: Hayri Onal, University of Illinois at Urbana-Champaign, Dept. Agricultural and Consumer Economics, Urbana, IL, 61801, United States of America, h-onal@illinois.edu

1 - Optimal Crop Yield Growth and Land use Change From Biofuel Expansion

Scott Malcolm, USDA Economic Research Service, Washington, DC, Smalcolm@ers.usda.gov, Liz Marshall

Expansion of agricultural production to meet biofuel production goals affects land use and agricultural markets. One solution to reduce land use change and mitigate market impacts is to increase crop yields. This paper examines how research to accelerate crop yield growth can be managed to reduce impacts on agricultural land.

2 - Renewable Fuel Standards in US: The Roles of Technology and Policy

Hayri Onal, University of Illinois at Urbana-Champaign, Dept Agricultural and Consumer Economics, Urbana, IL, 61801, United States of America, h-onal@illinois.edu, Madhu Khanna, Xiaoguang Chen, Haixiao Huang

Recent US energy policies aim at increasing the share of renewable fuels in transportation and mandate blending 36 B gallons of biofuels with petroleum-based transportation fuels by 2022. Biofuels produced from corn, oilseeds, and cellulosic biomass compete with food crops on limited agricultural land. We address economic impacts of this policy on food/feed markets and regional land use. A spatially disaggregated dynamic equilibrium model is developed and solved using Dantzig-Wolfe decomposition. Empirical results are presented.

3 - Experiences with a Linked National Model of the Forest and Agricultural Sectors

Ralph Alig, USDA Forest Service, PNW Research Station, Corvallis, OR, 97330, United States of America, ralig@fs.fed.us

An OR/MS-based tool, the Forest and Agriculture Sectors Optimization Model-Green House Gases (FASOMGHG), includes forest bioenergy and carbon accounting. Increased demands for land will affect forestry's potential contributions to bioenergy and other goods and services. Significantly more cropland will be required to help feed an additional 3 billion people by 2050 while producing bioenergy; furthermore, tens of millions of other acres are needed to house another 125 million U.S. residents.

4 - Second Generation Biofuels: Economic and Policy Issues
Wallace Tyner, Department of Agricultural Economics, Purdue University, West Lafayette, IN, 47907, wtyner@purdue.edu

This presentation will cover major economic and policy issues confronting second generation biofuels. There are three major sources of uncertainty for potential investors in second generation biofuels: technology, market, and government policy. This presentation will cover policy issues such as the blend wall, import tariffs, the RFS, and biofuel subsidies. It will also cover expected infrastructure impacts.

■ TC04

C - Ballroom D4, Level 4

Planning and Scheduling in the Power Sector

Cluster: Electrical Energy Systems
Invited Session

Chair: Alexandra Newman, Associate Professor, Colorado School of Mines, Room 319, Engineering Hall, Golden, CO, 80401, United States of America, anewman@mines.edu

1 - Hydroelectric Scheduling: Inflow Forecasting and Parallel Decomposition
Anderson Rodrigo de Queiroz, PhD. Student, University of Texas at Austin, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, ar_queiroz@yahoo.com.br, Luana Marangon Lima, David Morton, Elmira Popova

We model a hydroelectric scheduling problem as a multi-stage stochastic program with a probabilistic model for the future inflow process. We solve this problem via a sampling-based decomposition algorithm, using a parallel implementation to improve computation time. We present a time series model for the inflows that lends itself to the parallel decomposition algorithm.

2 - Infrastructure Investments Under Uncertainty in the Energy Sector
Asgeir Tomasgard, Professor, NTNU, Alfred Getz vei 3, 7491, Norway, asgeir.tomasgard@iot.ntnu.no, Morten Nielsen

The paper presents optimal investment strategies for a limited geographical region, and have high detail when it comes to technology choice, markets and demand, physical properties of the system and modelling of regulation and incentives. The model analyse optimal investment strategies for power plants, transportation systems and distribution systems for energy. Improvements will be gained by including stochastic elements in supply of renewable energy (wind, hydro, solar etc).

3 - Estimating the Cost Savings From Demand Response using the Unit Commitment Model
Jennifer Van Dinter, PhD candidate, Colorado School of Mines, Golden, CO, 80401, United States of America, jvandint@mymail.mines.edu

A power system's delicate balance relies on the availability of spinning reserves, which supply instantaneous generation in the event of an unanticipated outage. However, committing to provide spinning reserves forces some generators to operate well below their efficient level, increasing fuel consumption and emissions. We explore potential costs savings from the implementation of demand response, or load shedding, in lieu of a fraction of spinning reserves, using a unit commitment model.

4 - Mathematical Optimization Technique for Managing Selective Catalytic Reduction
Passakorn Phananiramai, University of Texas at Arlington, Arlington, TX, United States of America, passakorn.phananiramai@mavs.uta.edu, Jay Rosenberger, Victoria Chen, Melanie Sattler

Selective catalytic reduction (SCR) is an emission control technique that reduces harmful emissions of oxides of nitrogen (NOx). To maintain performance, an effective SCR management plan that is both efficient at reducing NOx and limiting operating costs is extremely desirable. In this research, we develop an SCR management framework that finds an optimal SCR management plan that minimizes NOx emissions using integer programming.

■ TC05

C - Ballroom D5, Level 4

Queueing Models I

Contributed Session

Chair: Raha Akhavan-Tabatabaei, Assistant Professor, Universidad de los Andes, Cra 1 Este # 19A-40, Bogotà, Colombia, r.akhavan@uniandes.edu.co

1 - Approximating the M/M/1+D Queue
Isilay Talay Degirmenci, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States of America, isilay.talay@duke.edu, Otis Jennings

We explore two heuristics for approximating the steady state queue length distribution for single server queuing systems with deterministic abandonment times. Based on heavy-traffic limit theory, the second approach extends to generally distributed interarrival and service time random variables.

2 - jMarkov: A Modelling Software for Markov Chains and QBDs
Marco Sergio Cote Vicini, Universidad de los Andes, Cra 1 Este # 19A-40, Bogotá, Colombia, ms.cote133@uniandes.edu.co, Raha Akhavan-Tabatabaei, Juan Jose Ucros, Germán Riaño

jMarkov is an object oriented modeling software designed for stochastic systems, It allows the user to create any size Markov Models. This is achieved extending a given class and implementing functions that describe the dynamics of the system. The user only needs to describe the dynamics of the system in terms of the states that the system can be and the events that can modify the current state. jMarkov also provides the tools to model Quasi-Birth and Death Processes with the same philosophy.

3 - Inventory Rationing for Multiple Classes and Finite Populations
Pedram Sahba, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, pedram@mie.utoronto.ca, Baris Balcioglu

We consider a system with different fleets of machines subject to failures. Failed components are repaired in a centralized repair shop. There is a centralized spare part inventory operated according to an inventory rationing policy. We use a sequence of queueing systems. Each queue is indexed with a rationing level/fleet r and is employed to obtain the distribution of down machines in fleet r. Additionally, the server is subject to interruptions. We test the accuracy of our method.

4 - Role of Higher Moments in The Accuracy of G/G/m Approximations
Daniel Felipe Otero, Research Assistant, Universidad de los Andes, Cra 1 Este # 19A-40, Bogotá, Colombia, df.otero128@uniandes.edu.co, Raha Akhavan-Tabatabaei

Classical G/G/m approximations consider up to the second moment of inter-arrival time and service time distributions. We study the role of the third and fourth moments in the accuracy of queue time estimation by these models and present some cases where considering the higher moments can improve the estimates. Finally we show a numeric solution to estimate the mean value of the queue time using the higher moments.

5 - A Queueing Network Model for Cycle Time Analysis of a MiniFAB in Semiconductor Manufacturing
Raha Akhavan-Tabatabaei, Assistant Professor, Universidad de los Andes, Cra 1 Este # 19A-40, Bogotà, Colombia, r.akhavan@uniandes.edu.co, Juan Jose Ucros

We model the semiconductor MiniFAB as a network of queues with re-entrance and decompose the network to single-stage queueing models to represent toolsets. WIP dependent arrival and failure processes and non-exponential distributions are assumed to be in effect. We apply the phase-type distribution to approximate the non-exponential distributions of each stage and present results.

■ TC06

C - Ballroom E, Level 4

Tutorial: The Trojan Horse of Time-Risk Preference Representations

Cluster: Tutorials
Invited Session

Chair: Matthew J. Sobel, Case Western Reserve University, Dept. of Operations, Weatherhead School, 10900 Euclid Ave, Cleveland, OH, 44106-7235, United States of America, matthew.sobel@case.edu

1 - The Trojan Horse of Time-Risk Preference Representations
Matthew J. Sobel, Case Western Reserve University, Dept of Operations, Weatherhead School, 10900 Euclid Ave, Cleveland, OH, 44106-7235, United States of America, matthew.sobel@case.edu

Throughout the management sciences, individuals and organizations compare alternatives with consequences that are risky and unfold over time. This tutorial examines representations of preferences that are sensitive to timing and risk. It reviews the logical foundations of the two major contending representations and finds that each of them is self-contradictory. In particular, properties of preferences that are consistent with discounting are also consistent with risk neutrality. In this sense, discounting implies risk neutrality. Then the tutorial briefly examines the prospects of developing new representations that are logically consistent. The tutorial ends by applying the various representations to a model of a supply chain contract.

■ TC07

C - Ballroom F & G, Level 4

Daniel H. Wagner Prize for Excellence in Operations Research

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research
Invited Session

Chair: Allen Butler, President, Daniel H. Wagner Associates, Inc., 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, Allen.Butler@va.wagner.com

1 - OnTheMark: Integrated Stochastic Resource Planning
Mark Squillante, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com, Yingdong Lu, Shilpa Mahatma, Aleksandra Mojsilovic, Heng Cao, Mayank Sharma, Jianying Hu, Tarun Kumar, Chen Jiang, Ta-Hsin Li, Yang Liu, Yichong Yu

We present a suite of innovative operations research models and methods that supports the effective and efficient management and planning of human capital supply chains and that has been developed and implemented to optimize performance in the information technology services industry. This suite constitutes an end-to-end solution that is deployed as a critical part of the human capital management and planning process within IBM, driving growth, profitability and client satisfaction.

■ TC08

C - Room 11A, Level 4

Reliability Issues in Location Models

Sponsor: Location Analysis
Sponsored Session

Chair: Dmitry Krass, Professor, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Krass@Rotman.Utoronto.Ca

1 - A New Median Interdiction Model: RIVAL
Rick Church, Professor, University of California, Santa Barbara, Department of Geography, Santa Barbara, CA, 93106-4060, United States of America, church@geog.ucsb.edu

Over the past two decades, a number of models have been developed to address the possibility of an intentional disruption of a supply chain, facility operations, and network connections. This paper discusses recent developments in median facility interdiction in general, as well as proposes a new expanded model, called RIVAL, which can be used to generate worst case losses for a wider range of covering and median systems than existing models.

2 - Median Problem with Unreliable Facilities (MPUF) on a Line
Oded Berman, Professor, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Berman@Rotman.Utoronto.Ca, Dmitry Krass

Consider a set of facilities on a unit line where each facility may fail with a certain probability and customer demand is uniformly distributed. The objective is to minimize expected travel cost. We derive an analytical solution to the n-facility version and use it to study centralization and co-location effects.

3 - Optimal Search Path for Service in the Presence of Disruptions
Dmitry Krass, Professor, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Krass@Rotman.Utoronto.Ca, Oded Berman, Eduard Ianovsky

Consider the following basic search path problem: a customer residing at a node of a network needs to obtain service from one n facilities whose locations are known and fixed. Facilities may become inoperational with certain probability; the state of the facility only becomes known when the facility is visited. Customer travel stops when the first operational facility is found. The objective is to minimize the expected total travel distance.

■ TC09

C - Room 11B, Level 4

Environmental Issues in Operations Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Suresh Muthulingam, Assistant Professor of Operations Management, Johnson Graduate School of Management, 401P Sage Hall, Cornell University, Ithaca, NY, 14853, United States of America, sm875@cornell.edu

1 - Consumer Perceptions of Remanufactured Consumer Products
Daniel Guide, Jr., Associate Professor of Operations & Supply Chain Management, Smeal College of Business, The Pennsylvania State University, 464 Business Bldg University Park, PA, 16802, United States of America, dguide@psu.edu, Meg Meloy, James Abbey, Selin Atalay

We explore consumer attitudes toward remanufactured goods produced at different levels of brand equity and discounting. The study is theoretically grounded in previous marketing research on consumer contamination and possessions and the extended self.

2 - Outsourcing Environmental Inspections: Which Private-sector Inspectors are Reliably Stringent?
Michael Toffel, Assistant Professor, Harvard Business School, Morgan Hall 497, Boston, MA, 02163, United States of America, mtoffel@hbs.edu, Lamar Pierce

Many governments have outsourced vehicle emissions testing to private garages, despite risks that doing so could result in lax inspections and excessive pollution. Certification, franchising, and corporate ownership are private governance mechanisms that might encourage garages to inspect more stringently. Analyzing millions of emissions tests, we find that some of these governance mechanisms are associated with more stringent testing, which has implications for managing quality and suppliers.

3 - Linking Environmental Initiatives and Performance
Ravi Subramanian, Georgia Institute of Techology, 800 West Peachtree St. NW, Atlanta, GA, 30308, United States of America, Ravi.Subramanian@mgt.gatech.edu, Manpreet Hora

As part of sustainability undertakings, firms announce initiatives to reduce the environmental impacts of their products and processes. However, it is unclear which of these initiatives have a positive impact on environmental performance. In this study, we examine the association between announcements of firm-level environmental initiatives and performance as measured by toxicity-weighted pollutant releases.

4 - Investment in Energy Efficiency by Small and Medium-Sized Firms
Suresh Muthulingam, Assistant Professor of Operations Management, Johnson Graduate School of Management, 401P Sage Hall, Cornell University, Ithaca, NY, 14853, United States of America, sm875@cornell.edu

We investigate the adoption and non-adoption of energy efficiency initiatives using a database of over 100,000 recommendations provided to more than 13,000 small and medium-sized manufacturing firms. We identify several factors that influence firms' decisions of which energy-efficiency initiatives to implement. We draw implications for enhancing adoption of energy-efficiency initiatives and for other decision contexts where a collection of process improvement recommendations are made to firms.

■ TC10

C - Room 12A, Level 4

Global Health Supply Chains

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Terry Taylor, Associate Professor, Haas School of Business, U.C. Berkeley, 545 Student Services #1900, Berkeley, CA, 94720, United States of America, taylor@haas.berkeley.edu

1 - Improving the Public Distribution of Essential Medicines in Sub-Saharan Africa: The Case of Zambia

Jérémie Gallien, London Business School, London, United Kingdom, jgallien@london.edu, Romain Davroux, Prashant Yadav, Zachary Leung, Anastasia Chen

Essential medical drugs and supplies are critically needed in Zambia. However, the current public distribution system results in poor availability of these products to patients. To address this issue, we develop an alternative control system involving optimization and mobile phones. Using a simulation model built with extensive field data collected in collaboration with the World Bank, Crown Agents and JSI, we find this proposal to be promising. Finally, we discuss its implementation.

2 - Improving HIV Early Infant Diagnosis (EID) Supply Chains in Sub-Saharan Africa

Sarang Deo, Assistant Professor, Northwestern University - Kellogg School of Management, Evanston, IL, United States of America, s-deo@kellogg.northwestern.edu, Jérémie 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 that transport samples from remote clinics to a central lab. We develop a queuing network model of the EID supply chain and uncover key operational decisions that cause delays and suggest systematic improvements that can reduce overall mortality. We quantify the benefit in mortality based on retrospective data collected from Uganda.

3 - Purchasing Commitments to Encourage Pharmaceuticals to Invest in Research and Development

Yehuda Bassok, USC, Bridge Hall, Los Angeles, CA, 90089, United States of America, ybassok@marshall.usc.edu, Sriram Dasu

Developing and producing drugs and vaccines is risky. The success rate in developing new products is low, and the R&D costs are high and are irreversible. The objective is to design mechanisms to encourage development of new products, build capacity and produce the appropriate products. We develop a payment mechanism that encourages pharmaceuticals to develop and produce drugs and at the same time encourages states and donors to reveal their true demand and not to inflate it.

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

Terry Taylor, Associate Professor, Haas School of Business, U.C. Berkeley, 545 Student Services #1900, Berkeley, CA, 94720, 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.

■ TC11

C - Room 12B, Level 4

Supply Chain Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Shuya Yin, University of California Irvine, Paul Merage School of Business, Irvine, CA, United States of America, syin@exchange.uci.edu

1 - Demand Uncertainty and Production Lead Time in a Durable Goods Market

Xiaobo Zheng, PhD Student, Simon School of Business, University of Rochester, Rochester, NY, 14627, United States of America, xiaobo.zheng@simon.rochester.edu, Vera Tilson

Lead time and the resulting demand uncertainty affect production and pricing decisions of durable goods manufacturers. Manufacturers must make production decisions based on economic forecasts of demand. After the production is complete and economic conditions better understood, the manufacturer can adjust pricing to increase its profits. Durable goods manufacturers face additional complication - the cannibalization of sales via the second-hand market.

2 - Combating Strategic Counterfeiters in Licit and Illicit Supply Chains

Xin Fang, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15215, United States of America, xfang@andrew.cmu.edu, Sridhar Tayur, Soo-Haeng Cho

We consider a brand name company faced with a counterfeiter who strategically decides the price, quality, and type of his goods between a low-price substitute (sold via an illicit supply chain) and a deceptive counterfeit (sold via a licit supply chain). We analyze the effectiveness of various anti-counterfeiting strategies and find that, although it is ideal that strategies which are effective against counterfeiting also benefit consumers, this is not always the case.

3 - Contracting with Asymmetric Price-Dependent Stochastic Demand Information in Supply Chains

Xiang Fang, University of Wisconsin Milwaukee, 3202 N. Maryland Ave., Milwaukee, United States of America, fangx@uwm.edu, Yunzeng Wang

We consider a supplier who sells to a newsvendor retailer. The retailer holds private demand information, and the demand is price-dependent and stochastic. We use mechanism design theory to derive optimal contracts for the supplier. We then analyze the values of information to the supplier, retailer and the channel. We also compare every player's performance under different contract forms.

4 - Demand Shaping and Product Overselling to Match Supply and Demand for Assemble-to-Order Firms

Man Yu, Assistant Professor, HKUST Business School, Clear Water Bay, Hong Kong - PRC, manyu@ust.hk, Roman Kapuscinski, Hyun-Soo Ahn

We consider the joint pricing and order-fulfillment decisions for assemble-to-order firms with substitutable products. We show that the firms' profit can be significantly improved by shaping demand and overselling products.

5 - Equilibrium Analysis of Capacity Allocation with Demand Competition

Zhixin Liu, Assistant Professor, University of Michigan - Dearborn, 19000 Hubbard Drive, Dearborn, MI, 48126, United States of America, zhixin@umd.umich.edu

This work studies the capacity allocation decisions in a supply chain where a supplier provides a product to multiple retailers. The retailers order the supplier's capacity subject to a capacity allocation mechanism, and also compete for customers' demand. We perform an equilibrium analysis for the allocation of the supplier's capacity under different types of allocation rules, and find that the profits of the supplier and retailers are not increasing with the capacity level of the supplier.

■ TC12

C - Room 13A, Level 4

Supply Chain Optimization

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: T Warren Liao, Professor, Louisiana State University, 3128 PFT Hall, Baton Rouge, LA, 70803, United States of America, ieliao@lsu.edu

1 - Supply Allocation for Disaster Management: The Case of the Louisiana Gulf Coast

Peter Kelle, Professor, Louisiana State University, ISDS Department, Baton Rouge, LA, 70803, United States of America, qmkell@lsu.edu, Helmut Schneider, Huizhi Yi

Supply allocation and distribution problems are considered with the specifics of hurricane situations. Different scenarios are considered under uncertainties. For the case of the Louisiana Gulf Coast we build up an optimization model based on stochastic programming. The sensitivity of the solution is examined by simulation using some projections and some real-life data.

2 - Optimization of Supply Chain Inventory using Metaheuristics

T Warren Liao, Professor, Louisiana State University, 3128 PFT Hall, Baton Rouge, LA, 70803, United States of America, ieliao@lsu.edu

A procedure is developed to determine the optimal inventory of a 3-level serial supply chain based on historical demand series using metaheuristics. The procedure is applied to five different forcasting methods, five different forcasting accuracy measures, two different inventory policies, lead times of 1-5 units, using two different metaheuristic algorithms. The results are discussed.

3 - A Comparison of Computational and Theoretical Approaches to Inventory Optimization

Qinglin Duan, Louisiana State University, 3128 Patrick F. Taylor Hall, Department of Industrial Engineering, Baton Rouge, LA, 70803, United States of America, hpduan@gmail.com, T Warren Liao

We apply two versions of Ant Colony Optimization (ACOr)to deal with single-echelon inventory system controlled by(R,Q) policy with backorder and compare them to corresponding theoretical approaches: Rosling(2002) and Axäster(2005). Several demand datasets were tested. The results are presented and the advantages of ACOr over theoretical models are discussed.

4 - A Decomposition Method for an Equipment Overhaul Problem with Coupled Demands for Service Parts

Collin Chan, PhD Candidate, ORIE, Cornell University, 257 Rhodes Hall, Ithaca, NY, 14853, United States of America, csc45@cornell.edu, Peter Jackson, Huseyin Topaloglu, John Muckstadt

We consider the problem of procuring and allocating service parts for a non-stationary equipment overhaul problem with stochastic demands for multiple job types requiring different combinations of service parts. We use a price-driven decomposition approach to optimize the total inventory cost. Using numerical results, we point to places in the parameter space where our policy yields cost advantages over independent order-up-to procurement and simple FCFS / myopic allocation.

■ TC13

C - Room 13B, Level 4

Delay Announcements

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Gad Allon, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu

1 - Cheap Talk in Queues with Multiple Customer Classes

Gad Allon, Northwestern University, 2001 Sheridan Road, 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 - Information and Pricing in Service Systems with Congestion-Based Staffing Policy

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

Many service systems adopt congestion-based staffing policy in which the number of servers is adjusted according to queue length. We study both the control issue over staffing policy and the control issue over arrival rate with a toll. Different information scenarios on servers' status and the queue length are considered.

3 - On the Accuracy of Announcing the Delay of the Last Customer to Enter Service in Large Call Centers

Rouba Ibrahim, University of Montreal, Montreal, Canada, rei2101@columbia.edu, Avishai Mandelbaum, Achal Bassamboo, Mor Armony

We study ways of predicting customer delay in a call center based on the recent history of delays. Our delay predictions may be used to make delay announcements. A main predictor is the delay of the last customer to enter service (LES) at the time of a new arrival. First, we prove the asymptotic accuracy of LES in many-server single-class queues with announcement-dependent balking and abandonment. Then, we evaluate the accuracy of LES via empirical analysis of real-life call center data.

4 - Staffing and Routing in a Two-call Center System with Reassignment Costs: Supply Chain Methodology

Yale T. Herer, Technion, Israel Institute of Technology, Faculty of Industrial Engineering and Ma, Haifa, 32000, Israel, yale@technion.ac.il, Yanir Cohen, Sergey Zeltyn, Segev Wasserkrug

We study call-centers that have the ability to reassign calls at a known cost. We take a minimum expected cost approach and consider staffing and waiting costs as well. We examine static (state-independent) policies for the two location problem. Moreover, we consider dynamic (state-dependent) policies for the one location problem with an external service provider and a two location problem. For the last problem we draw on an analogy with the two location inventory problem with transshipments.

■ TC14

C - Room 14, Level 4

Supply Chain Management VI

Contributed Session

Chair: Mehmet Barut, Associate Professor, Wichita State University, 1845 N Fairmount St, Wichita, KS, 67260, United States of America, Mehmet.Barut@wichita.edu

1 - Revenue Sharing with a Rational Retailer

Seb Heese, Indiana University, 1309 E 10th Street, Bloomington, IN, 47405, United States of America, hheese@indiana.edu, Eda Kemahlioglu-Ziya

Revenue sharing contracts are widely used to align the incentives of different channel members. Under a typical revenue sharing contract, if it is impossible or prohibitively expensive for the manufacturer to always verify the retailer's sales reports, a rational retailer has incentive to underreport sales and cheat the manufacturer out of part of its profit. We develop a simple analytical model and investigate the impact of such opportunism on the different supply chain constituents.

2 - Global Supply Chain Design with Offshoring and Transfer Pricing

Ziping Wang, University of Bridgeport, 230 Park Ave, Bridgeport, CT, 06460, United States of America, zipingw@bridgeport.edu, Xiaohang Yue, Samar Mukhopadhyay

This paper discusses offshoring and transfer pricing strategies for global supply chain in uncertain environment. A global company may move production to a foreign country to take advantage of low manufacturing cost, and also experience tax savings. We study four alternative global supply chain designs with stochastic demand and catch how the transfer price acts as an incentive mechanism. Possible suggestions are also presented to global firms.

3 - Price Negotiation, Quantity Commitment and Capacity Decisions in a Multi-tier Supply Chain

Yulan Wang, Assistant Professor, Hong Kong Polytechnic University, Kowloon, Hong Kong, Hong Kong - PRC, tcywang@polyu.edu.hk, Baozhuang Niu, Pengfei Guo, Jeannette Song

We analyze the wholesale price negotiation and capacity/inventory risk allocation issue in a three-tier supply chain composed of an OEM, a CM and a supplier, under two outsourcing structures, control and delegation and two risk allocation contracts, push and pull. We derive the generalized Nash Bargaining-induced wholesale prices and equilibrium ordering/capacity decisions. Then we study the preference of the OEM over the outsourcing structure and risk allocation mechanism.

4 - Capacity Investment and Task Assignment in Supply Chain Programs: Planning and Coordination Mechanisms

Suri Gurumurthi, PhD Candidate, Duke University, 13304 Rose Garden Lane, Durham, NC, 27707, United States of America, sg61@duke.edu

The elements of programs are tasks that heterogeneous resources owned and operated by the constituent firms. Tasks are divisible and can be shared between multiple resources conditional on their capabilities. I model uncertainties in task work requirements and capture both synergies and inefficiencies implied by inter-firm collaboration. I develop capacity planning mechanisms that lead to optimal program outcomes in expectation, and incentive mechanisms that coordinate the capacity investments.

5 - Capacity Implications of Co-promotions in Two-echelon Supply Chains

Mehmet Barut, Associate Professor, Wichita State University, 1845 N Fairmount St, Wichita, KS, 67260, United States of America, Mehmet.Barut@wichita.edu, Ahmet Ozkul, Hurrem Yilmaz

Marketers practice co-promotions to manipulate their budgets to ease the clutter in promotional space and to shift the supremacy of price upon customers' purchase decision. Considering two types of products, we propose a framework to match co-promoted products with firms' effective capacity, and test our hypotheses with experimental data. The results reveal that the type of product and ordering policies of the focal company may be detrimental to the success of the co-promotion strategy.

■ TC15

C - Room 15, Level 4

Computer Science-Applications to OR I

Contributed Session

Chair: Clara Novoa, Assistant Professor, Texas State University, 601 University Dr, San Marcos, TX, 78666, United States of America, cn17@txstate.edu

1 - Search Tree Restructuring

Erik Zawadzki, PhD Student, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, epz@cs.cmu.edu, Tuomas Sandholm

Poor branching decisions in search can increase solve time by orders of magnitude. We introduce an approach where, instead of committing to the tree so far, we restructure the tree throughout the search. We define two tree-modifying operators and show that conflict-directed backtracking (CDBT) can be expressed as a compound operation. CDBT is, however, only one of many compound tree operations. We study more aggressive compound operations and present experiments on graph coloring and 3SAT.

2 - A New Heuristic Algorithm for the Non-unique Probe Selection Problem

Elisa Pappalardo, Department of Mathematics and Computer Science, University of Catania, Viale Andrea Doria, 6, Catania, Italy, epappalardo@dmi.unict.it, Beyza Ahlatcioglu Ozkok, Panos Pardalos

The identification of biological agents in a sample is an important problem arising in medicine. In this talk we introduce a new model and heuristic for the Non-unique probe selection problem. This model consists of selecting optimal oligonucleotide probe sets for use in hybridization experiments in which target viruses or bacteria are to be identified in biological samples. Furthermore, the feasible solution is produced for large, real data sets.

3 - An Infinite Hidden-Markov Model for Multiple Change Point Estimation

Chandan Reddy, Assistant Professor, Wayne State University, 5143 Cass Avenue, 452 State Hall, Detroit, MI, 48084, United States of America, reddy@cs.wayne.edu, Adel Alaeddini, Kai Yang

Despite their capability in monitoring the variability of processes, control charts are not effective tools for identifying process change points. In this paper, we develop an infinite hidden Markov model (HMM) with parameters estimated using Dirichlet process (DP) and Markov Chain Monte Carlo (MCMC) for identifying multiple change-points in different types of processes. We also use extensive simulation studies to study the performance of the proposed method.

4 - Parallel Knapsack Algorithms on Multicore Architectures

Clara Novoa, Assistant Professor, Texas State University, 601 University Dr, San Marcos, TX, 78666, United States of America, cn17@txstate.edu, Apan Qasem, Hammad Rashid

This work investigates the scalability of two parallel implementations of dynamic programming recursions for the integral knapsack problem on multicore architectures. The study also identifies a tunable parameter which can be used to enhance speedup.

■ TC16

C - Room 16A, Level 4

Scheduling II

Contributed Session

Chair: Jeffrey Schaller, Professor, Eastern Connecticut State University, 83 Windham St., Department of Business Administration, Willimantic, CT, 06226, United States of America, schallerj@easternct.edu

1 - Scheduling in Bicriteria Stochastic Single Machine Systems

Hossein Soroush, Professor, Kuwait University, P.O. Box 5969, Department of Stat. & OR, Safat, 13060, Kuwait, h.soroush@ku.edu.kw, Talal Al-Khamis

We study a bi-criteria single machine scheduling problem with stochastic job attributes. The objective is to find an optimal sequence that minimizes the expected value of a nonlinear function of two performance criteria. The problem is NP-hard; however, special cases are solvable exactly when there are some conditions on the cost functions and the criteria. Computational results are reported to show the performance of the proposed solution strategies.

2 - An LP Based General Method for Job Shop Scheduling with Intermediate Inventory Holding Costs

Phil Kaminsky, University of California Berkeley, IEOR, Berkeley, CA, 94720, United States of America, kaminsky@ieor.berkeley.edu, Kerem Bulbul

We present a shifting bottleneck heuristic for job shop scheduling problems with intermediate holding costs. We utilize information from the LP formulation of the associated timing problem to solve sub-problems, and can be used for any objective function whose associated timing problem can be expressed as a linear program. Computationally, this approach performs as well or better than specialized algorithms for specific objective functions that have appeared previously in the literature.

3 - Minimizing Sequence-dependent Setup Costs in Feeding Batch Processes Under Due Date Restrictions

Stefan Bock, Professor, University of Wuppertal, Gauflstrafle 20, Wuppertal, 42097, Germany, sbock@winfor.de, Kathrin Klamroth

We address the minimization of sequence-dependent setup costs in feeding batch processes. Since these processes supply subsequent stages, due dates have to be guaranteed. Besides analyzing the complexity status of the problem, we propose new Branch\ &Bound algorithms. By making use of new dominance rules, problem instances of large sizes can be solved to optimality. Moreover, a Tabu Search procedure is introduced. The efficiency of the approaches is validated by computational experiments.

4 - Parallel Machine Scheduling Problem

Mona Asudegi, PhD Student, University of Maryland, 1173 G, Glenn Martin Hall, College Park, 20740, United States of America, asudegi@umd.edu, Ali Haghani

Parallel machine scheduling is a well known problem in optimization area. Though this problem is NP hard, but the structure of formulation may help solving the problem easier. In this study a new formulation is proposed for construction machine scheduling and the approach for solving it is discussed.

5 - Scheduling Jobs in a Permutation Flowshop to Minimize Total Earliness and Tardiness

Jeffrey Schaller, Professor, Eastern Connecticut State University, 83 Windham St., Department of Business Administration, Willimantic, CT, 06226, United States of America, schallerj@easternct.edu, Jorge Valente

This paper considers the problem of scheduling jobs in a permutation flow shop with the objective of minimizing total earliness and tardiness. Procedures are described and results of tests on various problem sets are reported.

■ TC17

C - Room 16B, Level 4

Logistics and SCM in India

Cluster: OR/MS in India

Invited Session

Chair: N Viswanadham, Professor, Indian School of Business, Gachibowli, Hyderabad, AP, 500032, India, n_viswanadham@isb.edu

1 - Sourcing Strategies in the Presence of Low Cost Suppliers in a Supply Base

B Mahadevan, Professor, Indian Institute of Management Bangalore, Bannerghatta Road, Bangalore, 560076, India, mahadev@IIMB.ERNET.IN, Jishnu Hazra

Economies such as India offer value propositions of low cost of products requiring sourcing strategies that address cost-heterogeneous supply base. In this paper we address the buyer's decisions pertaining to "how much capacity to reserve" and "from how many suppliers" while sourcing from a cost heterogeneous supply base. We derive suppliers' capacity reservation price. We develop solutions that are robust to the number of suppliers from whom capacity is procured through reservation.

2 - Automated Railway Investment Analysis using Line Capacity Simulator

Hari Prasad, Manager, Analytics, Delta Partners Media Arab Emirates, hari.prasadh@gmail.com, hari.uday@gmail.com

In this paper, we present an automated business intelligence tool to aid operational and infrastructural decision making for short term , mid term and long term railway investments.It is based on innovative simulation techniques modeling all the major parameters of traffic flow which are the section details,including location of stations and block signals, number of tracks, track characteristics by way of speed limits and curvatures, speed restrictions and gradients and train characteristics , for both timetabled and un-timetabled operations. The full extent of section investments in capacity is possible through the detailed simulator analysis, i.e. number of tracks, block sections (through stations, intermediate blocks and automatic signaling at any inter-signal distance), relaxing speed restrictions, smoothening gradients and train running options (longer trains, faster trains). The simulation output can be further used for traffic planning, time-tabling, maintenance planning and operational analysis.

3 - Orchestrating the Logistics in The World's Largest Democratic Activity: The Indian General Elections

N Viswanadham, Professor, Indian School of Business, Gachibowli, Hyderabad AP 500032, India, n_viswanadham@isb.edu, S. Kameshwaran, I.V. Subba Rao, Somya Saxena

The General Elections in India is the largest democratic election in the world. In the 15th General Elections conducted in 2009, 714 million strong electorate used 13,68,430 electronic voting machines in 8,28,804 polling stations around the country to elect 543 members. The election was conducted in five phases, spanning over a month to trade-off the security versus logistics of this massive event. Around 4.1 million civilian staff members and 2.1 million security personnel were deployed and transported using 119 special trains. The total budget estimated for this massive operation was INR 1,120 Crores. In this paper, we describe the electoral process that endeavors to deliver free, fair, and impartial elections in the world's largest democracy in the presence several political, social and terrorist risks.

■ TC18

C - Room 17A, Level 4

Modeling Frameworks

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Larry J. LeBlanc, Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States of America, Larry.LeBlanc@Owen.Vanderbilt.edu

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - From Spreadsheets to C++: Different Approaches for Implementing Optimization Models

Larry J. LeBlanc, Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States of America, Larry.LeBlanc@Owen.Vanderbilt.edu, Tom Grossman

Recent developments in software and programming techniques have increased the options for building optimization models to include various spreadsheet approaches, algebraic modeling languages, and traditional matrix generators. With a spreadsheet, options include native spreadsheet, spreadsheet with VBA, and a new automatic code generation approach. In many cases, model development is faster in spreadsheets than in with algebraic software. We discuss the relative merits of the various approaches.

2 - Robust Optimization Made Easy with ROME

Joel Goh, Stanford University, Stanford, CA, United States of America, joelgoh@stanford.edu, Melvyn Sim

We introduce ROME, a MATLAB-based algebraic modeling toolbox for modeling a class of robust optimization problems. ROME serves as an intermediate layer between the modeler and optimization solver engines, allowing modelers to express robust optimization problems in a mathematically meaningful way. Using modeling examples, we discuss how ROME can be used to model and analyze robust optimization problems. ROME is freely distributed for academic use from www.robustopt.com.

3 - Robust Optimization Put Into Practice

Marcel Hunting, Paragon Decision Technology, Schipholweg 1, Haarlem, 2034 LS, Netherlands, marcel.hunting@aimms.com

The AIMMS modeling language offers support for robust optimization. We show how a deterministic model can be transformed into a model that handles uncertain data. Recently support for MIP models has been added.

■ TC19

C - Room 17B, Level 4

Emerging Trends in Pricing and Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Mehmet Sekip Altug, Visiting Assistant Professor, George Washington University, School of Business, Washington, DC, 20052, United States of America, maltug@gwu.edu

1 - Revenue Management with Costly Price Adjustments

Alp Muharremoglu, Assistant Professor, Columbia University, Graduate School of Business, United States of America, alp2101@columbia.edu, Sergei Savin, Sabri Celik

We consider a variant of the pricing problem faced by a firm that sells a fixed inventory over a finite horizon in the presence of price-adjustment costs. In economics literature, such price-adjustment costs are widely studied and are typically assumed to include a fixed component (e.g., advertising costs), an inventory dependent component (e.g., inventory relabeling costs), as well as a component that depends on the magnitude of the price adjustment (e.g., cognitive and coordination managerial costs).We develop and solve a fluid model based on the original stochastic dynamics and propose three fluid-based heuristic policies. We derive expressions for the expected profit generated by each one of these heuristics when applied to the stochastic problem and derive sufficient conditions for the asymptotic optimality of the policies. We test the performance of the heuristics in a numerical study and demonstrate a robust, near-optimal performance of one of the heuristics for a wide range of problem parameters. Finally, we demonstrate the importance of proper accounting of price-adjustment costs in several alternative business settings.

.2 - Dynamic Pricing of Multiple Products in the Presence of Capacity Flexibility

Oben Ceryan, 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 the influence of capacity flexibility on a firm's dynamic pricing strategy. We consider a firm producing multiple substitutable products utilizing product dedicated and flexible resources and characterize the structure of the optimal production and pricing decisions. We show that the availability of a flexible resource helps maintain stable price differences across items even though the price of each item may fluctuate over time.

3 - A Branch-and-cut Algorithm for the Latent-class Logit Assortment Problem

Gustavo Vulcano, New York University, 44 West Fourth Street, Suite 8-76, New York, NY, 10012, United States of America, gvulcano@stern.nyu.edu, Juan Jose Miranda Bront, Paula Zabala, Isabel Mendez

We study the product assortment problem of a retail operation. Each customer checks the offer set displayed by the firm, and either chooses one of those products or quits without purchasing. The firm's goal is to maximize the expected revenue extracted from each customer. The general version of the problem is NP-Hard. In this paper, we analyze unconstrained and constrained versions of it, and propose a B&C algorithm that is computationally feasible and leads to high-quality solutions.

4 - Optimal Dynamic Return Management of Fixed Inventories

Mehmet Sekip Altug, Visiting 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.

■ TC20

C - Room 18A, Level 4

Extensions to Traditional Pricing and Revenue Optimization Approaches

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Maarten Oosten, SAS Institute, 100 SAS Campus Drive, Cary, NC, United States of America, maarten.oosten@sas.com

1 - An Optimization Model for Renewal Pricing and Expiration Management in the Apartment Industry

Amruth Sivalenka, Vice President, Business Consulting, The Rainmaker Group, 5755 North Point Pkwy, Suite 77, Alpharetta, GA, 30022, United States of America, asivalenka@letitrain.com, Rajan Batta

The apartment industry is similar to the traditional industries, like hotel and car-rental, in general business format. However, the apartment industry has the unique revenue-critical aspects of renewals and expiration management. Being alien to the traditional industries, these two aspects have been understudied problems. They have significant impact on revenues in the apartment industry. In this work, we present an optimization model for simultaneous renewal pricing and expiration management. The optimization model optimizes rents by dynamically looking into the long-term future with network effects while allowing us to embed corporate strategies. The model compensates for the risks and costs associated with demand seasonality, current lease expirations, renewal behavior, price-demand relationship, month-to-month leases, turn-costs, and vacancy loss.

2 - Joint Pricing and Seat Inventory Optimization
Claire Cizaire, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, cizaire@MIT.EDU, Peter Belobaba

This paper develops a methodology to simultaneously optimize the pricing and revenue management of an airline's two fare products. The two fare products' clearly defined attributes remain the same over time, however, their prices vary. We describe an approach to optimize the revenues by jointly setting the prices and booking limits of the products over time. We present PODS simulation results of this approach and compare them to other methods.

3 - A Model for Resource Exchange Alliances that Takes Competition into Account
So Yeon Chun, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States of America, gth586a@mail.gatech.edu, Anton Kleywegt, Alexander Shapiro

A widely used type of alliance involves the exchange of resources, including money, among alliance members, before alliance members sell the resulting products. Most models of alliances considered in the literature ignore the resulting competition among alliance members. We consider a model of 2 alliance members to optimize resource exchange taking into account resulting competition.

4 - Heuristics for Dynamic Multi-Fare RM Under Choice Models
Lin Li, Sabre Holdings, 3150 Sabre Drive Southlake, Southlake, TX, 76092, United States of America, ll2053@gmail.com, Guillermo Gallego, Richard Ratliff

We consider the single leg multiple fare dynamic Revenue Management problem where demand for the demand for the different fare classes is driven by a customer choice model. We develop two near optimal and computationally efficient heuristic, which generates control policy without having to solve the computationally intensive dynamic programming. Extensions of the heuristics to dynamic RM with time heterogeneous choice models and RM with non-homogeneous arrivals are also discussed.

■ TC21

C - Room 18B, Level 4

Resilient Power Distribution

Sponsor: Service Science
Sponsored Session

Chair: Alexandre Street de Aguiar, Assistant Professor, Pontifical Catholic University of Rio de Janeiro - Electrical Engineering Department, Marques de São Vicente 225, L401, DEE., Rio de Janeiro, RJ, 22451900, Brazil, street@ele.puc-rio.br

1 - Improving the Resilience of Power Distribution Systems to Hurricanes
Suraj Chanda, Texas A&M University, TAMU 3128, College Station, TX, 77843, United States of America, chandasuraj37@gmail.com, Alex Sprintson, Emily Zechman

Power distribution systems are essential for providing lifeline services during hurricanes and other catastrophic events. This talk presents a methodology for improving the resilience and survivability of such systems. In particular, we develop algorithms for hardening the power distribution infrastructure and allocating backup resources subject to budget constraints. Our objective is to improve a city-wide fragility curve of the number of affected customers as a function of the wind speed.

2 - A Heuristic Method for Grid Outage Plan Optimization
Qiming Tian, Dr., IBM Research - China, Diamond building, ZGC Software Park, Beijing, 100193, China, tianqim@cn.ibm.com, XingBo Zhang, XinJie Lv, Wenjun Yin, Jin Dong, Jun Luo

Grid outage plan for equipment maintenance, customer installation or network upgrades is important for operation management of utility companies. In this paper, multiple objectives and complex constrains of outage plan are modeled and a heuristic method is proposed to optimize them. A system has been built for a Chinese provincial grid and the result shows the method can help to improve grid reliability, workload balance and planning efficiency.

3 - A Method to Detect and Solve Confliction Between Equipment Outage and Power Supply Guarantee
Hairong Lv, IBM Research - China, Diamond building, ZGC Software Park, Beijing, 100193, China, lvhr@cn.ibm.com, Qiming Tian, Wenjun Yin, Feng Jin, Jin Dong, XingBo Zhang

Utility companies need to perform outages for equipments maintenance while guaranteeing power supply for important users. There are usually conflictions between equipment outages and power supply guarantee because of complex grid topology and operation mode. In this paper, these conflictions are detected with a method based on topology analysis, and then some of them are solved by operation mode adjustment with a genetic algorithm based method.

4 - A Robust Optimization Approach for the Unit Commitment Problem with n-K Security Criterion
Alexandre Street de Aguiar, Assistant Professor, Pontifical Catholic University of Rio de Janeiro - Electrical Engineering Department, Marques de São Vicente 225, L401, DEE., Rio de Janeiro, RJ, 22451900, Brazil, street@ele.puc-rio.br, Fabricio Oliveira, Jose Manuel Arroyo

This work shows recent developments on the contingency-constrained unit commitment problem. The proposed model takes into account a general n-K security criterion, in which demand must be supplied under any contingency state comprising the simultaneous failure of up to K generation units. The robust counterpart provides an efficient formulation in which a combinatorial set of contingencies is avoided. Case studies validate the model superiority over the contingency-dependent formulation.

■ TC22

C - Room 18C, Level 4

Sustainable Value Chains

Sponsor: Service Science
Sponsored Session

Chair: Tony Cox, President, Cox Associates, 503 Franklin Street, Denver, CO, 80218, United States of America, tcoxdenver@aol.com

1 - Towards the Creation of Sustainable Value Chains
Julia Wolf, Assistant Professor for Sustainability in Logistics and Supply Chain Management, European Business School, Soehnleinstrasse 8, Wiesbaden, 65201, Germany, julia.wolf@ebs.edu

This research deepens our understanding of Sustainable Supply Chain Management (SSCM) by deriving a model of SSCM from three qualitative case studies of from the automotive industry. This model conceptualizes SSCM as a combination of the number of business processes covered, the number of tiers in a supply chain involved and the breadth of sustainability dimensions covered (consideration of economical, ecological and social elements). It uncovers major antecedents and performance outcomes.

2 - Making Sustainability More Sustainable in a Risky World
Tony Cox, President, Cox Associates, 503 Franklin Street, Denver, CO, 80218, United States of America, tcoxdenver@aol.com

Trying to develop more sustainable approaches to production, use, and protection of resources in an uncertain world may backfire, reducing the wellbeing and capabilities of future generations. This can happen if planned and actual system responses differ, or if sustainability undermines flexibility. We discuss how to use risk analysis to make sustainability less dangerous, by hedging against uncertainties and focusing on total benefits produced over the uncertain lives of scarce resources.

3 - Building Relational Capital in Environmental Manufacturing to Substitute Vertical Integration
Ozan Ozcan, Graduate Assistant, USF University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, oozcan@mail.usf.edu, Kingsley Reeves, Deniz Ozcan

In this study, we will examine the collaboration of sustainability focused companies with their first and second tier suppliers to understand if they have an organizational structure that is a substitute (or at least complementary) to a pure vertically integrated organizational structure. We will employ social network analysis to investigate the relationship between sustainability focused companies and their suppliers that helps foster knowledge, technology, and personnel transfer.

4 - Water Reuse Planning and Management: A System Dynamics Approach
Fuzhan Nasiri, Postdoctoral Associate, Yale University, New Haven, CT, United States of America, fuzhan.nasiri@yale.edu, Julie Zimmerman

Water reuse decision making, within an integrated water supply management framework, is a complex process linked to water quantity, quality and pricing aspects with benefits ranging from water savings to energy and material recovery. This study proposes a system dynamics approach to model and analyze the water-reuse process in an urban setting, in the Great Lakes region, with respect to future scenarios of population and climate change.

■ TC23

C - Room 18D, Level 4

Joint Session Media Planning/ RMPS: Panel Discussion: Yield Ad Revenue Optimization in Media Ad Sales & Promotion Planning

Cluster: Media Planning and Optimization/ Revenue Management and Pricing Section
Invited Session

Moderator: Expert from Rainbow Media, syiale@rsgmedia.com

1 - Panel Discussion: Research Opportunities into Yield Ad Revenue Optimization in Media Ad Sales and Promotion Planning

Panelists: Expert from Rainbow Media, syiale@rsgmedia.com, Expert from Wall Street Journal, Thomas Siegman, James Walker

A panel of industry experts and researchers will discuss research opportunities for Yield Ad Revenue Optimization in the 142.2 million dollar Media Ad Sales and Promotions Planning industry. What are the real world concerns around implementing technologies to optimize inventory for Media & Entertainment businesses? Where are their opportunities for revenue lift as a result of optimization techniques? Data source: AdAge, 2008 Measured Ad Spending Data

2 - Television Program Promotion in the Emerging DVR Age

Panelist: James Walker, Saint Xavier University, Chicago IL, United States of America,walker@sxu.edu

This presentation will examine the recent rapid growth in digital video recorder penetration in the U.S. The current and potential impact of the DVR on the effectiveness of traditional spot advertising and program promotion will be reviewed. Grounded in research on DVR usage, strategies for adjusting program promotion to meet the DVR challenge will be offered.

■ TC24

C - Room 19A, Level 4

Joint Session SPPSN/HAS: Public Health - Strategies for Population Protection

Sponsor: Public Programs, Service and Needs/ Health Applications
Sponsored Session

Chair: Eva Lee, Professor & Director, Georgia Institute of Technology, Center for Operations Research in Medici, Industrial & Systems Engineeriing, Altanta, GA, 30332-0205, United States of America, eva.lee@gatech.edu

1 - Optimal Social Distancing for Controlling Pandemic Flu: Why Closing Schools is Often Not Worth it

Benjamin Armbruster, Northwestern University, 2145 Sheridan Road (Tech Bldg), Evanston, IL, 60208-3119, United States of America, armbruster@northwestern.edu

During the spread of the novel H1N1 influenza (swine flu), the most common public health measure until the availability of a vaccine were school closures. School closures have a high societal cost, which must be weighed against its benefits in stemming the spread of disease. Using two models, we find that the chance a population is reinfected from outside argues against the use of social distancing measures in many situations.

2 - Analyzing the Effect of Vaccine Prioritization

Fan Yuan, Graduate Student, Georgia Institute of Technology, Center for Operations Research in Medici, Industrial & Systems Engineering, Atlanta, GA, 30332-0205, United States of America, fanyuan@gatech.edu, Eva Lee

We develop a mathematical model to track the effectiveness of prioritized vaccination in a pandemic flu mass vaccination event. The model combines a disease propagation model, vaccine distribution, and a set of multi-stage queuing models at the point-of-dispensing. This model prioritizes the high-risk population under insufficient inventory of stockpile. This work is joint with the Centers for Disease Control and Prevention.

3 - A Decision Support Framework for Network Design in Disaster Area

Angel Ruiz, Associate professor, Université Laval, 2325, Rue de la Terrasse, Québec, QC, G1V0A6, Canada, Angel.Ruiz@osd.ulaval.ca, Monia Rekik, Jacques Renaud

This talk proposes a decision support framework to feed decision makers with a number of alternatives regarding the number, the location and staffing of humanitarian help facilities to relief the population when a disaster occurs. Our approach is inspired by the steps commonly observed in emergency management processes a few hours after a disaster. The choices offered to managers are however optimized by a variety of mathematical approaches.

4 - Modeling HIV Prevention, Detection and Treatment Strategies for High-risk Population

Wonki Kim, Georgia Institute of Technology, Atlanta, GA, United States of America, wkim46@gatech.edu, Eva Lee

This work is joint with the Centers for Disease Control and Preventation.

■ TC25

C - Room 19B, Level 4

Traffic Management

Contributed Session

Chair: Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Gainesville, FL, 32607, United States of America, yafeng@ce.ufl.edu

1 - Dynamic Highway Toll Pricing Based on a Stochastic Partial Differential Equation Traffic Flow Model

Li Yang, University of Michigan, 3552 Green Brier Blvd Apt 437B, Ann Arbor, MI, 48105, United States of America, youngli@umich.edu, Romesh Saigal

A stochastic traffic flow model using stochastic partial differential equations has been developed and validated by real highway data. Based on that model, the dynamic congestion pricing problem has been modeled as a stochastic control problem. A dynamic pricing strategy could be obtained by solving the stochastic control problem numerically. The effectiveness of the pricing strategy is also studied through simulation.

2 - Use of the Triangular Distribution for Freeway Speed Data

Mostafa Ghandehari, Senior Lecturer and Graduate Advisor, University of Texas at Arlington, Civil Engineering, Box 19308, University of Texas at Arlington, Arlington, TX, 76019, United States of America, ghandeha@uta.edu, Siamak Ardekani

Data for speeds on a freeway is modeled as a triangular distribution. The method of moments is applied to estimate the parameters. After Algebraic transformations symmetric functions on three parametrs are solutions of a cubic equation. A goodness of fit test validates the results.

3 - Research on Travel Isochrones in Urban Traffic Network Considering Traffic Control

Shoupeng Tang, Tongji University, Tongji Lianhe Guangchang C#708, 1388 Siping Rd., Shanghai, China, shouptang@gmail.com

Emergency traveling (traveling of emergency medical rescue) need traveler to find out the nearest destination (a hospital) to the origination (traffic accident scene). Traditionally, the nearest destination was determined according to its geographical distance. But, in this case, what is needed is the dynamic time-shortest destination (DTSD). Here, a new algorithm of finding travel isochrones in urban traffic network will be developed. With its help, the DTSD under traffic control will be found.

4 - Second-Best Congestion Pricing and its Interpretation in Transportation Networks

Yasushi Masuda, Professor, Keio University, Faculty of Science & Technology, 3-14-1, Hiyoshi, Kohoku, Yokohama, 223-8522, Japan, masuda@ae.keio.ac.jp, Toyokazu Kido

Explored is the second-best pricing problem of congested transportation networks with elastic demand where only a subset of links are charged. We derive a simple expression of the second-best pricing rule and provide a clear interpretation. Also examined is the issue of heterogeneity and anonymity of users. We extend the analysis of the second-best price to the case with heterogeneous user population, and study the impact of type-dependent/independent pricing schemes on social welfare.

5 - Robust Signal Timing for Sustainable Mobility

Yafeng Yin, Assistant Professor, University of Florida, 365 Weil Hall, Gainesville, FL, 32607, United States of America, yafeng@ce.ufl.edu, Lihui Zhang

Previous studies have developed signal timing models with environmental concerns. The models consider tailpipe emissions instead of roadside air pollution concentrations. Moreover, they either apply highly simplified formula to compute emissions or rely on microscopic driving-cycle-based emission models that are computationally demanding. This paper addresses the above limitations and develops signal timing to make a tradeoff between traffic delays and roadside air pollution concentrations.

■ TC26

C - Room 4A, Level 3

Joint Session DM/ QSR: Quality and Statistical Decision Making in Health Care Applications II

Sponsor: Data Mining/ Quality, Statistics and Reliability
Sponsored Session

Chair: Jing Li, Assistant Professor, Industrial Engineering, Arizona State University, Tempe, AZ, United States of America, jing.li.8@asu.edu

Co-Chair: Hui Yang, Assistant Professor, University of South Florida, 4202 E. Fowler Ave. ENB118, Tampa, FL, 33620, United States of America, huiyang@usf.edu

1 - Analysis of Temporal Variations of Laboratory Test Results of Patients in Intensive Care Units

Jose Zayas-Castro, Professor and Chair, University of South Florida, Department of Industrial & Management Sy, Gainesville, FL, United States of America, josezaya@usf.edu, Alcides Santander-Mercado, Peter Fabri, Phillip Foulis

It is estimated that more than five million patients are admitted to ICUs yearly in the US, being cardiovascular disease and postoperative management two of the main indications. These two populations represent 34.3% of deaths in the US. This research will focus on the design of a methodology to analyze temporal changes of postsurgical laboratory test results of patients undergoing cardiovascular surgery, helping doctors to anticipate undesirable changes in the patient's condition.

2 - Likelihood Ratio Methods for Outbreak Detection in Spatiotemporal Surveillance

Kwok Tsui, Georgia Institute of Technology, Atlanta, GA, United States of America, ktsui@isye.gatech.edu

For public health surveillance, timely detection of a rate increase in disease incidence is very important. In this talk we propose a general framework for spatial and spatiotemporal surveillance based on likelihood ratio statistics. We show that the CUSUM and other popular likelihood ratio statistics are special cases under the framework. We compare the efficiency of these surveillance methods using both Monte Carlo simulations and a real example.

3 - A Data Mining Approach to Prognostic Analysis of Thoracic Transplantations

Zhenyu (James) Kong, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, james.kong@okstate.edu, Dursun Delen, Asil Oztekin

This study conducts survival and prognostic analyses preceded by data mining-based modeling to group lung transplant recipients in differing risk groups. Hence, a matching index (MI) is created through structural equation modeling-based decision tree modeling. MI is validated via response surface methodology-based simulation modeling to determine a viable matching and allocation schema for various risk group lung transplant recipients.

4 - Linking Nursing Care Coordination and Patient Care Quality

Shuai Huang, Arizona State University, Tempe, AZ, United States of America, shuang31@asu.edu, Jing Li

The quality of patient care in hospital is not only affected by the health care activities of individual nurses, but also their coordination, as well as the administrative policies of nurses' belonging units. We develop a multilevel model to link unit-level patient care quality with nurses' activities, especially their coordination as well as the administrative policy at the unit level.

■ TC27

C - Room 4B, Level 3

Integer Programming II

Contributed Session

Chair: Stephen Cauley, Visiting Assistant Professor, Purdue University, 1432 Camden Ave. #305, Los Angeles, CA, 90025, United States of America, stcauley@purdue.edu

1 - A Quadratic Assignment Problem with Linear Side Constraints for a Distributed Network of Computers

Diana Higuera Serrano, University of Oklahoma, 202 West Boyd, Room 116H, Norman, OK, 73019, United States of America, diana.higuera.s@ou.edu, Hillel Kumin

This paper deals with the problem of finding an optimal schedule for assigning programs to processors for transmitting messages in a distributed network of computers. The problem is modeled as a quadratic assignment problem with side contraints. Computational results are given for solving this NP hard problem.

2 - Some Computational Results for the Bidder Selection Problem

Ebisa Wollega, University of Oklahoma, 202 W. Boyd, Room 116H, Norman, OK, 73019, United States of America, ebisa.d.wollega-1@ou.edu, Hillel Kumin

The bidder selection problem arises in a military context when bidders need to be selected at various bid quantities to satisfy a known demand while also satisfying a protected base capability. This 0-1 integer programming problem is solved using both dynamic programming and integer programming algorithms and the results compared computationally.

3 - Advanced Sensitivity Analysis of the Fuzzy Assignment Problem

Ue-Pyng Wen, Professor, National Tsing Hua University, 101 Kung Fu Road, Sec. 2, Hsinchu, 300, Taiwan - ROC, upwen@ie.nthu.edu.tw, Chi-Jen Lin, Pei-Yi Lin

This paper concentrates on sensitivity analysis of the fuzzy assignment problem (FAP). Owing to the high degeneracy of the FAP, traditional sensitivity analysis, which determines the range in which the current optimal basis remains optimal, is impractical. Hence, we attempt to perform another type of advanced sensitivity analysis to determine the range of perturbation to keep the current optimal assignment remaining optimal. A labeling algorithm is then presented.

4 - Multi-vehicle Mobility Allowance Shuttle Transit: Formulation and Comparison with Single-Vehicle Case

Wei Lu, Texas A&M University, CE/TTI Building, Room 301D, 405, College Station, TX, 77843, United States of America, cooperharris@tamu.edu, Luca Quadrifoglio

A mixed integer programming (MIP) formulation is developed for the static scheduling of the multi-vehicle MAST system. The performance of the multi-vehicle MAST system is compared with its single-vehicle counterpart. The optimal fleet size as a function of the demand is also studied. Compared to the single-vehicle MAST system, the multi-vehicle MAST system is more realistic and is able to respond to heavier transit demand and is expected to provide a more satisfactory service to its customers.

5 - Satellite Downlink Scheduling: Real Time Solutions for a Constrained Minimization Problem

Stephen Cauley, Visiting Assistant Professor, Purdue University, 1432 Camden Ave. #305, Los Angeles, CA, 90025, United States of America, stcauley@purdue.edu, Fattaneh Cauley

A scheduling algorithm is proposed for the transmission of information via a satellite to receivers on the ground. The satellite contains a number of antenna-beam areas, which are serviced by synchronized burst transmitters. The problem is to develop a near optimal schedule for the transmission of information based upon an evolving beam topology. The efficient algorithm developed in this work can be employed on the limited on-board satellite computing hardware given a short time horizon.

■ TC28

C - Room 4C, Level 3

Panel Discussion: Analytical and Statistical Opportunities in Industries

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Moderator: Heidi Xia, Senior Research Engineer, Dow Chemical, B1603 Dow Chemical Company, 2301 Brazosports Blvd, Freeport, TX, 77541, United States of America, HXia@dow.com

1 - Issues in Designing Experiments for Consumer Research

Panelist: William Brenneman, Procter & Gamble Company, 11511 Reed Hartman Highway, Cincinnati, OH, 45241, United States of America, brenneman.wa@pg.com

In a large consumer products company there are opportunities to leverage the power of designed experiments in many different functional areas such as packaging, process, formulation and consumer research. I will discuss some interesting aspects of designing experiments for consumer research studies.

2 - Process Chemometrics at The Dow Chemical Company
Panelists: Swee-Teng Chin, Senior Research Engineer, Analytical Technology Center, Dow Chemical Company, B1225, Dow Chemical Company, 2301 North Brazosport Blvd, Freeport, TX, 77541, United States of America, schin@dow.com, Lloyd Colegrove, Technical Leader, Analytical Technology Center, The Dow Chemical Company, 2301 N Brazosport Blvd., Freeport TX 77541, United States of America, LFColegrove@dow.com, Leo Chiang, Research Specialist, Dow Chemical, B1225, Dow Chemical Company, 2301 North Brazosport Blvd, Freeport TX 77541, United States of America, hchiang@dow.com, Mary Beth Seasholtz, Technical Leader, Analytical Technology Center, 1897 Building, Midland Operations, Midland MI 48674, United States of America, MSeasholtz@dow.com, Cathy Johnson, Senior Statistical Specialist, Analytical Technology Center, The Dow Chemical Company, 2301 N Brazosport Blvd., Freeport TX 77541, United States of America, CCJohnson@dow.com

We utilized applied statistical specialist to implement statistical process control at the operations level and PhD-degreed Chemometricians for complex data analyses. We'll describe these techniques and highlight major challenges. 1 practical applied statistics does not transfer from the classroom environment into the industrial environment. 2 there are few programs to develop chemometricians for industry. 3 there is no standard data architecture for near-instantaneous corrective action.

3 - Panel Discussion: Analytical and Statistical Opportunities in Industries
Panelists: Heidi Xia, Senior Research Engineer, Dow Chemical, B1603 Dow Chemical Company, 2301 Brazosports Blvd, Freeport, TX, 77541, United States of America, HXia@dow.com, Swee-Teng Chin, Senior Research Engineer, Analytical Technology Center, Dow Chemical Company, B1225, Dow Chemical Company, 2301 North Brazosport Blvd, Freeport TX 77541, United States of America, schin@dow.comWilliam Brenneman,Procter & Gamble Company, 11511 Reed Hartman Highway, Cincinnati OH 45241, United States of America, brenneman.wa@pg.com

What are the opportunities for analytical and statistical research in an international chemical company? The presenter will show you various opportunities, special challenges and technique used from product research and development, process development as well as production trouble shooting & improvement.

■ TC29

C - Room 5A, Level 3

Statistical Process Control

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Don McCormack, Principal Customer Advocate, SAS Institute, 2901 Oakhaven Dr., Austin, TX, 78704, United States of America, Don.McCormack@jmp.com

Co-Chair: Bradley Jones, Principal Research Fellow, JMP division of SAS, United States of America, Bradley.Jones@jmp.com

1 - The Use of Control Charts with Image Data
Fadel Megahed, PhD Student, Virginia Tech, 250 Durham Hall, Blacksburg, VA, 24061, United States of America, fmegahed@vt.edu, Jaime Camelio, William Woodall

We review control charts which have been proposed for use with image data in industry, and in some medical device applications, and discuss some of their advantages and disadvantages. In addition, we highlight some application and research opportunities available in the use of control charts with image data.

2 - CUSUM Control Charts for Reliability Data
Geoff Vining, Professor, Virginia Tech, Hutcheson Hall, Blacksburg, VA, 24061, United States of America, vining@vt.edu, Denisa Olteanu, William Woodall

This talk presents new CUSUM charts for monitoring the parameters of a Weibull distribution within a reliability context. We first give a brief overview of previous work in this area. We then present a procedure for monitoring the Weibull scale parameter. We then present a procedure for monitoring the Weibull shape parameter.

3 - Multistage Multimode Process Monitoring using PLRTs Considering Modeling Uncertainty
Ran Jin, Georgia Institute of Technology, 755 Ferst Dr. NW, Atlanta, United States of America, jinr@gatech.edu, Jianjun Shi, Kaibo Liu

Multistage multimode manufacturing process is characterized by different baseline models. However, existing monitoring methodologies usually assume only one operation mode under normal conditions. In this paper, we propose piecewise linear regression trees (PLRTs) to model the process under normal conditions. A control chart system is developed and optimized considering the modeling uncertainty. Finally, we use a wafer manufacturing process to evaluate the ARL performance.

■ TC30

C - Room 5B, Level 3

Reliability I

Contributed Session

Yang Lu, University of Maryland - College Park, 3111 Kim Building, College Park MD 20742, United States of America, keenbat@gmail.com

1 - Reliability Analysis of Repairable Systems using Continuous-Time Bayesian Networks
Dingzhou Cao, PhD Candidate, Wayne State University, 4815 Fourth Street, Detroit, MI, 48201, United States of America, dcao@wayne.edu, Alper Murat, Ratna Babu Chinnam

We explore the use of Continuous-Time Bayesian networks (CTBNs) for modeling reliability and availability of repairable dynamic systems. CTBNs overcome the state-space explosion problems of Markov chains and the inability of dynamic Bayesian networks (DBNs) in handling limited repair resources and/or priorities.

2 - Bayesian Multiobjective Design of Optimal Life Testing Plans
Saleem Ramadan, PhD Student, Ohio University, Stocker Center, 294, Athens, OH, 45701, United States of America, sr108707@ohio.edu, Tao Yuan

This study proposes a method for designing optimal life testing plans using Bayesian approach and multi-objective genetic algorithms. Two optimization criteria, precision and cost, are considered simultaneously. The failure times are assumed to follow the Weibull distribution with Type-I censoring. The prediction precision is measured by the preposterior variance of the pth quantile of the life distribution at the testing condition. NSGA is used to find the Pareto-solutions.

3 - Modeling the Hazardous Material Transport Network Through a Game Theory Approach
Yang Lu, University of Maryland - College Park, 3111 Kim Building, College Park, MD, 20742, United States of America, keenbat@gmail.com, Wenxin Qiao, Ali Haghani

Hazardous material transporters are always concerned with minimizing both transportation costs and associated risks. Existing studies had formulated hazardous material transportation problem into a two player zero sum game where either travel time or disaster cost is minimized. This paper developed a game theoretic model that both objectives are achieved simultaneously. A new parameter which connects risk and travel cost is introduced and discussed in terms of how it affects the solution.

■ TC31

C - Room 5C, Level 3

Data Mining II

Contributed Session

Chair: Wandaliz Torres-Garcia, PhD Candidate, Arizona State University, P.O. Box 878809, Tempe, AZ, 85287-8809, United States of America, wandaliz@asu.edu

1 - A General Asymmetric Loss and it's Application in SVM
Derek Koh, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, United States of America, derek.koh@asu.edu, George Runger

As most data mining techniques are trained by minimizing the error rate and ignoring the sign of the error, information about the nature of the error is thrown out. In problems where optimization of errors is focused solely on the ability to identify a positive class accurately, understanding the nature of the error is vital. This paper proposes an asymmetric loss function applied to SVM that focuses on one side of the loss function such that prediction precision is optimized.

2 - Identify Non-convex Data Boundaries via Empty Convex Hulls
Onur Seref, Assistant Professor, Virginia Tech, 1007 Pamplin Hall, Blacksburg, VA, 24061, United States of America, seref@vt.edu, Chris Zobel

We present a method that explores a set of points with a non-convex boundary by recursively identifying empty convex hulls that are larger than a threshold around the data points. It is easy to classify an inquiry point as a member if it is in the convex hull formed by the data points, but not in any of the empty convex hulls. This method is ideal for one-class classification and can be extended to multi-class with an appropriate distance measure between a point and the boundary.

3 - Bayesian Kernel Models for Non-gaussian Processes
Cameron MacKenzie, Graduate Student, Industrial Engineering, University of Oklahoma, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, cmackenzie@ou.edu, Theodore Trafalis

Bayesian statistical methods have recently been combined with kernel techniques and support vector machines to develop data mining tools for classification and regression. These Bayesian methods usually assume a Gaussian process, which may not always be a valid assumption. We develop a Bayesian model based on a beta distribution where the parameters of the distribution are functions of the kernel matrix of the input data. We compare the model's accuracy with existing classification algorithms.

4 - Data Mining in Neurological Brain Disorders using Network Modeling and Classification Methods
Jicong Zhang, PhD Candidate, University of Florida, 303 Weil Hall, ISE Department, Gainesville, FL, 32611, United States of America, jicong@ufl.edu, Panos Pardalos

Many studies have been done for identifying the characteristics of neurological brain disorders. EEG and fMRI can be applied for diagnosis or identification of epileptic seizures and Parkinson's disease. In this study, network modeling, optimization and data mining methods (i.e. PCA, ICA, SVM) are applied to identify different states of a brain disorder, based on feature extraction and constructed brain networks. Good preliminary results will be shown.

5 - Multiple Time Series Approximations using Two-dimensional Wavelets Approach
Wandaliz Torres-Garcia, PhD Candidate, Arizona State University, P.O. Box 878809, Tempe, AZ, 85287-8809, United States of America, wandaliz@asu.edu, George Runger

The approximation problem for multiple time series is studied through a two-dimensional imaging methodology. The performance of this novel two-dimensional approach is tested using wavelets decomposition on three different near infrared datasets. The performance was evaluated using the number of coefficients after compression and its respective residual error measure (SSE) and compared to multiple one-dimensional wavelets. Some interesting results are presented.

■ TC32

C - Room 6A, Level 3

Efficient Semidefinite Relaxations for Hard Optimization Problems

Sponsor: Computing Society
Sponsored Session

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

1 - The Power of SDP Relaxations - Computing Strong Bounds for QAPs and Graph Problems
Hans Mittelmann, Professor, Arizona State University, Box 871804, Tempe, AZ, 85287-1804, United States of America, mittelmann@asu.edu

Semidefinite relaxations of discrete optimization problems can yield excellent bounds on their solutions. We present three examples from our collaborative research. The first addresses the quadratic assignment problem. It yields the strongest lower bounds known for larger dimensions. We next compute upper bounds on the spherical kissing number improving all previously known results. Finally, improved upper bounds for binary codes are obtained in many cases.

2 - Solving Doubly Positive SDP Relaxations for Stable Set and the Maximum-Clique Problem
Alexander Engau, Assistant Professor, University of Colorado Denver, Mathematical and Statistical Sciences, CB 170, POB 173364, Denver, CO, 80217-3364, United States of America, aengau@alumni.clemson.edu, Miguel Anjos, Immanuel Bomze

We present an application of our previously proposed interior-point cutting-plane method for the computation of improved semidefinite theta bounds on the stability and clique numbers of a graph. This approach is based on a cutting-plane interior-point algorithm that selects a relevant cut set dynamically while exploiting warm starts of successive relaxations without the need to restart or modify previous iterates. Our results indicate that small and medium-sized problems can be solved routinely.

3 - On Equivalence of Semidefinite Relaxations for Quadratic Matrix Programming
Dongdong Ge, Shanghai Jiao Tong University, 535 Fahua Zhen Road, Shanghai, 200052, China, dongdong@gmail.com, Yichuan Ding, Henry Wolkowicz

We analyze 2 popular SDP relaxations for quadratically constrained quadratic programs. These are based on vector-lifting and on matrix-lifting,and are of greatly different size and expense. We prove, under mild assumptions, that the 2 relaxations deliver equivalent bounds. Our results provide a theoretical guideline for how to choose an inexpensive SDP relaxation and still gain a strong bound; and, they shed insights on how to simplify large-scale SDP constraints by exploiting sparsity patterns.

■ TC33

C - Room 6B, Level 3

Computational Challenges in Large-Scale Network Design and Routing

Sponsor: Computing Society
Sponsored Session

Chair: W. Art Chaovalitwongse, Rutgers University, 96 Frelinghuysen Rd, Piscataway, NJ, 08854, United States of America, wchaoval@rci.rutgers.edu

Co-Chair: Zhe Liang, Rutgers University, 900 Davidson Rd, Piscataway, NJ, United States of America, liangzhe@eden.rutgers.edu

1 - A Branch-and-Check-and-Bound Algorithm for the Redundant Multicast Routing Problem with SRLG
Chungmok Lee, Postdoctoral Scholar, RUTCOR, 640 Bartholomew Rd, Piscataway, United States of America, chungmok@rci.rutgers.edu, Zhe Liang, W. Art Chaovalitwongse

A shared risk link group is a set of edges which are subjected to a common risk. The goal is to find a minimum cost redundant tree routing while any two paths assigned to the same destination does not use edges of the same risk group. In this talk, a branch-and-check-and-bound algorithm to solve the problem is presented. The algorithm is based on the fast enumeration of two tree routes, and checking the feasibility of given trees.

2 - Variable Objective Search
Oleksandra Yezerska, Texas A&M University, College Station, TX, 77843-3131, United States of America, yaleksa@tamu.edu, Sergiy Butenko, Baski Balasundaram

We introduce the variable objective search framework for combinatorial optimization. The method utilizes different objective functions used in alternative mathematical programming formulations of the same problem. The proposed technique is illustrated using alternative quadratic unconstrained binary formulations of the classical maximum independent set problem in graphs.

3 - Flight Sequence Model for Flight Conflict Resolving Problem
Zhe Liang, Rutgers University, 900 Davidson Rd, Piscataway, NJ, United States of America, liangzhe@eden.rutgers.edu, W. Art Chaovalitwongse, Elsayed Elsayed

Everyday Oakland ARTCC receives requested flight plans from the airlines entering the Pacific airspace. It is common that the flight plans from different airlines incur conflicts due to FAA safety standards. The flight conflict rescheduling problem is to resolve the conflicts with the minimum cost. We propose a flight sequence model (FSM) for the problem, and use column generation to solve the FSM. The computational results show that the FSM outperforms all other methods in all test cases.

4 - An Approximation Algorithm for the k-BCDS Problem in Wireless Sensor Networks
Anurag Verma, Texas A&M University, College Station, TX, 77843-3131, United States of America, anuragverma@neo.tamu.edu, Sergiy Butenko

We study k-bottleneck connected dominating sets (k-BCDS) as an alternative to minimum connected dominating sets (CDS) that have been used as a method of choosing nodes to be in the virtual backbone in a wireless sensor network. k-BCDS was introduced recently as an alternate strategy that minimizes the maximum distance any node in the backbone has to transmit, thus balancing the energy requirement of all nodes. We provide a 6-approximate distributed algorithm for the k-BCDS problem.

■ TC34

C - Room 7, Level 3

Infectious Disease Modeling and Control

Sponsor: Computing Society
Sponsored Session

Chair: Nedialko Dimitrov, Naval Postgraduate School, 1 University Circle, Monterey, CA, 93943, United States of America, ned@alumni.cs.utexas.edu

1 - Computing Methods to Support Public Health Epidemiology
Achla Marathe, Asociate Professor, Virginia Tech, CRC XV VBI, Blacksburg, 24061, United States of America, amarathe@vbi.vt.edu, Keith Bisset, Bryan Lewis, Stephen Eubank, Madhav Marathe

Recent quantitative changes in computing technology have created new opportunities for collecting, integrating and accessing information related to large socio networks. This has provided entirely new ways to reason and control epidemics. The talk will describe how network and interaction based models, along with realistic social networks, can support public policy and address public health care issues. It will illustrate their applicability via user defined case studies.

2 - Simulation Based Optimization of Public Health Policy Decisions
Priyank Patel, The University of Texas at Austin, Electrical & Computer Engineering, 1 University Station C0803, Austin, TX, 78712-0240, United States of America, priyank.patel@mail.utexas.edu, Lauren Meyers, Sebastian Goll, Nedialko Dimitrov, Gregory Johnson

Differential equation based compartmental models are widely used in epidemiology to model epidemics and make public health policy decisions. We describe a modular software package that lets us augment these models with long distance travel effects to simulate epidemics on a continental scale along with a set of public health policies to combat them. These simulations are in turn driven by an optimization algorithm that finds the best policy. Visualization tools are also built into the package.

3 - Optimal Vaccine Allocation During an Influenza Epidemic
Laura Matrajt, student, University of Washington, Guggenheim Hall #414, Box 352420, Seattle, WA, 98195-2420, United States of America, laurama@amath.washington.edu, Ira Longini,

We compare optimal vaccination strategies started at various points in time in two settings: a population in a developed country where children account for 24% of the population, and a population in a less developed country, where children account for 25% of the population. We minimize mortality or hospitalizations and we find an optimal vaccination allocation. We find that population structure is an important factor and that there is a switch in the optimal vaccination strategy at some time.

■ TC35

C - Room 8A, Level 3

Control and Constrained Optimization In Stochastic Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Natarajan Gautam, Associate Professor, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, gautam@tamu.edu

1 - Risk-sensitive Control of Diffusions
Vivek Borkar, Professor, Tata Institute of Fundamental Research, Tata Institute of Fundamental Research, Homi Bhabha Road, Mumbai, 400005, India, borkar.vs@gmail.com, Anup Biswas, Krishnannair Suresh Kumar

Risk-sensitive control of diffusions deals with minimizing the asymptotic growth rate of `exponential of integral' cost. This talk will report some recent results on: 1. a rigorous derivation of the corresponding Hamilton-Jacobi-Bellman equation under suitable conditions, 2. an averaging theory for singularly perturbed risk-sensitive control problems.

2 - Entropy Approach for Incorporating Fat-tailed Constraints in Financial Models
Sandeep Juneja, Associate Professor, Tata Institute, HB Road, Colaba, Mumbai, 400005, India, juneja@tifr.res.in, Santanu Dey

Entropy based ideas in finance in past are used in portfolio optimization and model calibration. Aim is to find a probability that minimizes KL distance with respect to a known measure and satisfies moment constraints on functions of underlying assets. We show that under KL distance, the optimal solution may not exist when views involve fat tailed dist. This drawback may be corrected if `polynomial-divergence' entropy is used. We discuss existence, uniqueness and related ideas.

3 - Stochastic Fluid-flow Models to Optimize Service Rate and Number of Servers
Ronny Polansky, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ronnyp@tamu.edu, Natarajan Gautam

We consider a fluid-flow queueing system with multiple channels (servers) and slowly varying number of sources. For this system we use a threshold policy to assign the service speed and number of servers during each time window of control. The objective of this research is to determine the optimal thresholds so that an appropriate cost is minimized subject to satisfying quality of service constraints. We illustrate an application to data center energy management.

■ TC36

C - Room 8B, Level 3

Operations Research in High Schools - Project MINDSET and Outreach: A Panel Discussion

Sponsor: INFORM-ED
Sponsored Session

Moderator: Ken Chelst, Wayne State University, IME Department, 4815 Fourth St., Detroit, MI, 48201, United States of America, aa1276@wayne.edu

1 - Panel Discussion: Reaching Out to Bring OR to High Schools
Panelists: Kenneth Chelst, Wayne State University, Detroit, MI, United States of America, kchelst@wayne.edu, Karen Keene, karen_keene@ncsu.edu, Thomas Edwards, Wayne State University, Detroit MI, United States of America, t.g.edwards@wayne.edu, Dave Goldsman, Georgia Tech, Atlanta GA, United States of America, sman@gatech.edu, Andres Weintraub, Department of Industrial Engineering, University of Chile, Santiago, Chile, aweintra@dii.uchile.cl, Robert Young, young@ncsu.edu

The session begins with an overview of Project MINDSET. This NSF funded project has supported the development of a full year high school mathematics curriculum based on OR. The curriculum is being piloted in Michigan and North Carolina. Panelists will describe their efforts to bring operations research into high schools in North Carolina, Michigan, Georgia, California, Texas and Chile. The discussion will explore strategies for taking the first steps in reaching out in other locales.

■ TC37

C - Room 8C, Level 3

Approximations and Large Deviations Computations with Many Server Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Jose Blanchet, Columbia University, 500 W 120th Suite 340, New York, NY, United States of America, jose.blanchet@columbia.edu

1 - Invariance of Fluid Limits for SRPT and SJF Queues
Christian Gromoll, University of Virginia, Charlottesville, VA, United States of America, gromoll@virginia.edu, Martin Keutel

The shortest remaining processing time policy is important because it minimizes the queue length over all work conserving protocols. A non-preemptive variant of this protocol, shortest job first, is simpler to implement as it only applies the rule at the completion time of each job. In this talk, we'll compare the two variants and show that they have the same fluid limits. In particular, we'll argue that in many ways, the performance of SRPT can be achieved by using the simpler SJF policy.

2 - Large Deviations Computations for Large Loss Systems: A Point Process Approach
Henry Lam, PhD Candidate, Harvard University, Department of Statistics, Cambridge, MA, United States of America, khhlam@gmail.com, Jose Blanchet

I will talk about the large deviations and efficient Monte Carlo estimation of quantities related to steady-state loss of a many-server loss system i.e. customers leave system immediately without waiting if system capacity is reached. We utilize a point process description of the system to devise an importance sampling scheme that involves a randomized time horizon followed by exponential tilting. Algorithmic efficiency is proved with exponential decay rate obtained concurrently.

3 - Large Deviations Computations in Many Server Queues
Jose Blanchet, Columbia University, 500 W 120th Suite 340, New York, NY, United States of America, jose.blanchet@columbia.edu, Xinyun Chen, Jing Dong, Henry Lam

We discuss large deviations results and efficient Monte Carlo algorithms for many server systems. Applications include sample-path large deviations for infinite server systems with high arrival rates and large deviations for the steady-state queue length in the Halfin-Whitt regime.

■ TC38

C - Room 9A, Level 3

Conic Programming Approaches for Nonconvex Optimization Problems

Sponsor: Optimization/Linear Programming and Complementarity (Joint Cluster ICS)
Sponsored Session

Chair: Bissan Ghaddar, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, bghaddar@uwaterloo.ca

1 - Positive Polynomials Over Equality Constrained Unbounded Sets
Luis Zuluaga, Associate Professor, University of New Brunswick, P.O. Box 4400, Fredericton, Canada, lzuluaga@unb.ca, Juan Vera, Javier Pena

A simple yet powerful algebraic connection between the set of polynomials that are non-negative on a given closed domain and the set of polynomials that are non-negative on the intersection of the same domain and the zero set of a given polynomial is presented. This connection has interesting theoretical as well as algorithmic implications. It yields a succinct derivation of copositive programming reformulations for a big class of programs, generalizing Burer's copositive formulation results.

2 - Dynamic Generation of Valid Polynomial Inequalities for Polynomial Programs
Bissan Ghaddar, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, bghaddar@uwaterloo.ca, Miguel Anjos, Juan Vera

Recently semidefinite programs have been used to build hierarchies of convex relaxations to polynomial programs. This approach is computationally expensive and is only tractable for small problems. We propose an algorithm to dynamically generate valid polynomial inequalities to general polynomial programs in which we iteratively improve the bounds while only using low degree relaxations. We present results on non-convex binary quadratic problems to illustrate the effectiveness of this approach.

3 - Exploiting SOCs in NLPs
Ashutosh Mahajan, Post Doc, MCS Division, Argonne National Lab, 9700 S Cass Avenue, Argonee, IL, 60527, United States of America, mahajan@mcs.anl.gov, Todd Munson

We describe a methods for automatically reformulating different kinds of constraints as second order cones. We show by using specific examples that such reformulation can improve the solution time by several orders of magnitude.

■ TC39

C - Room 9B, Level 3

Mixed Integer Programming (MIP)

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Alper Atamturk, Univ of California- Berkeley, Berkeley, CA, United States of America, atamturk@berkeley.edu

1 - Computing with Multi-term Disjunctions
Simge Kucukyavuz, Ohio State University, 1971 Neil Ave, Columbus, OH, United States of America, kucukyavuz.2@osu.edu, Yunwei Qi, Suvrajeet Sen

We propose an algorithm to solve large-scale CGLPs with multi-term disjunctions, effectively. The multi-term disjunctions are created adaptively via the cutting plane tree algorithm. We present preliminary computations with the proposed method.

2 - Probabilistic Set Covering
Shabbir Ahmed, Associate Professor, Georgia Institute of Tech, 765 Ferst Drive NW, Atlanta, GA, United States of America, sahmed@isye.gatech.edu

We consider deterministic integer programming models for probabilistic set covering problems with coefficient uncertainties. By exploiting the sub- and super-modularity properties of the probabilistic covering constraints and analyzing their polyhedral structure, we develop strong valid inequalities to strengthen the formulations.

3 - On n-step MIR and Partition Inequalities for Integer Knapsack and Capacitated Flow Sets
Kiavash Kianfar, Assistant Professor, Texas A&M University, Department of Industrial and Systems Eng, Texas A&M University, College Station, TX, 77843-3131, United States of America, kianfar@iemail.tamu.edu

We show that the partition inequalities (PIs) of Pochet and Wolsey (1995) for the integer knapsack and capacitated flow sets are dominated by/special cases of the n-step MIR inequalities of Kianfar and Fathi (2009) in case of non-divisible/divisible coefficients. We also present facet-defining conditions for PIs using n-step MIR. Our results provide an alternative view to PIs based on MIR and underscore the importance of n-step MIR in generating strong valid inequalities.

4 - Two-Stage Robust Integer Programming for Power Grid Optimization Under Uncertainty
Yongpei Guan, University of Florida, 303 Weil Hall, Gainesville, United States of America, guan@ise.ufl.edu, Ruiwei Jiang, Muhong Zhang

We study a power grid optimization problem in which the wind farm supply is uncertain. In our approach, we assume that the wind farm supply is within an uncertain set, and develop two-stage robust integer programming formulations for the problem, based on different uncertain set settings for the wind farm output. We analyze the tractability of each proposed approach. Finally, the computational experiments testing a 118-bus data set show the effectiveness of our proposed approaches.

■ TC40

C - Room 9C, Level 3

Solver Interface APIs I

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited 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 - New CoinMP Release 2.0: A Simple C-API Windows DLL and Unix Solver Library (LP/MIP) based on COIN
Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

The COIN Open Source Initiative has become very popular in the recent years. To make life easier for users that simply want to solve models and not compile C++ applications, we have developed a standard C-API Windows DLL CoinMP.DLL that implements most of the functionality of CLP, CBC, and CGL. A Linux/Unix version using AutoMake is also available.

2 - GMO: GAMS' Next-Generation Model API
Steven Dirkse, Director of Optimization, GAMS Development Corp., 1217 Potomac St. NW, Washington, DC, 20007, United States of America, sdirkse@gams.com, Alex Meeraus, Michael Bussieck, Lutz Westermann, Jan Jagla, Paul Vandereijk

The GAMS model API plays a key role in linking solvers to GAMS. As solution technology & computing environments change, the model API must change with them. In this talk we describe the new API, its underlying philosophy, and the features required (both new and old) to create high-quality solver links on today's computers.

3 - Overview of and Update on ASL, the AMPL/Solver Interface Library
David M. Gay, AMPL Optimization LLC, 900 Sierra Place SE, Albuquerque, NM, 87108-3379, United States of America, dmg@ampl.com

The AMPL language processor communicates via files with solvers, including a ".nl" file of instance details. The AMPL/Solver interface library (ASL) has readers of .nl files that read this information and set up data structures for function evaluations carried out by ASL routines. It also provides a ".sol" file writer for returning solution details to the AMPL language processor. This talk provides an overview of the ASL, including some recent extensions, e.g., for stochastic programming.

■ TC41

C - Room 10A, Level 3

Topics in Networks

Sponsor: Optimization/Networks
Sponsored Session

Chair: Mauricio Resende, Lead Member of Technical Staff, AT&T Labs Research, 180 Park Avenue, Florham Park, NJ, 07932, United States of America, mgcr@research.att.com

1 - Design of Metro Ethernet Networks
Robert Doverspike, AT&T Labs Research, 200 S. Laurel Ave, Middletown, NJ, United States of America, rdd@research.att.com, Rodrigo Toso, Mauricio Resende, Dongmei Wang

Major telecommunications carriers in the USA are spending billions of dollars to evolve their networks from legacy SONET/SDH rings over fiber to packet/Ethernet networks over fiber and DWDM. This talk will describe the structure of these networks and our approach and planning tools for their optimal multi-layer design.

2 - Shortest Paths and Minimum Spanning Trees Over Preferential-Attachment Networks
Matthew Fontana, Massachusetts Institute of Technology, 77 Massachusetts Avenue, E49-169, Cambridge, MA, 02139, United States of America, mfontana@mit.edu, Thomas Magnanti

The preferential-attachment model of graphs is popular in network science. Little seems to be known theoretically about the characteristics of weighted edge versions of this and similar models. We present, to an order of magnitude, results regarding the expected value of (weighted) shortest path lengths and the total cost of minimum spanning trees over certain kinds of preferential-attachment models, including random plane-oriented recursive trees.

3 - Column-generation Algorithms for the Maximum Lifetime Problem in Wireless Sensor Networks
Behnam Behdani, PhD Student, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, behdani@ufl.edu, J. Cole Smith

We address the problem of maximizing the lifetime of a wireless sensor network with energy-constrained sensors and a mobile sink. The sink travels along discrete locations to gather information from all the sensors. Information can be sent to the sink in a multi-hop fashion via wireless links. We describe a linear programming and column-generation formulation of this problem, as well as a delay-tolerant version of it. Computational results demonstrate the efficiency of the proposed algorithms.

■ TC42

C - Room 10B, Level 3

Stochastic Integer Programming and Applications

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Andrew Trapp, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, act25@pitt.edu

1 - Decomposition Methods for Solving the Two-stage Stochastic Graph Partitioning Problem
Neng Fan, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, 32611, United States of America, andynfan@ufl.edu, Qipeng Phil Zheng, Panos Pardalos

In this talk we introduce the two-stage stochastic graph partitioning problem and present the stochastic mixed integer programming formulation for finite explicit scenarios. Several decomposition methods are used to reformulate the program and construct the algorithms for solving this problem.

2 - Stochastic Security Constrained Unit Commitment Models and Solution Algorithm
Qipeng Phil Zheng, Assistant Professor, West Virginia University, Industrial & Management Systems Eng, P.O. Box 6070, Morgantown, WV, 26505, United States of America, Qipeng.Zheng@mail.wvu.edu, Panos Pardalos, Jianhui Wang

A two-stage stochastic security-constrained unit commitment problem usually simulates the day-ahead unit commitment in the first stage while the second-stage formulation mimics the real-time economic dispatch/unit commitment with uncertain factors such as load. The most challenging task in solving this type of problem is the large number of scenarios and the mixed-integer nature of the subproblems. In this talk we propose a method based on Benders decomposition and show some numerical results.

3 - The Bilevel Knapsack Problem with Stochastic Right-hand Sides
Osman Ozaltin, University of Pittsburgh, Pittsburgh, PA, United States of America, oyo1@pitt.edu, Andrew J. Schaefer, Oleg A. Prokopyev

We introduce the bilevel knapsack problem with stochastic right-hand sides, and provide necessary and sufficient conditions for the existence of an optimal solution. When the leader's decisions can take only integer values, we present an equivalent two-stage stochastic programming reformulation with binary recourse. We develop a branch-and-cut algorithm for solving this reformulation, and a branch-and-backtrack algorithm for solving the scenario subproblems.

4 - On a Level-set Characterization of the Integer Programming Value Function and its Application to Stochastic Programming
Andrew Trapp, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, act25@pitt.edu, Oleg A. Prokopyev, Andrew J. Schaefer

We examine the IP value function and provide its characterization based upon level-set minimal vectors. While an optimal solution exists over this set of vectors, membership is often difficult to verify. We instead generate and search over the truncated integral monoid, a superset, formed from select constraint matrix columns. We demonstrate the applicability of our characterization to solve two-stage stochastic IPs using global branch-and-bound, and discuss encouraging computational results.

■ TC43

C - Room 1, Level 2- Mezzanine

Modeling for Medical Decision Making

Sponsor: Health Applications
Sponsored Session

Chair: Julie Ivy, North Carolina State University, 111 Lampe Drive, Raleigh, NC, United States of America, jsivy@ncsu.edu

1 - Mitigating Inequities in Organ Allocation via Revised Health Reporting Frequencies
Z. Gozde Icten, University of Pittsburgh, zgi1@pitt.edu, Atul Bhandari, Lisa Maillart, Andrew J. Schaefer

The minimum frequency with which patients awaiting liver transplantation must report their current health to UNOS depends on their last reported score. We consider an infinite horizon MDP where in each period, the patient chooses to either transplant, wait, or record her current health and examine (i) the degree to which an individual patient can benefit from this flexibility, and (ii) investigate how the resulting inequities can be mitigated through revised updating frequency requirements.

2 - Equitable Dispatching Policies for Emergency Medical Services
Laura McLay, Assistant Professor, Virginia Commonwealth University, 1015 Floyd Ave, Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu, Maria Mayorga

How to fairly dispatch ambulances responding to 911 calls is an important responsibility of emergency medical service systems. This research provides a model for identifying equitable dispatching protocols using infinite horizon, average cost Markov decision process models. Four notions of equity will be discussed that explore equity from both the patient and service provider perspectives. We illustrate the resulting dispatching policy when selecting each notion of equity.

3 - A Combined Systems Dynamics/Discrete-event Simulation of the Breast Cancer Screening Process
Jeremy Tejada, North Carolina State University, 100 Calibre Chase Dr., Apartment 302, Raleigh, NC, 27609, United States of America, jjtejada@ncsu.edu, James Wilson, Julie Ivy

We discuss a combined discrete-event/systems-dynamics model of breast cancer screening. Phase I determines women in the population who will get breast cancer; and a tumor growth equation is used to estimate the cancer's beginning time. In phase II, the overall screening process is simulated.

4 - A POMDP-based Approach for Determining the Implied Cost
Kuang-Hao Yeh, Graduate Student, North Carolina State University, 400 Daniels Hall, College of Eng., NCSU, Raleigh, NC, 27695, United States of America, kyeh@ncsu.edu, James Wilson, Julie Ivy

Understanding of the impact of diagnosing breast cancer in preclinical (asymptomatic) and clinical (symptomatic) stages is essential to identify an optimal screening policy. We develop a perfect breast cancer screening POMDP model assuming that the current screening recommendation(s) is optimal, and develop an inverse algorithm to explore the relationship between the implied mortality rate and the screening policy.

■ TC44

C - Room 2, Level 2- Mezzanine

Joint Session HAS/ SPPSN: Mathematical Models for Infectious Disease Control

Sponsor: Health Applications/ Public Programs, Service and Needs
Sponsored Session

Chair: Elisa Long, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06520, United States of America, elisa.long@yale.edu

1 - Modeling the Eradication of Infectious Diseases

Karima Nigmatulina, PhD Project Scientist, Intellectual Ventures, 1600 132nd Ave NE, Suite 100, Bellevue, WA, 98005, United States of America, knigmatulina@intven.com, Philip Eckhoff

Global infectious disease eradication campaigns, such as current campaigns against polio and malaria, have great potential to impact global health. Modern computing and mathematical modeling can help address many campaigns challenges. Using malaria as an example, we present a new computational framework developed at Intellectual Ventures to support the rational planning of global disease eradication. The importance of capturing stochastic events when modeling eradication will be highlighted.

2 - Evaluating Risk-specific Cervical Cancer Screening Strategies

Adriana Ley-Chavez, PhD Candidate, ISE Dept, The Ohio State University, 210 Baker Systems, 1971 Neil Avenue, Columbus, OH, 43210, United States of America, ley-chavez.1@osu.edu, Julie Higle

Cervical cancer can be prevented with appropriate screening. HPV infections are a necessary cause for cervical cancer and are sexually transmitted. Each patient's sexual behavior affects her probability of developing cervical cancer, but current guidelines do not recommend risk-specific screening. We estimate each patient's risk level based on her behavioral characteristics, and use a disease progression and screening simulation model to design and evaluate risk-specific screening strategies.

3 - HIV Screening Strategies in the United States: A Cost-Effectiveness Analysis

Elisa Long, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06520, United States of America, elisa.long@yale.edu

Despite new routine HIV screening recommendations, 25% of HIV+ individuals are status-unaware. Testing for acute infection may identify people at an earlier stage and reduce new infections. As 4th-generation HIV tests become available (which reduce the window period of detection from weeks to days), the need for acute testing diminishes. We developed a dynamic HIV transmission model to compare the costs and benefits of alternative HIV screening strategies, for a variety of test characteristics.

4 - Airborne Disease Transmission: Modeling the Spread of Tuberculosis

Karima Nigmatulina, PhD Project Scientist, Intellectual Ventures, 1600 132nd Ave NE, Suite 100, Bellevue, WA, 98005, United States of America, knigmatulina@intven.com

Roughly a third of the world's population is infected with tuberculosis and 1-2 million people die from TB annually. We will present the mathematical airborne transmission model that has been developed at Intellectual Ventures to guide campaigns intended to control and eradicate airborne diseases such as TB, flu, measles, mumps, etc. A model of TB transmission will be used to provide specific examples and illustrations.

■ TC45

C - Room 6, Level 2- Mezzanine

Scheduling in Health Care

Sponsor: Health Applications
Sponsored Session

Chair: Mehmet Ayvaci, PhD Candidate, University of Wisconsin Madison, 3239 Mechanical Engineering, 1513 University Ave, Madison, WI, 53706, United States of America, ayvaci@wisc.edu

1 - Exact and Sampling-based Methods for Appointment Scheduling with Discrete Random Durations

Mehmet Begen, Assistant Professor, University of Western Ontario, 1151 Richmond St. N, London, ON, N6A3K7, Canada, mbegen@ivey.uwo.ca, Maurice Queyranne, Retsef Levi

We determine in polynomial time optimal appointments for a given sequence of jobs (surgeries) on a processor (operating room) to minimize the expected total underage (idle-time) and overage (waiting time and overtime) costs when each job has an integer random duration given by a joint discrete probability distribution. In the case of unknown duration distributions, we determine bounds on the number of independent samples required to obtain provably near-optimal solution with high probability.

2 - Mathematical Programming Framework for Staff Planning in Anesthesia Departments

Farhad Ghassemi, Postdoctoral Fellow, MIT, Sloan School of Management, 77 Massachusetts Avenue E40-110, Cambridge, MA, 02139, United States of America, farhad@mit.edu, Peter F. Dunn, Warren S. Sandberg, Danny Segev, Retsef Levi, Wilton C. Levine

Staff planning in anesthesia departments is challenging mainly due to stochasticity in demand for services. We provide a mathematical programming framework for staff planning and discuss several mechanisms to ensure that the demand is more efficiently met. These mechanisms include a data-driven approach to determine the desired staffing level, variable-length daily shifts, bundling of services and changing the coverage ratio between the staff and nurses or residents.

3 - Robust Scheduling in Multiple ORs

Camilo Mancilla, PhD Student, Lehigh University, cam306@lehigh.edu, Robert H. Storer

We develop algorithms for robust scheduling by which we mean schedules that lose little in performance in the presence of disturbances and an associated rescheduling or control policy. The application of the proposed methodology is in the scheduling of surgical blocks in multiple OR's. The problem is formulated as a stochastic multi-stage integer program using sample average approximation.

■ TC46

C - Room 7, Level 2- Mezzanine

Panel Discussion: Academic Administration and Operations Research/ Management Science: A Good Combination?

Cluster: Invited Panels on Professional Issues
Invited Session

Moderator: Cynthia Barnhart, Associate Dean for Academic Affairs, School of Engineering, Massachusetts Institute of Technology, Room 1-206, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, cbarnhar@mit.edu

1 - Academic Administration and Operations Research/Management Science: A Good Combination?

Panelists: Cynthia Barnhart, Associate Dean for Academic Affairs, School of Engineering, Massachusetts Institute of Technology, Room 1-206, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, cbarnhar@mit.edu, Anand Anandalingam,University of Maryland, Smith School of Business, College Park MD, United States of America, ganand@rhsmith.umd.edu, Patrick Harker, University of Delaware, Newark DE, United States of America, harker@udel.edu, Elisabeth Pate-Cornell,Professor and Chair, Stanford University, Management Science and Engineering, 475 via Ortega, Stanford CA 94305, United States of America, mep@stanford.edu, James Bean, Senior Vice President and Provost, University of Oregon, Eugene OR 97403, United States of America, jcbean@uoregon.edu

Have you ever wondered what it is like to be an academic administrator? This panel, comprised of a department head, dean, provost and university president with backgrounds in OR/MS, will share their experiences and answer your questions.

■ TC47

C - Room 8, Level 2- Mezzanine

Teaching Project Management

Cluster: Topics in Project Management
Invited Session

Chair: Nicholas G. Hall, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States of America, hall_33@fisher.osu.edu

Co-Chair: Karolina Glowacka, Assistant Professor, Stevens Institute of Technology, Howe School of Technology Management, Hoboken, NJ, 07030, United States of America, kglowack@stevens.edu

1 - Project Management at Case, and New Market Opportunities

George Vairaktarakis, Professor of Operations, Case Western Reserve University, Weatherhead School of Management, Cleveland, OH, 44106, United States of America, gxv5@case.edu

Project Management has been successfully delivered at the School of Management at Case Western since 2003. Highlights of the course will be provided together with new market opportunities. We discuss how audiences other than MBA students are greatly benefiting from Project Management training in the greater Cleveland Area and internationally.

2 - Progress in Online Learning in Project Management
Frank T. Anbari, Clinical Professor, Drexel University, Goodwin College of Professional Studies, 3001 Market St., Suite 100, Philadelphia, PA, 19104, United States of America, anbari@drexel.edu

The rapid growth of project management, the increasing market for education, and the expansion of telecommunications and online learning technologies have led to an explosion of interest and enhanced opportunities for delivering online education programs in project management throughout the world. We review the main relevant issues, describe our experiences with technological and pedagogical developments, compare them to those of similar institutions, and highlight trends in such programs.

3 - Revamping a Curriculum: GWU's Modern, Comprehensive Project Management MS (in Two Delivery Systems)
Denis Cioffi, Associate Professor, The George Washington University, 2201 G Street, N.W., Washington, DC, 20052, United States of America, dcioffi@gwu.edu, Homayoun Khamooshi, Young Hoon Kwak

The evolution of GW's Masters in Project Management is discussed, and its revamped, comprehensive curriculum, which balances numerical elements and human dynamics courses, is presented. The current and future project managers who take advantage of GW's distance education —- identical to campus —- are also prepared for working in a virtual project environment. We conclude by discussing possible futures in PM education.

4 - Teaching Modern Project Management as an MBA Elective
Nicholas G. Hall, Ohio State University, Fisher College of Business, 2100 Neil Avenue, Columbus, OH, 43210-1144, United States of America, hall_33@fisher.osu.edu

This course, started in 2006, is now the most popular operations elective in the Fisher College MBA program, with 25% of students enrolling. Topics discussed include: marketing the course, course design for diverse student backgrounds, managing students' expectations, balance between principles and practice, critical chains and agile methods, prerequisite and following courses, guest speakers, cases, student presentations, games and simulation exercises, software support, and final exam format.

■ TC48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - IBM ILOG - IBM ILOG CPLEX Optimization Studio: The Complete Optimization Development Toolkit
John Gregory, Senior Product Manager, IBM Software Group - ILOG TEAM, 926 Incline Way, Suite 100, Incline Village, NV, 89451, United States of America, jgregor@us.ibm.com

IBM ILOG CPLEX Optimization Studio now completely supports the rapid development and deployment of both mathematical programming and constraint programming models from a powerful IDE using the OPL language, programmatic APIs, or other 3rd party modeling interfaces. In this tutorial we will discuss the latest enhancements, while exploring the end-to-end model development capabilities supported in this single package, along with the various deployment options from CPLEX Optimization Studio, or the optional IBM ILOG ODM Enterprise.

2 - Responsive Learning Technologies, Inc. - Online Games to Teach Operations and Supply Chain Management
Sam Wood, Responsive Learning Technologies, 4546 El Camino Real, #243, Los Altos, CA, 94022, United States of America, wood@responsive.net

Participate in a demonstration of online games that are used in operations management courses and supply chain management courses in hundreds of undergraduate and MBA-level programs to teach topics like capacity management, lead time management, inventory control, and supply chain design and logistics.

■ TC49

C -Room 10, Level 2- Mezzanine

Competing (Overlapping, Sequential or Simultaneous) Electronic Markets

Sponsor: Information Systems
Sponsored Session

Chair: Ravi Bapna, University of Minnesota, 321 19th Ave S, Minneapolis, United States of America, rbapna@umn.edu

1 - The Effect of Online Bidding on Sequential Automobile Auctions
Karthik Kannan, Purdue University, kkarthik@purdue.edu, Eric Overby

We analyze the impact of online bidding on sequential auction outcomes. We show both analytically and empirically that increased online bidding smooths the distribution of bids across the sequence, which increases both the probability of successful auctions and the winning price, even when the total number of bids remains constant. Thus, our paper shows that lower buyer transaction costs associated with the Internet can increase, rather than decrease, seller welfare in an auction context.

2 - Competitive Bidding in Overlapping Auctions with Unit-Demand Buyers
Sarah Rice, University of Connecticut, 2100 Hillside Road, Storrs, CT, United States of America, Sarah.Rice@business.uconn.edu

We compare traditional auction mechanisms with an automated bidding agent in a competitive simultaneous auction setting. Conditional upon the goal of the auction, whether it is to maximize revenue or maximize buyer surplus, we characterize the optimal mechanism choice. We find that with multiple simultaneous auctions and competitive bidding our automated agent maximizes social surplus of all bidders in the market, while uniform price auctions result in the greatest seller revenue.

3 - Optimal Design of Multiple Overlapping Online Auction Market
Seokjoo Chang, Professor, State University of New York at Albany, School of Business, 1400 Washington Ave., Albany, NY, 12222, United States of America, SChang@uamail.albany.edu, Ravi Bapna, Paulo Goes, Alok Gupta

Our paper examines whether the distribution of bidder willingness-to-pay is endogenous to individual mechanism level and market level control factors. Then we shed light on the optimal design of multiple overlapping online auctions market. While our work is motivated from the current research stream on the notion of bidder behavior in simultaneous and sequential auctions as well as optimal market design, we extend the research scope to a substantially more general case of overlapping auctions.

4 - How IT and Fragmentation Disrupts Markets - A Simulation Analysis
Bruce Weber, London Business School, Regent's Park, London, NW14SA, United Kingdom, bweber@london.edu, Chris Parker

High frequency algorithmic trading has been blamed for a number of securities market aberrations including price spikes and extreme volatility. Have advances in technology fostered trading practices that negatively impact the entire market? Are curbs on computer-driven trading warranted? We simulate a multiple, fragmented exchange national market system to analyze how different exchanges' trading rules and smart order routing techniques can generate undesirable outcomes.

■ TC50

C -Room 11, Level 2- Mezzanine

Getting More From Your Data with Google

Cluster: Cloud Computing
Invited Session

Chair: Max Lin, Software Engineer, Google, 76 9th Ave. Floor 4, New York, NY, 10011, United States of America, whlin@google.com

1 - Google Prediction API: Machine Learning as a Service on the Cloud
Max Lin, Software Engineer, Google, 76 9th Ave. Floor 4, New York, NY, 10011, United States of America, whlin@google.com

The Google Prediction API now adds Google's machine learning solutions to researchers and practitioners' toolkits through a simple, three-step process. In this talk we will introduce the advantages of machine learning on the cloud, present strategies of training classifiers on terabytes of data, and discuss how the Google Prediction API alleviates the restrictions of resource provisioning, scalability, and integration in big data analysis.

2 - BigQuery: Enabling Interactive Queries Over Your Ginormous Data
Barry Brumitt, Staff Software Engineer, Google, 651 N. 34th St., Seattle, WA, 98112, United States of America, barryb@google.com

The analysis of large data sets presents special challenges, typically requiring expensive hardware, custom software, and inordinate patience. Further, the batch nature of many extant large-scale solutions hinders an exploratory style of data interaction. In this talk, I'll show how BigQuery, a web service running on Google's computing infrastructure, can quickly analyze terabyte/billion-row corpora via a familiar SQL-like language.

■ TC51

C -Room 12, Level 2- Mezzanine

National Security Research at RAND II

Sponsor: Military Applications
Sponsored Session

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

1 - Medics, Corpsmen, Medical Technicians: More Similar Than Different?
Adam Resnick, Operations Researcher, RAND Corporation, 1776 Main St, Santa Monica, CA, 90401, United States of America, resnick@rand.org

Enlisted medical training will be consolidated at the Medical Enlisted Training Campus (METC). This project creates a methodology for determining a joint vs. Service-specific scope of practice for medical specialties. We apply the methodology to military Medic, Corpsman, and Medical Technician occupations. We recommend training options for the METC to adopt, to enhance interoperability and joint deployability of medical forces.

2 - Lateral Transfers for Army Organizational Clothing and Individual Equipment (OCIE)
Carol E. Fan, Operations Researcher, RAND Corporation, 1776 Main Street, Santa Monica, CA, 90407, United States of America, fan@rand.org, Elvira N. Loredo

Active Army Soldiers receive OCIE from Central Issue Facilities located around the world. Inventory management of OCIE is complicated by several factors: 1) turn-ins of used OCIE are a major source of supply for CIFs, and 2) improvements in OCIE have led to significant changes over the past few years. RAND has developed a method for reducing inventory investment while maintaining performance goals in this dynamic environment through better utilization of existing inventory.

3 - Targeting the Occupational Skill Pairings Needed in New Air Force Colonels
Brent Thomas, Operations Researcher, RAND, 4570 Fifth Avenue, Suite 600, Pittsburgh, PA, 15208, United States of America, bthomas@rand.org

Many colonel jobs need officers with a substantial background in more than one area (say, intelligence officers with expertise in political-military affairs). We will present a flow model that recommends sizes for numerous skill pairings' pyramids of colonels, consistent with colonel jobs' needs and with targets for new general officers. The method estimates the percentages of new colonels needed with each primary skill and paired skill, reflecting both preferred and less-demanding parameters.

■ TC52

C -Room 13, Level 2- Mezzanine

Port and Border Security I

Cluster: Homeland Security and Defense
Invited Session

Chair: Gary Gaukler, Texas A&M University, TAMU-3131, College Station, United States of America, gaukler@tamu.edu

1 - TransNIEMO: A Model of Interregional Trade with Explicit Consideration of Highway Network Effects
James Moore, Professor and Department Chair, University of Southern California, GER 240 MC 0193 USC, Los Angeles, CA, 90089, United States of America, jmoore@usc.edu, JoongKoo Cho, Peter Gordon, Harry Richardson, JiYoung Park, Qisheng Pan, Eunha Jun, Soo Cho

Input-output models of economies are widely used for policy analysis, but rarely adapted to capture trade relationships among sub-national economies. Increased costs resulting from large scale network disruption will impact all economic sectors and have associated state-level impacts. TransNIEMO integrates the USDOT model of the national highway network with NIEMO (National Interstate Economic Model), making it possible to study economic and infrastructure impacts in much more spatial detail.

2 - Interdicting Nuclear Smuggling in a Port Network
Gary Gaukler, Texas A&M University, TAMU-3131, College Station, United States of America, gaukler@tamu.edu, Yu Ding, Chenhua Li

In this talk, we present methods to interdict nuclear materials smuggling in a sea port network. This port network is comprised of foreign and domestic ports and the transportation links between them. We compare different detector hardware deployment strategies and evaluate the impact of budget constraints on the overall performance of the detection strategy. We also discuss how to incorporate measurements and inspection results from upstream inspection stages at downstream ports.

3 - Prioritized Interdiction Plans for Nuclear Smuggling Networks
Dennis Michalopoulos, Operations Research Scientist, Tidal Enterprises, 130 Cumberland Rd, Apt 233, Austin, TX, 78704, United States of America, dennis@TidalTV.com, John W. Barnes, David Morton

We develop a model for prioritizing radiation detector installation locations along a nation's border. Both smuggler identity and the interdiction budget are assumed to be random variables. Upon realizing the budget, detectors are installed at locations ranked from highest to lowest importance until it is exhausted. Subsequently, the smuggler reveals his identity and then selects an origin-destination path in the residual network that maximizes his evasion probability.

4 - Quantifying Information Gains of Networked Sensor System for Detecting Nuclear Material Smuggling Flow: An Ensemble Filtering Approach
Jeffrey Taylor, Graduate Research Assistant, University of Utah, Department of Civil Engineering, Salt Lake City, UT, 84112, United States of America, jeffrey.taylor.d@gmail.com, Jay Przybyla, Xuesong Zhou

This talk presents an ensemble filtering approach to model the error propagation (including both miss and false alarm rates) in a networked transportation inspection system for detecting nuclear material smuggling flow. Utilizing filtering results, a spatial information theoretic model is used to quantify the information gains associated with fixed or mobile sensor location plans to assist in network design/modification.

■ TC53

C -Room 14, Level 2- Mezzanine

Dynamic Linear Models

Sponsor: Marketing Science
Sponsored Session

Chair: Garrett Sonnier, Assistant Professor, University of Texas, Austin, 1 University Station, B6700, Austin, TX, United States of America, Garrett.Sonnier@mccombs.utexas.edu

1 - Optimal Advertising When Envisioning a Product-Harm Crisis
Olivier Rubel, University of California, Davis, orubel@ucdavis.edu, Prasad Naik, Shuba Srinivasan

We propose a stochastic dynamic model of brand advertising in which, at each instant, a non-zero probability exists for the occurrence of a crisis event. We gain new insights about optimal ad spending in such turbulent times by analytically solving the dynamic problem faced by the firm. We also empirically validate the model.

2 - The Evolution of Internal Market Structure
Oliver Rutz, Yale University, 135 Prospect Street, New Haven, United States of America, oliver.rutz@yale.edu, Garrett Sonnier

We present a dynamic factor-analytic choice model to capture evolution of brand positions in latent attribute space. The dynamic attributes means are modeled as a Bayesian dynamic linear model (DLM). Applying the model to a panel data set on household purchases in the malted beverage category, we find considerable evidence for dynamics in the latent brand attributes. From a managerial perspective, we find advertising expenditures helps explain variation in the dynamic attribute means.

3 - A Dynamic Factor Model for Understanding the Intermediate Effects of Advertising on Sales
Norris Bruce, Associate Professor, Marketing, University of Texas, Dallas, norris.bruce@utdallas.edu, Kay Peters, Prasad Naik

This work investigates the intermediate effects of advertising (IEA), and the purported sequence through which these effects (cognitive, affective, and experience) mediates the effects of advertising on sales. We model IEA as time-varying, latent factors, and employ the Bayesian Kalman Filter/Smoother, and the RJMCMC algorithms. We find support for two temporal sequences; and both are consistent with purchase decisions for low-involvement, frequently purchased items.

■ TC54

C -Room 15, Level 2- Mezzanine

Contemporary Issues in Technology and Knowledge Management - I

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Adrian Choo, Robinson College of Business, Georgia State University, 35 Broad St., Suite 1044, Atlanta, GA, 30303, United States of America, achoo@gsu.edu

1 - Effects of Organizational Context in Knowledge Creation in R&D Projects
Aravind Chandrasekaran, The Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, chandrasekaran.24@osu.edu, Kevin Linderman

This research investigates the extent of tacit and explicit knowledge created in R&D projects. We find Psychological Safety and Team Heterogeneity as two competing mechanisms that promote tacit and explicit knowledge in R&D projects. Using Nonaka's knowledge creation theory, we investigate the organizational mechanisms that maximize explicit knowledge. We test our model using project level data from 110 R&D Projects collected from 34 high technology organizations.

2 - Diversity Effects on Project Evaluation
Stylianos Kavadias, Associate Professor, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, United States of America, Stylianos.Kavadias@mgt.gatech.edu, Nektarios Oraiopoulos

New product development teams are often prone to two types of errors: terminating too early a project that would have been successful, or continuing a project that eventually fails. Our work studies how the corresponding probability for each type of error changes as the team members become more diverse with respect to their preferences. Unlike previous studies, we allow for strategic considerations that might lead a team member to vote against their individual preferences.

3 - Technology-Enabled Intervention in a Health Care Supply Chain for a Heterogeneous Population
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 K. Sinha

Although many have benefited from health care innovations, striking disparities in care for underserved populations remain. In this study we investigate the supply chain coordinating mechanisms of awareness, affordability and access in the delivery of asthma care while serving as participant-observant researchers for the roll-out of a newly developed and customized clinical decision support system in a safety net that provides access to care for low-income, uninsured and underserved populations.

■ TC55

C -Room 16, Level 2- Mezzanine

New Product Development in the Health Care Industry

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Stefan Haefliger, ETH Zurich, Kreuzplatz 5, Zurich, 8032, Switzerland, shaefliger@ethz.ch

1 - The Impact of Knowledge Structures on Firm Performance in the Biopharmaceutical Industry
Zeynep Erden, ETH Zurich, KPL G13, Kreuzplatz 5, Zurich, 8032, Switzerland, zerden@ethz.ch, Georg von Krogh, David Klang, Renato Sydler

In the knowledge-based view, the firm creates, transfers, and utilizes knowledge that impacts on its performance. Incorporating recent research on the knowledge-based view of the firm, we review and test the impact of knowledge stock structures on firm performance on a global sample of public companies in the biopharmaceutical industry.

2 - Division of Labor across Organizational Forms During a Technological Discontinuity
Lourdes Sosa, London Business School, London, United Kingdom, lsosa@london.edu

Research has shown incumbents underperform entrants in the R&D of radical innovation. Using data on biotechnology's impact on the anticancer drug market, I show that whereas diversifying entrants perform best, de novo entrants perform worst but execute the riskiest projects (gene therapy). I discuss implications of this division of labor.

3 - Team Characteristics In Licensing and Commercialization of Inventions From Academic Medical Center
Ayfer Ali, Harvard Business School, 44 HBS Mail Ctr, Boston, MA, United States of America, aali@hbs.edu

NIH's emphasizes the need for interdisciplinary and multidisciplinary team collaboration and training in bringing basic research to the clinic. In this paper I use patent data from two large Academic Medical Centers to understand whether cross-domain (clinical and research) expertise on the inventing team, measured by inventor educational background, influences the hazard of licensing and commercialization of the inventions.

4 - Designing a New Program for Elective Surgery: Impact on Patient Experience, Quality and Efficiency
Paulo Gomes, Assistant Professor, Universidade Nova de Lisboa, Universidade Nova Lisboa, Lisbon, Portugal, pgomes@fe.unl.pt, Pedro Barros

We study the challenges associated with the design and implementation of a program designed to deal with waiting lists for elective surgery - SIGIC. The program has three key features: offer of a maximum waiting guarantee, allows option for private sector after a waiting threshold, and use of a centralized database for managing the waiting list. We analyze the impact of the SIGIC on different dimensions of performance: waiting list, resource efficiency, and technical quality of the service.

■ TC56

C - Room 1, Level 1

Agent-Based Modeling & Simulation - Overview and Tutorial

Sponsor: Simulation Society
Sponsored Session

Chair: Charles Macal, Director, Center for Complex Adaptive Agent Systems Simulation, Argonne National Laboratory, 9700 S. Cass Ave., Bldg 221-Decision & Information Sciences, Argonne, IL, 60439, United States of America, macal@anl.gov

1 - Agent-based Modeling and Simulation-Overview and Tutorial
Charles Macal, Director, Center for Complex Adaptive Agent Systems Simulation, Argonne National Laboratory, 9700 S. Cass Ave., Bldg 221-Decision & Information Sciences, 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. Complex adaptive systems, emergent behavior, and self-organization are a few of the notions from ABMS. Applications are growing rapidly in fields ranging from modeling the stock market to predicting the spread of epidemics. This tutorial covers the foundations of ABMS, development toolkits and methods, practical aspects, and the relationship of ABMS to conventional OR.

■ TC57

C - Room 2, Level 1

Optimal Investing

Sponsor: Financial Services Section
Sponsored Session

Chair: Jim Primbs, Assistant Professor, Stanford University, 444 Terman Engr. Ctr., Stanford, CA, 94305, United States of America, japrimbs@stanford.edu

Co-Chair: Andrew Lim, University of California, Berkeley, 4141 Etchverry Hall, Berkeley, CA, 94720, United States of America, lim@ieor.berkeley.edu

1 - Portfolio Selection with Market Impact Costs
Poomyos Wimonkittiwat, Berkeley, CA, United States of America, poomyos@berkeley.edu, Andrew Lim

To account for market impact effects, we formulate a dynamic portfolio selection model with an additional term in the objective that penalizes fast trading in large quantities. In the case of quadratic utility, we adopt multiple time scale asymptotic expansions to derive the relationship between the optimal trading rate for the market impact model and the solution of the classical fully liquid Merton problem.

2 - Optimal Investment Strategies: Straight vs. Convertible Debt Financing

Kyoko Yagi, Professor, Akita Prefectural University, 84-4 Ebinokuchi, Tsuchiya, Yurihonjo, Akita, Japan, yagi@akita-pu.ac.jp, Ryuta Takashima

In this paper we consider the optimal investment problem of the firm, which is financed with equity and either straight debt or convertible debt. We examine the effect of optimal capital structure on firm's investment decision and their asset return dynamics. In particular, we investigate how the issuance of convertible debt affects investment, asset return dynamics and capital structure relative to that of straight debt.

3 - Convex Optimization Approaches for Maximally Predictable Portfolio Selection

Jun-ya Gotoh, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo, Japan, jgoto@indsys.chuo-u.ac.jp, Katsuki Fujisawa

The maximally predictable portfolio (MPP) was proposed by Lo and MacKinlay (1997) so that the return model of the resulting portfolio would attain the largest goodness-of-fit. In this talk, a heuristic algorithm for approaching the MPP is proposed. To confirm the solution accuracy, an SDP relaxation approach is also presented. Numerical results demonstrate that the proposed algorithm efficiently finds near globally optimal solutions, confirming its advantages over the existing MIP approaches.

4 - Transaction Costs in Dynamic Portfolio Optimization

Jim Primbs, Assistant Professor, Stanford University, 444 Terman Engr. Ctr., Stanford, CA, 94305, United States of America, japrimbs@stanford.edu

We present suboptimal methods of handling proportional transaction costs in dynamic portfolio optimization problems under a power utility. Even at small levels (less that 0.5%) transaction costs can significantly degrade performance of strategies that trade daily. We present new suboptimal methods for incorporating transaction costs and provide comparisons.

■ TC58

C - Room 3, Level 1

Optimization Methods in Finance Applications

Cluster: Quantitative Finance
Invited Session

Chair: Stan Uryasev, Professor, University of Florida, 303 Weil Hall, Gainesville, 32611, United States of America, Uryasev@ufl.edu

1 - Calibrating Risk Preferences with Generalized CAPM Based on Mixed CVaR Deviation

Konstantin Kalinchenko, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, kalinchenko@ufl.edu, R. Tyrrell Rockafellar, Stan Uryasev

Generalized Capital Asset Pricing Model based on mixed CVaR deviation is used for calibrating risk preferences of investors protecting investments in SP500 with options. The new Generalized Beta is designed to capture tail performance of SP500 returns. Calibration is done by extracting information about risk preferences from option prices on SP500. In addition to the risk preferences, we calculate an optimal allocation to a portfolio of options for the considered group of investors.

2 - Portfolio Credit Risk Optimization

Oleksandr Romanko, Algorithmics Inc., 185 Spadina Avenue, Toronto, Canada, Oleksandr.Romanko@algorithmics.com, Ian Iscoe, Alexander Kreinin, Helmut Mausser

Measures of a portfolio's credit risk are typically based on extreme quantiles of the credit loss distribution. While a simulation-based framework allows assessing credit risk, the large number of scenarios required to obtain robust risk estimates presents a computational challenge. We describe and compare several optimization models that derive from a structural, or Merton-type, model for credit risk. In particular, we consider formulations that combine scenarios with analytic approximations.

3 - Optimal Trading Strategy with Tax Consideration

Ali Alfaraj, University of Florida, 473A Weil Hall, Gainesville, United States of America, ali.alfaraj@ufl.edu, Alexander Veremyev, Stan Uryasev

Paper considers a portfolio optimization model accounting for transaction costs (both proportional and fixed charge) and taxes. The model trades stocks on daily basis. Different variants of the model are reduced to linear, quadratic, and mixed-integer non-linear programming problems. In-sample and out-of-sample model performance is reported.

■ TC59

H - Salon A, 4th Floor

Decision Support Systems I

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 - Information Distortion and its Impact on Decision Systems

Orhan Güvenen, Bilkent University, gorhan@bilkent.edu.tr

The information and communication technologies (ICT) did not only affect the individuals' lives but also opened new levels of awareness for public, corporate decision makers in terms of governance, and for academicians in terms of proposing new areas of research. At the same time, the intensification of information and communication technologies made it harder to control the quality, authenticity and reliability of the information that is available. The inconvenient truth is; the information can be distorted, manipulated, distracted or influenced in order to mislead the user of the information for a specific purpose. There are several examples to these phenomena from all disciplines which created very high social and economic alternative costs. Any search for a system optimal requires that ethics must remain constant in the dynamics of time and space at the citizens, institutions, nation states and international level. In preventing information distortion: the starting point, the initiator, the igniter constant should be ethics for the regulators and for the information system security practice. This approach should include the other explanatory variables in order to understand and minimize the error margins of the complex structures and decision systems.

2 - Integrated Single-Shift and Multi-Shift Workforce Models For Cross-Training and Over-Time Decisions

Shrikant Jarugumilli, Graduate Research Assistant, Missouri University of Science and Technology, Department of Engg Mgmt & Sys. Engg., Rolla, MO, 65409, United States of America, sj35f@mail.mst.edu, Scott Grasman, Naiping Keng

We present an integrated workforce planning model that allocates workers to machines for a single-shift and workers to shifts for multiple shifts. The cross-training programs are designed based on the overtime allocation of the workers. This presentation presents results obtained from the MIP formulation.

3 - Secure and Efficient Online Auditing

Haibing Lu, Doctoral Student, Rutgers University, 29 James Street 303, Newark, NJ, 07102, United States of America, haibing@cimic.rutgers.edu

Online auditing is the process of checking queries that are submitted in a continuous manner, to ensure that no sensitive information is disclosed by combining responses to past queries with the response to the current query. Recent work shows that in certain cases, irrespective of whether a new query is answered or denied based on the previous queries, sensitive information gets disclosed anyway. We propose a novel auditing scheme, which effectively prevents the query denial dilemma.

4 - Improved Timber Recovery using Enhanced Information and Optimization

James Little, Staff Researcher, University College Cork, Western Road, Cork, Ireland, jlittle@4c.ucc.ie, Enda Keane, Garret Mullooly, Glen Murphy

With commercial terrestrial scanning becoming more available, there is an opportunity for improved pre-harvest inventory measurement on many forests. This in turn can lead to better production planning on recovery and utilization of the timber resources. It is possible to identify what products to extract from which forest and at what price, to satisfy both buyer and seller. In this paper, we present models which underpin this improved decision-making using data from Northern England/Scotland.

5 - Wheat Variety Multi-criteria Decision Support

Jay Parsons, Optimal Ag Consulting, Inc., 3226 Ledgestone Court, Fort Collins, CO, 80528, United States of America, jay.parsons@OptimalAg.com

The crop variety selection decision has become increasingly complicated with numerous new varieties becoming available that are designed to address specific growing concerns. A multi-criteria decision support tool has been developed to help wheat producers sort through this difficult production and risk management decision. It represents an important advance in decision support to the grain industry where typically data is available but little is done to help producers synthesize it.

■ TC60

H - Salon B, 4th Floor

Assessment, Aggregation and Bias

Sponsor: Decision Analysis
Sponsored Session

Chair: Miguel Lobo, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, miguel.lobo@insead.edu

1 - Human Judgment is Heavy-Tailed: Empirical Evidence and Implications for the Aggregation of Estimates and Forecasts
Miguel Lobo, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, miguel.lobo@insead.edu, Dai Yao

How frequent are large disagreements in human judgment? We investigate this question empirically using 17 datasets that include over 20,000 estimates and forecasts. We find incontrovertible evidence for excess kurtosis, that is, of fat tails. Fitting a generalized normal distribution to the data, we find values for the shape parameter ranging from 1 to 1.6 (where 1 is the double-exponential distribution, and 2 the normal distribution).

2 - Strictly Proper Assessment Mechanisms for Prediction Markets
SangIn Chun, Stanford University, 96 Thoburn CT 116, Stanford, United States of America, sanginchun@gmail.com, Ross Shachter

Prediction markets are gaining support for the assessment of uncertain quantities. Competitive scoring rules and dynamic pari-mutuel markets are promoted as strictly proper incentive mechanisms for participants in these prediction markets. However, even with these mechanisms, we show conditions under which participants are discouraged from providing truthful forecasts.

3 - Model-based Identification and Correction of Cognitive Biases in Subjective Probability Assessments
Venkat Prava, Graduate Student, Johns Hopkins University, 3400 N. Charles St., 313 Ames Hall, Baltimore, MD, 21218, United States of America, avadhanulu@gmail.com, Benjamin Hobbs, Robert Clemen, Melissa A. Kenney

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. The models have been applied to the Clemen and Ulu (2008) dataset.

■ TC61

H - Room 400, 4th Floor

Operations Management III

Contributed Session

Chair: Ismail Civelek, Visiting Assistant Professor, Northwestern University, 2145 Sheridan Road, C210, Evanston, IL, 60208, United States of America, ismail.civelek@gmail.com

1 - Where Have All the Tickets Gone?
Claudio Bartolini, Research Manager, HP Labs, 1501 Page Mill Rd, Palo Alto, CA, 94304, United States of America, claudio.bartolini@hp.com, Philip Day

In this presentation we describe a new approach to analyzing the efficiency of an IT service organization using existing data to provide insight into the quality of incident transfer between workgroups. Based on this approach, we have developed a tool - the IT X-ray - that an analyst can use to quickly provide service organizations with an indication of where incident routing problems are occurring, leading to increased customer satisfaction and reduced delivery costs.

2 - The Learning Curve of Taxi Drivers in an Urban Area: An Empirical Analysis
Youngsoo Kim, Assistant Professor, Singapore Management University, 80 Stamford Road, Singapore, 178902, Singapore, yskim@smu.edu.sg

This study aims to better understand the dynamic change of individual taxi drivers' performance on both an aggregated output level (e.g., revenue and trips) and process level (e.g., occupancy rate and zone selection). Furthermore, we discuss how to utilize the knowledge of significant sources of performance improvements.

3 - Managing Service Effectiveness Through Salesforce Compensation
H. Alan Love, Texas A&M University, Mays Business School, College Station, TX, 77843, United States of America, alove@tamu.edu, Matthew Keblis, William Stein

Service effectiveness, measured as successful completion of transactions, depends on unobservable customer service representative (CSR) performance. Two contracts are developed: one based on piece-rate and another based on relative performance (tournaments). We show the manager and CSRs earn more using relative performance contracts with as few as two agents.

4 - Exploring Lean Production Through the Diffusion of Innovation: Development of a New Maturity Index
Helen Cherry, Lockheed Martin, 3800 Winfield Avenue, Fort Worth, TX, United States of America, hCherry@tuiu.edu, Yufeng Tu

The focus of this study is to develop an index to evaluate the lean production process in organizations thereby, providing a single value to document an organization's progress in its lean deployment. The elements of the new index include culture, innovation-value fit, and stages, which are analyzed by applying the framework derived from the diffusion of innovation theory.

5 - Blood Platelet Inventory Management with Protection Levels and Substitution
Ismail Civelek, Visiting Assistant Professor, Northwestern University, 2145 Sheridan Road, C210, Evanston, IL, 60208, United States of America, ismail.civelek@gmail.com, Alan Scheller-Wolf, Itir Karaesmen

We consider a discrete-time inventory system for a perishable product that has distinct demand streams for product of different ages (i.e. blood platelets). We introduce the critical level policy to the perishable inventory literature, protecting the newest items against excessive substitution. This reserves these newest items for future demand for procedures needing younger items. We show that the protection level policy may outperform other policies, particularly if supplies are capacitated.

■ TC62

H - Room 402, 4th Floor

Aviation Applications I

Contributed Session

Chair: Alex Huang, Sensis Corporation, 1700 Dell Avenue, Campbell, CA, 95008, United States of America, alex.huang@sensis.com

1 - Fitting Coxian Distribution Function to Air Traffic Data
Chatabush Roongrat, PhD Student, The University of Texas at Arlington, 500 West First Street, P.O. Box 19017, Arlington, TX, 76019, United States of America, chatabush.roongrat@mavs.uta.edu, Jay Rosenberger

The probability distribution functions for interarrival times or service times of airspace systems cannot be represented by traditional probability distribution functions. In this papar, we described different algorithms to fit Coxian distributions to the service time date of major Air Traffic Centers. Finally, we compared and evaluate those methods by using the goodness of distribution fit based on minimizing mean square error and number of phases.

2 - Predicting Arrival Delays: An Application of Spatial Analysis
Tony Diana, Federal Aviation Administration, 800 Independence Ave, SW, Washington, DC, 20591, United States of America, tony.diana@faa.gov

Analysts have many tools available to forecast delays. Local spatial autocorrelation statistics help determine how delays are autocorrelated to other ones in a space. Among the other spatial analytical techniques, kriging enables the interpolation of delay estimates at unobserved spaces based on the values at observed spaces. Error estimates can be mapped to define spatial patterns. Finally, spatial error regression provides a method for analysts to test the reliability of their findings.

3 - 2010 JPDO Portfolio Analysis
Gregory Carr, Sensis, 1700 Dell Ave., Campbell, CA, 95008, United States of America, greg.carr@sensis.com, Jeremy Eckhause, Shahab Hasan, Yuri Gawdiak

The Interagency Portfolio and Systems Analysis (IPSA) Division of the Joint Planning and Development Office (JPDO) for the Next Generation Air Transportation System (NextGen) will present results of analysis of a "most likely" state of the system in 2025 and several alternatives.

4 - Airlines: What Makes Them Successful?
Syed Shahabuddin, Professor, Central Michigan University, Smith 203C, Mount Pleasant, MI, 48858, United States of America, shaha1s@cmich.edu

Airlines all over the world are facing financial problems. These problems are mainly due to deregulations and privatization. Therefore, an airline that has an efficient operation and can provide quality service at a lower cost will succeed. By comparing the financial statements of many airlines and their ranking by quality of service, one can determine which ones are successful and which ones are not. My paper shows the characteristics of the airlines which are successful.

5 - Analysis and Evaluation of NextGen Air Traffic Management Concepts and Technologies

Alex Huang, Sensis Corporation, 1700 Dell Avenue, Campbell, CA, 95008, United States of America, alex.huang@sensis.com

Air Traffic Management (ATM) concepts and technologies (C&Ts) have been developed to increase the capacity, enhance the safety, and improve the efficiency of the future US air traffic system. This research offers an approach to assess NASA's ATM C&Ts. Such approach includes C&Ts categorization, identifying their benefit creating mechanisms, determining appropriate evaluation metrics, performing concept evaluation using simulation tools, and assessing benefits and estimating stakeholder costs.

■ TC63

H - Room 404, 4th Floor

Behavioral Decision Analysis: Time, Ambiguity, Risk

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

1 - Attitudes Towards Delayed Promotions

Ayse Onculer, ESSEC, onculer@essec.fr, Sonja Prokopec, Gilles Laurent

Retailers frequently use sales promotion tools as a part of their marketing effort. The current study investigates the impact of time preferences on attitudes towards sales promotion tools. Our conjecture is that delayed promotions do not always induce the same kind of purchase behavior and that risk attitudes, time preferences and affective responses contribute to differences in consumer reactions.

2 - Preferences and Subjective Valuation of Sequences of Lives

Jeffery L. Guyse, Associate Professor, Cal Poly, College of Business Admin., 3801 West Temple Ave, Pomona, CA, 91768, United States of America, jlguyse@csupomona.edu, L. Robin Keller

Survey results on individuals' preferences and valuation for temporal sequences of survival/mortality outcomes are presented and compared to previous results on monetary outcomes. Results and insights are discussed.

3 - Modeling Reference-Dependence Under Uncertainty

Jay Simon, Assistant Professor, Defense Resources Management Institute, Naval Postgraduate School, 699 Dyer Rd, Room 231, Monterey, CA, United States of America, jrsimon@nps.edu, L. Robin Keller

Reference-dependent models have become increasingly accepted as descriptive of human behavior, and normative models are now being developed to guide and structure the formation of preferences which induce this behavior. In this paper, we examine the implications of reference-dependence when studying preferences over gambles with intertemporal outcomes. We discuss various (normative) forms of utility functions, and develop the required conditions and assumptions.

4 - Counteracting the Uncertainty Effect Bias: An Anchoring-and-Adjustment Approach

Yitong Wang, University of California, Irvine, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, YWang07@merage.uci.edu, L. Robin Keller, Tianjun Feng

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. Three experiments were conducted to examine if 1) providing an anchor prior to judgments, 2) omitting probability information, and 3) introducing additional cognitive load are able to counteract the uncertainty effect bias.

5 - Risk Seeking Behavior Explained by Responsibiltiy Aversion

James Leonhardt, University of California, Irvine, Paul Merage School of Business, Irvine, CA, 92697-3125, United States of America, jleonhar@uci.edu, L. Robin Keller

In scenarios where decision makers must choose amongst options leading to harmful outcomes on the behalf of others we find a preference for unknown outcomes. This preference is greater than the preference for the possibility of lessening the loss and is thought to be the result of responsibility aversion.

■ TC64

H - Room 406, 4th Floor

Health Care, Modeling and Optimization III

Contributed Session

Chair: Li Sun, University of Louisville, 782 Theodore Burnett Ct Apt #3, Louisville, KY, 40217, United States of America, li.sun@louisville.edu

1 - Balancing Community Health Centers and Medicaid for Improved Access and Coverage

Hyunji Lee, Student, Penn State University, 2512 Plaza Drive, State College, PA, 16801, United States of America, hyunji317@gmail.com, Paul Griffin

In this talk, we consider improving Community Health Center and Medicaid service. A multi criteria decision model for getting better coverage of insurance and access of care is suggested to obtain a balanced investment in CHCs and Medicaid as well as finding the optimal CHC locations. A geographical and mathematical analysis of the state of Pennsylvania will be provided as an example.

2 - A Multilevel Integrative Approach to Case Mix/Capacity Planning in the Health Care Sector

Guoxuan Ma, FEB, K.U.Leuven, Naamsestraat 69, Leuven, 3000, Belgium, guoxuan.ma@econ.kuleuven.be, Erik Demeulemeester

An integrative approach to case mix/capacity planning is developed. The strategic level determines the patient volume and capacity requirements in view of maximizing overall contributions. The tactical level builds a balanced master surgery plan resulting in the minimum total expected bed shortage. And the operational policies are proposed to analyze the efficient trade-offs between patient service level and hospital resource efficiency and to provide valuable insights on advancing the planning.

3 - Differential Equations Modeling of Patients Dynamics in Emergency Rooms: Issues and Optimal Policies

Jerome Ndayishimiye, Graduate Student, University At Buffalo, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jn43@buffalo.edu, Jun Zhuang

Arbitrary physician staffing contribute to overcrowding of patients in emergency rooms (ERs), a problem that may lead to poor quality care and may create problems in managing an influx of patients following major disasters. We propose using differential equations to analyze the dynamics of patients and physicians in ERs by performing the stability and bifurcation analysis and then using optimal control theory to obtain optimal physician staffing policies.

4 - Managing ICU Bumping

Hsiao-Hui Lee, PhD candidate, University of Rochester, CS-4-333 Carol Simon Hall, University of Rochester, Rochester, NY, 14627, United States of America, hsiao-hui.lee@simon.rochester.edu, Gregory Dobson, Edieal Pinker

This paper describes a Markov chain model and associated computational algorithm of a single ICU with patient blocking and bumping. We describe how we have taken data on patient movements through ICUs in a large U.S. hospital to generate arrival patterns and LOS (length-of-stay) distributions for our model. We then apply the calibrated model to explore how a variety of changes to policy that affects patient arrival patterns or to ICU capacity can influence bumping rates.

5 - Patient Allocation Problem During Pandemic Influenza Outbreak

Li Sun, University of Louisville, 782 Theodore Burnett Ct Apt #3, Louisville, KY, 40217, United States of America, li.sun@louisville.edu, Gail DePuy

During an influenza pandemic outbreak, the hospitals would be overwhelmed by the surge demand of influenza patients. Our study is focusing on how to allocate the patients to appropriate hospitals. Mathematical models are built to optimize the patient allocation in terms of minimizing the patients' cost of access to service (e.g. travel distance), maximizing patient preferences, and balancing the workload among hospitals.

■ TC65

H - Room 408, 4th Floor

Inventory Management III

Contributed Session

Chair: Timothy L. Urban, Collins Professor of Operations Management, The University of Tulsa, 800 South Tucker Drive, Tulsa, OK, 74104, United States of America, timothy-urban@utulsa.edu

1 - Hedging Strategy of Multi-product Inventory Risk Under Monetary Inflation

Yuemeng Sun, Cornell University, 288 Rhodes Hall, Ithaca, NY, 14853, United States of America, ys273@cornell.edu, Peter Jackson

We consider hedging against correlation of operational returns with monetary inflation from the perspective of a retail business. Computing a dynamic hedging strategy is computationally demanding and hard to implement for multi-item inventory problems. We are thus motivated to consider two limiting strategies to maintain the benefit of hedging while reducing the complexity of implementation. We also compare the expected values of two limiting processes.

2 - Optimal Inventory Management Policy for Direct Reusable Deterioration Items

Jian Zhou, Library of South-West University, ChongQing, BeiBei, 400715, China, zhoujcn001@163.com

The quality of product will gradually decline during the process of recovery. For deterioration items, for example, the perishable books in library, the Palladium catalyst or Rhodium catalyst in chemical industry, such rate of decline is obvious. This paper tries to discuss the optimal inventory management policy for such direct reusable deterioration items. Author wants to prove there is a win-win between cost burden and customer satisfaction for the recovery of deterioration items.

3 - Discounted Cost Optimization of the Inventory with Continuous Replenishment

Junmin Shi, Instructor, Rutgers Business School, 1 Washington Park, Newark, NJ, 07102, United States of America, jshi@andromeda.rutgers.edu, Benjamin Melamed, Michael N. Katehakis, Ben Sopranzetti

This paper considers a continuous-review, single-product inventory system with constant replenishment and compound Poisson demands under the lost-sales policy. For any initial inventory level, we first obtain closed form expression for the expected discounted cost over the infinite time horizon, and then provide an algorithm to compute the optimal replenishment rate.

4 - Lot Sizing Approach for Spare Parts Inventory Management in Electronics Repair Industry

Mehmet Yesildag, PhD Student / Cost Engineer, University of Florida / Philips HealthCare NA, 2136 NW 47th Place, Gainesville, FL, 32605, United States of America, yesildagm@gmail.com, Suleyman Tufekci

Spare parts management in electronics repair industry utilizes several sources of supply. Recovery of defective parts from returned products is an option. Recovery of defective parts can be performed by two methods: internal (in-house) & external (at supplier). In this study, we define a lot sizing model for the spare part inventory management problem with internal & external recovery options. We determine polynomial and pseudo-polynomial time algorithms for various special cases of the problem.

5 - Revisiting the Inventory-staggering Problem

Timothy L. Urban, Collins Professor of Operations Management, The University of Tulsa, 800 South Tucker Drive, Tulsa, OK, 74104, United States of America, timothy-urban@utulsa.edu

The inventory-staggering problem is a well-known, multi-item inventory problem in which the receipt of the orders are scheduled in such a manner to minimize the maximum inventory level over the planning horizon. While the problem has been studied in some form for decades, it continues to be an area of interest. We consider alternative solution methodologies as well as extensions to this problem.

■ TC66

H - Room 410, 4th Floor

Supply Chain, Competition I

Contributed Session

Chair: Qiang Liu, School of Management, Xi'an Jiaotong University, Xi'an, 710049, China, qm_liu@yahoo.cn

1 - Pricing and Lead-times Decisions in a Duopoly Common Retailer Channel

Zhengping Wu, Assistant Professor, Singapore Management University, 50 Stamford Road, Singapore, Singapore, zpwu@smu.edu.sg, Scott Webster, Xiuming Niu, Kum Khiong Yang

We study a two-tier decentralized supply chain consisting of two suppliers and two common retailers facing a price- and lead-time-sensitive demand. We construct three different games, which differ in decision sequence, to analyze the optimal price and lead-time decisions. We characterize the equilibrium strategies in all games and discuss managerial implications of our modeling results.

2 - The Impact of Supply Chain and Knowledge Diffusion Network Structure on Innovation

Fethullah Caliskan, Graduate Assistant, University of South Florida, 4202 E. Fowler Avenue, ENB118, Tampa, FL, 33620, United States of America, fcaliska@mail.usf.edu, Ozan Ozcan, Kingsley Reeves

This is an application of social network analysis methods to supply chain and knowledge diffusion networks in industrial clusters. The objective is to assess the effects of an individual firm's relationship structure with its environment on innovation performance, as well as the effects of the network's relationship structure on the whole network's innovation performance. Preliminary results indicate a positive correlation between the variables "Clustering" and "Reach" with patent performance.

3 - Supplier Qualification and Selection Policies for a Quality-sensitive Buyer

Walter Yund, Rensselaer Polytechnic Institute, Industrial and Systems Engineering, 110 8th Street, Troy, NY, 12180, United States of America, yundw@rpi.edu, Jennifer Ryan, Yue Jin

We consider a manufacturer producing a product that incurs warranty cost, which is a function of the quality of an input supplied from one of several competing suppliers. We study a two-stage model in which the buyer inspects suppliers to assess their ability to meet a quality threshold, and then accepts bids from qualified suppliers. We consider how the manufacturer should set the quality threshold given the manufacturer's inspection costs and uncertainty over supplier quality.

4 - Buyer's Commitment Analysis in One-buyer-multi-supplier Negotiation

Qiang Liu, School of Management, Xi'an Jiaotong University, Xi'an, 710049, China, qm_liu@yahoo.cn, Qin Su

Multilateral negotiation is made up of sequential bilateral negotiations between a buyer and single supplier. The buyer's commitment strategies are referred to how many suppliers the buyer delegates during bilateral negotiations. It is illustrated that the buyer's final profit depends on the relationship between the buyer's and single supplier's relative bargaining powers and the suppliers' number. This paper provides an analytical framework of the buyer's commitment strategies.

■ TC67

H - Room 412, 4th Floor

Economics III

Contributed Session

Chair: Fouad El Ouardighi, Professor, ESSEC Business School, BP 105, Cergy, 95021, France, elouardighi@essec.fr

1 - Should I Go or Should I Stay? Entrepreneurship and Support for Internal Innovation

Liad Wagman, Assistant Professor, Illinois Institute of Technology, Stuart School of Business, 565 W Adams St., Suite 451, Chicago, IL, 60661, United States of America, lwagman@stuart.iit.edu, Silvana Krasteva

Start-ups are often formed by former employees. These employees frequently undertake projects related to their firm's line of business, begging the question of why an employee might choose to become an entrepreneur. We propose a model that highlights the strategic tradeoffs between external and internal development. Using our model, we draw predictions regarding what type of innovations will be developed in-house and which firms are more likely to support internal development.

2 - Experimental Research on the Incentive Effect of Herd Behavior
Yongheng Qin, School of Management, Xi'an Jiaotong University, No.28, Xianning West Road, P.O. BOX #2308, Xi'an,Shaanxi, China, qinyongheng@gmail.com, Difang Wan, Fan Jiang, Yahui Zhang

Based on the viewpoint that the herd behavior has incentive effect on investment of public goods in market environment proposed by Melissas(2005), we experimentally tested the effectiveness of herd behavior in organization context. The results show that: (1) the efficiency decreases gradually with complete information; (2) the herd behaviors occured under incomplete information conditon have positive incentive effect indeed, but with some limitations.

3 - Strategic Pre-emption in Deregulating and Liberalizing Markets
David Gillen, Professor, Sauder School of Business, 2053 Main Mall, Vancouver, BC, V6T1Z2, Canada, david.gillen@sauder.ubc.ca, Hamed Hasheminia

We consider an incumbent firm controlling access to network infrastructure. Initially the market is considered regulated but will be open to competition. Once deregulation of an industry is announced, the incumbent firm may not be able to set the requirement to grant access by contracting or merging with an entrant. The motivation of the incumbent is to reduce potential entrants in the future which is equivalent to sacrificing some market share today to have more market power tomorrow.

4 - Controlling Pollution and Environmental Absorption Capacity
Fouad El Ouardighi, Professor, ESSEC Business School, BP 105, Cergy, 95021, France, elouardighi@essec.fr

This pollution accumulation model shows that the environmental absorption capacity is impacted by economic activity. The resulting optimal control problem has two inter-related state variables: the stock of pollution and the absorption capacity of the environment.

■ TC68

H - Room 415, 4th Floor

E-Business/Commerce

Contributed Session

Chair: Max Kennedy, University of Kentucky, DSIS, Gatton College, Lexington, Ky, 40506, United States of America, mkenn3@uky.edu

1 - Individual Differences in the Centrality of Website Aesthetics, Online Trust, and Intention
Supavich Pengnate, Oklahoma State University, 89 S. University Pl. Apt.10, Stillwater, OK, 74075, United States of America, fone.pengnate@okstate.edu, Rathin Sarathy

In this article, we propose a conceptual framework for understanding how website design, especially website aesthetics, influences customers' trust in an e-commerce setting. We also clarify importance of individual differences in the centrality of website aesthetics (CWA) that may underlie a number of other customer perceptions of a website such as perceived design aesthetics, perceived usability, and intention to buy from the website.

2 - The Influence of Customer Reviews on Perceived Uncertainty
Jing Yang, Oklahoma State University, SSB B05, Oklahoma State University, Stillwater, OK, 74075, United States of America, jing.yang10@okstate.edu, Rathin Sarathy

Customer reviews have been discussed in the study of e-commerce for a while. However, the nature of e-market determines the difficulties of studies on it. Complementary to the conventional market, e-market is featured by its spatial and temporal separation with consumers. This characteristic triggers some barriers in online transaction. Customer reviews, as a media to build buyer-seller relationship, are an important tool to help us uncover the myth of e-commerce.

3 - How do Online Social Networks Influence Diffusion Processes?
Wei Chang, University of Pittsburgh, 233 Mervis Hall, Pittsburgh, PA, 15260, United States of America, wchang@katz.pitt.edu, Jennifer Shang

Existing studies of online social networking sites lack empirical evidence on how network agents influence each others' behavior. We employ a social network choice model to examine video diffusion in online communities. Our model also demonstrates the potential of leveraging influential users to promote advertised videos and retain site viewers.

4 - Moderating Effects of Ubiquity on Mobile Promotion
Morikazu Hirose, Associate Professor, Tokyo Fuji University, 3-8-1, Takadanobaba, Shinjuku-ku, Tokyo, 1698050, Japan, morikazu.187@mba.nifty.ne.jp

This study examines the effect of ubiquity on mobile promotions. Mobile promotion usage is explained based upon the Expectancy-Value Model, the Multi-benefit Framework of Sales Promotions, Information Privacy Concerns, and Ubiquity. Survey was conducted in Japan, which is the one of the highest mobile-Internet penetration markets in the world. The research results demonstrate the mobile promotions model and moderating effects of ubiquity on mobile promotions.

5 - The Semantic Web Through Ontologies and Folksonomies: Reduction of Information Search Cost
Max Kennedy, University of Kentucky, DSIS, Gatton College, Lexington, Ky, 40506, United States of America, mkenn3@uky.edu

This research analyzes a large set of research using the term Web 2.0. A framework is developed which includes characteristics, applications, services, uniqueness, and definitions. This considers where we have been and where we are going. This research looks at a distinguishing characteristic dividing web development- the semantic web and folksomonies - and develops a research framework for looking at one key problem area: search costs for information and weeding out noise and false information.

■ TC69

H - Salon F, 6th Floor

Hot Topics in Railroad Operations Research

Sponsor: Railway Applications
Sponsored Session

Chair: Chris Barkan, Professor, University of Illinois at Urbana-Champaign, 205 N Mathews RM1203, Urbana, IL, 61801, United States of America, cbarkan@illinois.edu

1 - Determining the Causes of Train Delay
Mark Dingler, Graduate Research Assistant, University of Illinois at Urbana-Champaign, B-118 Newmark Civil Engineering Laborato, 205 N. Mathews Ave, Urbana, IL, 61801, United States of America, dingler2@illinois.edu, Sam Sogin, Chris Barkan

One of the primary outputs from railroad simulation analysis is train delay; however, the specific factors that cause these delays are not well understood. We used the simulation software Rail Traffic Controller (RTC) to categorize the delays due to different types of conflicts and operational causes. The results were studied for trends and offer a better understanding of the conflicts and factors that contribute to train delay.

2 - Risk Analysis of Multiple-Car Releases in Railroad Hazardous Materials Transportation
Xiang Liu, Graduate Research Assistant, University of Illinois at Urbana-Champaign, 3214 Newmark Civil Engineering Lab, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, liu94@illinois.edu, Rapik Saat, Chris Barkan

Previous risk assessment of railroad hazardous materials transportation focused on the release from a single car in an accident. Considering railroad mainline accidents may involve multiple-car derailments and releases, we develop a probabilistic approach in which we assess multiple-car releases risk and evaluate various risk reduction options.

3 - Efficient Automation: Applying Lean Manufacturing to Freight Car Inspection and Maintenance
Bryan Schlake, University of Illinois at Urbana-Champaign, 205 N Mathews Ave., Urbana, IL, United States of America, schlake@illinois.edu, Chris Barkan, J. Riley Edwards

Railcar inspection effectiveness and efficiency significantly impacts rail network operations. Automated inspection technologies are being developed that can eliminate waste and reduce variability on the mainline and in terminals. This research applies Lean Manufacturing methods to the railcar maintenance process, quantifying both direct and indirect waste. Through application of these methods, we provide a basis for integrating technology and developing cost-effective maintenance strategies.

■ TC70

H - Salon G, 6th Floor

Joint Session AAS/ TSL: Robust Airline Scheduling

Sponsor: Aviation Applications/ Transportation Science and Logistics Society
Sponsored Session

Chair: Milind Sohoni, Indian School of Business, AC4-L1, ISB, Gachibowli, Hyderabad, 500032, India, milind_sohoni@isb.edu

1 - Robust Scheduling using a Stochastic Model of Delay Propagation
Mazhar Arikan, Purdue University, 403 W. State St KRAN 446, West Lafayette, IN, 47907, United States of America, marikan@purdue.edu, Vinayak Deshpande, Milind Sohoni

Flight delays have been a growing issue and they have reached an all-time high in recent years. We develop stochastic models, using empirical data, to analyze the propagation of delays through air-transportation networks. We then analyze robustness measures for airline networks. Our analysis enables us to make policy recommendations regarding managing bottleneck resources in the air-travel infrastructure, which if addressed, could lead to a significant improvement in air-travel reliability.

2 - Robust Slack Allocation in Airline Schedules
Virot Chiraphadhanakul, MIT, 77 Massachusetts Ave, Cambridge, 02139, United States of America, virot@mit.edu, Cynthia Barnhart

We investigate slack allocation approaches for robust airline schedule planning. Different models and objectives can affect the distribution of slack in the system in different manners. We evaluate the impacts of the resulting schedules on various performance metrics, including passenger delays and delay propagation. Along with the empirical results, we provide a comprehensive discussion of model behaviors and how an airline's characteristics can affect the strategy for robust scheduling.

3 - Robust Recovery
Fiona Xiao, Georgia Institute of Technology, 771 Lindbergh Drive NE, Atlanta, GA, 30324, United States of America, fiona.xiao.china@gatech.edu, John-Paul Clarke, Ellis Johnson

For deriving robust schedules that are not vulnerable to disruptions, we present a methodology to incorporate degradability into the scheduling process, i.e. making the existing schedule partitioned into independent subsystems, which allows us to differentiate the level of performance for each sub-system.

■ TC71

H - Salon H, 6th Floor

Panel: Future Directions for DEA Research

Cluster: In Honor of Bill Cooper
Invited Session

Moderator: Rajiv Banker, Temple University, Philadelphia, PA, United States of America, banker@temple.edu

1 - Future Directions for DEA Research
Panelists: William Cooper, University of Texas, Austin, TX, United States of America, cooperw@mail.utexas.edu, Emmanuel Thanassoulis, Aston University, Operations & Information Management Group, Birmingham AL, United States of America, e.thanassoulis@btinternet.com, Subhash Ray, University of Connecticut, CT, United States of America, subhash.ray@uconn.edu, Joseph C. Paradi, University of Toronto, Canada, paradi@mie.utoronto.ca, Finn Førsund, University of Oslo, finn.forsund@econ.uio.no

This session features a discussion of contributions of promising new research in DEA, comparison of alternative approaches, and important questions that remain to be addressed.

■ TC72

H - Salon J, 6th Floor

Facility Logistics II

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin, 1513 University Ave, Madison, United States of America, ananth@engr.wisc.edu

1 - Evaluation of Warehousing Alternatives in Metropolitan Areas
Fahrettin Eldemir, Assistant Professor, Fatih University, Buyukcekmece, Istanbul, 34500, Turkey, feldemir@fatih.edu.tr, Ozgur Uysal

In this study, three warehousing alternatives (multiple locations, ASRS and multi-floor) are compared from the perspective of initial set-up costs, operating costs, transportation costs, throughput, and space requirements. Mathematical models are developed for the multi-floor case and combined with existing ASRS design, facility location, storage allocation and construction cost models. Distribution system of a retailing company in Istanbul metropolitan area has been selected for a case study.

2 - Performance Analysis of Autonomous Vehicle Storage and Retrieval System
Sunderesh Heragu, Professor, University of Louisville, 200, JB Speed, Dept of Industrial Engineering, Louisville, KY, 40292, United States of America, s.heragu@louisville.edu, Banu Ekren

In this study, simulation based performance analysis of an autonomous vehicle storage and retrieval system (AVS/RS) is presented. The AVS/RS technology consisting of autonomous vehicles (AVs) and lifts has been implemented in many warehouses in Europe. The aim of this study is to find the near optimum values for the number of vehicles and lifts in the system that result in high performance under various pre-defined storage rack configuration scenarios.

3 - Assembly Line Feeding: To Kit or Not to Kit?
Veronique Limere, Ghent University, Technologiepark 903, Gent-Zwijnaarde, 9052, Belgium, veronique.limere@gatech.edu, Leon McGinnis, Marc Goetschalckx, Hendrik Van Landeghem

This research focuses on the costs encountered when supplying a part to an automotive assembly line in bulk versus in kits. A mathematical model is presented which includes operator costs for picking, kitting, replenishment of the supermarket and internal transport. Sensitivity analysis is performed to investigate the impact of characteristics of parts and production mix. Numerical experiments will be reported. The research has produced several counterintuitive results for the assignment policy.

4 - Optimal Zone Boundaries in a Puzzle-based Compact Storage System with Class-based Storage
Nima Zaerpour, PhD candidate, RSM Erasmus University, Postbus 1738, Rotterdam, 3000 DR, Netherlands, NZaerpour@rsm.nl, Yugang Yu, Rene B.M. de Koster

This paper studies a puzzle-based compact storage system with class-based storage. Every load can move in x- and y-directions as long as slots are available. A lift can move a load in z-direction. We derive the expected travel time of a random load from its storage location to the output. We optimize zone boundaries, leading to the minimum travel time. Results show that compared to random storage, class-based storage with optimal boundaries can significantly reduce the travel time.

■ TC73

H - Salon K, 6th Floor

Planning Models for Freight Transportation and Logistics

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Ahmad Jarrah, Associate Professor, The George Washington University, The George Washington University, 2201 G Street NW, Funger 409, Washington, DC, 20052, United States of America, jarrah@gwu.edu

1 - A Comprehensive Evaluation of Regional Freight Transportation Systems using an Integrated Platform
Rajeev Namboothiri, CIRRELT, C.P. 6128, succursale Centre-ville, Montreal, Canada, rajeev@crt.umontreal.ca, Michel Gendreau, Teodor Gabriel Crainic

We study the strategic national/regional planning of multi-commodity multi-modal freight transportation systems using an integrated evaluation platform. A comprehensive and realistic representation of the current state of such a system was developed. We present computational results examining the impact of planned and forecasted system modifications and regulatory policies.

2 - Vehicle Routing, Time Windows and Reliability
Tom Van Woensel, Associate Professor, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, T.v.Woensel@tue.nl, Duygu Tas, Nico Dellaert, Ton de Kok

Delivery reliability becomes more and more an order qualifier which is reflected by the customer's time windows in a vehicle routing problem. We consider stochastic travel time distributions, analyze the propagation through the network and the interplay with the customer's time windows. The reliability value of using these distributions in VRPTW is discussed and demonstrated on a number of instances.

3 - Routing Shipments and Drivers in Tandem

Mike Hewitt, Rochester Institute of Technology, 81 Lomb Memorial Drive, Rochester, NY, 14623, United States of America, mrheie@rit.edu

We present a new network design model that captures two critical decisions that consolidation carriers must make: (1) How to route shipments to achieve consolidation and minimize transportation costs, and, (2) How to route the drivers necessary to transport shipments without violating various rules, such as Department of Transportation (DOT) or union regulations. We present exact and heuristic solution approaches to the model and computational evidence of their effectiveness.

4 - Large-Scale Pickup and Delivery (P&D) Work Area Design

Ahmad Jarrah, Associate Professor, The George Washington University, The George Washington University, 2201 G Street NW, Funger 409, Washington, DC, 20052, United States of America, jarrah@gwu.edu, Jonathan Bard

We present a new approach for large P&D work area design (with 5,000 - 50,000 customers), while considering demand randomness and service times. The objective is to partition the customers into the minimum number of capacitated convex, continuous clusters. We formulate a capacitated clustering model with side constraints, and solve it using a column generation based iterative heuristic. Computer runs show the approach's viability, and its potential for reducing P&D costs by 7 to 8%.

■ TC74

H - Room 602, 6th Floor

Network Design and Network Reliability

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Wei Fan, Assistant Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd., Tyler, TX, 75799, United States of America, wfan@uttyler.edu

1 - Bicycle Network Design Problem

Jennifer Duthie, The University of Texas, 1 University Station, G2500, Austin, United States of America, jen.duthie@ssc.utexas.edu

Given level of service attributes for each link in a network, the goal of this research is to identify a set of links for improvement. This variant on the network design problem seeks to create routes of sufficient quality while considering traveler behavior and the costs of improvement.

2 - Equitable Transportation Network Design with Uncertain and Correlated Demand

Wei Fan, Assistant Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd., Tyler, TX, 75799, United States of America, wfan@uttyler.edu

This presentation addresses the Equitable Transportation Network Design Problem(ETNDP) with Uncertain and Correlated Demand,in which the benefit distribution among network users and the uncertain and spatially correlated demand are specifically accounted for.A Bi-level optimization model is formulated. A simulation-based genetic algorithm procedure is proposed to solving the ETNDP.Numerical results are presented to demonstrate the significance of both equity issue and demand uncertainty in ETNDP.

3 - Bicriterion Discrete Network Design Problem with Equilibrium Constraints

Chi Xie, Research Fellow, The University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, chi.xie@mail.utexas.edu, Dung-Ying Lin

This talk discusses an exact solution strategy for the bicriterion equilibrium discrete network design problem. We propose and prove a parametric solution framework by which the complete solution set of the bicriterion network design problem can be exhausted by repeatedly solving a parameterized scalar problem and updating the parameter set. A generalized Benders decomposition is further devised in the framework, which offers an efficient algorithmic tool for the scalar problem's solutions.

Tuesday, 4:30pm - 6:00pm

■ TD01

C - Ballroom D1, Level 4

New Techniques in Power-System Transmission Planning and Market Clearing

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Enzo Sauma, Pontificia Universidad Catolica de Chile, Ave. Vicuna Mackenna 4860, Santiago, Chile, esauma@ing.puc.cl

1 - Smart Flexible Just-in-time Transmission

Kory Hedman, PhD Candidate, University of California, Berkeley, 4124 Etcheverry Hall, Berkeley, CA, 94720, United States of America, kwh@berkeley.edu, Richard O'Neill, Shmuel Oren, Emily Bartholomew Fisher

There is currently a push to create a smarter, more flexible grid. By incorporating the flexibility of the network topology into dispatch models, it is possible to improve the social welfare. We present the concept of just-in-time transmission. This concept is based on the fact that transmission that is a detriment to network efficiency can be kept offline when not needed and, with the proper smart grid/advanced switching technology, can be switched back into service once there is a disturbance.

2 - Case Study on Transmission Planning Under Uncertainty

Jorge Vera, Pontificia Universidad Catolica de Chile, Ave Vicuna Mackenna 4860, Santiago, Chile, jvera@ing.puc.cl, Enzo Sauma, Fernando Traub

A way of dealing with uncertainty is the use of models based on Robust Optimization. Robust Optimization seeks solutions for an optimization problem that are insensitive to variations in problem data, at least within certain ranges. Typically, it is assumed that the data are within certain scenarios and a solution that is feasible for all these scenarios is sought. This paper illustrates the behavior of a Robust Optimization model for transmission planning in a 3-node network.

3 - Single and Multi-settlement Approaches to Market Clearing Mechanisms Under Demand Uncertainty

Javad Khazaei, University of Auckland, Department of Engineering Science, New Zealand, j.khazaei@auckland.ac.nz, David Young, Golbon Zakeri

In the presence of uncertainty in generation or demand, there is a need that the market clearing mechanism deals with the deviations between the real and predicted quantities, and does so optimally. For this purpose, one or two settlement markets have been suggested in the literature. In this talk, we will discuss a single settlement stochastic programming mechanism and present its characteristics. We then compare this with some currently existing two settlement markets.

4 - Integrating Transmission Planning, Generation Investment, and Market Operation Decisions in a Model

Enzo Sauma, Pontificia Universidad Catolica de Chile, Ave. Vicuna Mackenna 4860, Santiago, Chile, esauma@ing.puc.cl, Javier Contreras, David Pozo

Based on a previous paper by Sauma and Oren, we formulate a variant of the proactive network planning model, which uses the marginal theory to clear a perfectly competitive electricity market. The equilibrium model characterizes the interaction among generation and transmission decisions. Moreover, we also consider production costs that are inversely proportional to the install capacity. We illustrate our results using a 3-node network example.

■ TD02

C - Ballroom D2, Level 4

Managing Energy and Commodity Supply Chains

Cluster: Energy: Modeling the Interface Between Markets and Operations
Invited Session

Chair: Ankur Goel, Case Western Reserve University, 10900 Euclid Avenue, 324 Peter B Lewis Bldg., Cleveland, OH, 44113, United States of America, axg312@case.edu

1 - Recollections From Research in the Process Industries

Kumar Rajaram, Professor, UCLA Anderson School, 110 Westwood Plaza, Suite B 410, Los Angeles, CA, 91403, United States of America, krajaram@anderson.ucla.edu

In this talk, I will describe some of my research in the process industries over the past 15 years focusing on problems, modeling and implementation challenges and suggest directions for future research.

2 - Contract Portfolio Optimization for a Gasoline Supply Chain
Shanshan Wang, The University of Chicago Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, swang5@chicagobooth.edu, Dan Adelman

Major oil companies sell gasoline through three channels of trade: branded (associated with long-term contracts), unbranded (associated with short-term contracts), and spot market. We propose two analytical models: a strategic model to capture the high-level economic tradeoffs among the components of the supply contract portfolio, and a tactical model to dynamically adjust the contract portfolio in anticipation of future market conditions, while satisfying contractual obligations.

3 - Procurement Risk Management in the Petroleum Market using Strategic Inventories
Fernando Oliveira, Associate Professor, ESSEC Business School, Avenue Bernard Hirsch-BP 50105, Cergy, Cergy, 95021, France, oliveira@essec.fr

We examine the interactions between the management of the Strategic Petroleum Reserve (SPR), procurement risk management by refiners, and financial risk management by speculators. We discuss the trade-off between preserving social welfare by the government and procurement risk management. Finally, we analyze the use of financial options to manage the SPR, showing that all the agents benefit from such a scheme, and that speculators and refiners differ in their valuation of these options.

4 - Systematic Risk in Supply Chain Sales
Vishal Gaur, Associate Professor, Johnson School, Cornell University, 321 Sage Hall, Ithaca, NY, 14850, United States of America, vg77@cornell.edu, Nikolay Osadchiy, Sridhar Seshadri

This paper studies the systematic market associated risk in sales revenue in supply chains. We show empirically that the systematic component in the sales variance is significant and increases for the firms upstream in supply chains. The effect is supported by the firm and industry-level data. We hypothesize that the increase is due to the aggregation of orders placed by the customers downstream. Using the input-output data at the industry level, we find evidence supporting this hypothesis.

■ TD04

C - Ballroom D4, Level 4

Electricity and Gas Optimization

Cluster: Electrical Energy Systems
Invited Session

Chair: Luiz Barroso, PSR, Praia de Botafogo 228/1701, Rio de Janeiro, 22260020, Brazil, luiz@psr-inc.com

Co-Chair: Bruno Flach, PSR, Praia de Botafogo 228/1701, Rio de Janeiro, 22260020, Brazil, bruno@psr-inc.com

1 - Economic Analysis of Industrial Clusters with Carbon Capture
Kjetil Midthun, Research Scientist, SINTEF Applied Economics, S.P. Andersens vei 5, Trondheim, 7465, Norway, Kjetil.Midthun@sintef.no, Vibeke S. Nörstebö, Thor Björkvoll, Asgeir Tomasgard

We present an investment decision model for industrial clusters with carbon capture. The industrial cluster use natural gas and include a natural gas power plant. The basis of our work is a technical economic description of each process of the cluster. With mathematical modeling it is possible to analyze and optimize both the production processes and the profitability of each process/plant and the plants together.

2 - Medium-term Optimal Gas Procurement for CCGTs
Miguel Carrion, Universidad de Castilla - La Mancha, Campus Tecnologico Fabrica de Armas, Toledo, Spain, Miguel.Carrion@uclm.es, Antonio J. Conejo

We consider a producer that seeks to determine the monthly allocation of natural gas for its CCGTs within a planning horizon of three months. The operation is bounded by an annual quota of gas. This model is formulated as a stochastic problem where the pool price is characterized via scenarios. Monthly gas allocations and on/off status of units are here-and-now decisions, whereas the pool trading is wait-and-see. The model performance is assessed using a realistic case study.

3 - An Integrated Expansion Planning Model of Electricity and Natural Gas Systems
Jose Wanderley Marangon-Lima, Professor, Federal University at Itajubà, Av BPS 1303, Itajuba, MG, 37500-099, Brazil, marangon@projesom.com.br, Antonio Carlos Zambroni de Souza

A long-term, multi-area and multistage model for the expansion planning of integrated electricity and natural gas network is presented. In the proposed Gas Electricity Planning integrated model, the thermal generation plants are the links between the gas and the electricity grids. The proposed model is formulated as a mixed-integer linear optimization problem that minimizes the investment and operation costs. A simplified Brazilian integrated system is used to illustrate the proposed framework.

4 - Integrated Model for Electricity and Natural Gas Transmission Systems
Mohammad Shahidehpour, Profesor, Illinois Institute of Technology, 3301 South Dearborn, Chicago, United States of America, ms@iit.edu, Zuyi Li

The natural gas transmission could affect the security and the economics of power transmission. Economically, natural gas contracts could affect the operating cost of power systems. From the security viewpoint, natural gas supply disruptions may lead to forced outages of multiple gas-fired units which could jeopardize the power system security. The integrated model would minimize power system operating cost by taking into consideration power system and natural gas transmission constraints.

■ TD05

C - Ballroom D5, Level 4

Queueing Models II

Contributed Session

Chair: Ananth Krishnamurthy, University of Wisconsin, 1513 University Ave, Madison, United States of America, ananth@engr.wisc.edu

1 - Variability Functions for the Parametric Decomposition of Queueing Networks with MAPs
Sunkyo Kim, Associate professor, Ajou University, San 5 Woncheon-dong, Suwon, Korea, Republic of, sunkyo@ajou.ac.kr

We consider variability functions for the parametric decomposition approximation of queueing networks with Markovian arrival processes. Based on analytical results for the MAP/MAP/1 departure process, we show that the proposed variability function for two-moment, three-parameter and three-moment, four-parameter decomposition approximations performs well with the innovations method in modeling cross correlation in a queueing network with Markovian random routing.

2 - Queueing Systems with Satisfaction-Dependent Arrival Processes
Justin Azadivar, Post-Doctoral Research Associate, University of Minnesota, Room ME L101, University of Minnesota, Minneapolis, MN, 55455, United States of America, jazadivar@gmail.com, Z. Max Shen, George Shanthikumar

We consider designing queueing infrastructure in an environment where the availability of servers when customers arrive affects their future arrival rate. Matching the number of servers with the arrival rate generates a sub-optimal solution unless changing arrival rates are taken into account.

3 - Delay and Capacity Analysis of Isolated, Curbside Bus Stops
Weihua Gu, PhD Candidate, Department of Civil & Env. Engineering, University of California, Berkeley, 416G Mclaughlin Hall, UC Berkeley, Berkeley, CA, 94720, United States of America, gwh02ster@gmail.com, Yuwei Li, Michael Cassidy, Julia Griswold

A queueing model is formulated for curbside bus stops that are isolated from the effects of traffic signals. When the bus arrivals to the stop are Poisson, an analytical solution method is derived. Simulation is used for other cases. The results have many applications, e.g., to evaluate average bus delay at the stop, or to estimate the stop's capacity given a target service level. Insights from our model are at odds with information furnished in professional handbooks.

4 - Multi-class Queueing Systems with Multiple Types of Interruptions: Modeling Congestion at Waterways Entrances
Tayfur Altiok, Professor, Rutgers University, Department of Industrial and Systems Eng, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, altiok@rci.rutgers.edu, Ozgecan S. Uluscu

We consider a single-server queue subject to multiple types of operation-independent interruptions motivated by operations and vessel queueing at entrances of waterways. We use waiting-time arguments and service completion time analysis to obtain the expected waiting time of a customer (vessel) in the aforementioned queue with n classes of customers and k possibly simultaneous and class-independent service interruptions. We discuss extensions to class-dependent failures.

5 - Impact of Information Quality in Kanban Controlled Systems with Advanced Demand Information
Ananth Krishnamurthy, University of Wisconsin, 1513 University Ave, Madison, United States of America, ananth@engr.wisc.edu, Deng Ge

This research investigates the effect of quality of information in kanban control system (KCS) with advance demand information (ADI). We present a stochastic model of a manufacturing system operating under KCS with ADI and determine the optimal release control policy by analyzing the underlying Markov Decision Process. The model is used to study the sensitivity of the system performance to different types of variations in the quality of ADI.

■ TD06

C - Ballroom E, Level 4

Tutorial: Auctions in Supply Chains/Procurement

Cluster: Tutorials
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 - Auctions in Supply Chains/Procurement
Damian Beil, Associate Professor, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, dbeil@umich.edu

This tutorial introduces the basic ingredients of procurement auction research. After discussing the classic market-pricing logic of the open-descending auction, we demonstrate how simple modeling embellishments can extend the market-pricing auction logic to also capture key operational realities and tradeoffs encountered in procurement practice. This tutorial should be of value to anyone interested in studying competitive bidding in supply chains.

■ TD07

C - Ballroom F & G, Level 4

Daniel H. Wagner Prize for Excellence in Operations Research

Cluster: Daniel H. Wagner Prize for Excellence in Operations Research
Invited Session

Chair: Allen Butler, President, Daniel H. Wagner Associates, Inc., 2 Eaton Street, Suite 500, Hampton, VA, 23669, United States of America, Allen.Butler@va.wagner.com

1 - A Short-range Scheduling Model for Blockbuster's Order Processing Operation
Casey Chung, Blockbuster Distribution, McKinney, TX, 75069, United States of America, casey.chung@blockbuster.com, Milin d Dawande, Chelliah Sriskandarajah

We describe the creation and implementation of a Mixed Integer Programming model to schedule Blockbuster's short-range order processing operations. This application, in daily use since January 2007, has resulted in cost savings of about $4.17 million over 2007-2009, in addition to significantly improved capacity utilization. Recognizing that Blockbuster's system of multiple processing departments which compete for subsequent shared resources is typical in industry, we also discuss the adaptability of our approach to other organizations.

2 - Marketing Optimization in Retail Banking
Ramasubramanian Sundararajan, GE Global Research, India, ramasubramanian.sundararajan@ge.com, Abhinanda Sarkar, Beata Zmudzka, Karolina Bak, Tarun Bhaskar, Sridhar Dasaratha, Debasis Bal, Jayanth K Marasanapalle

We address the problem of making optimal product offers to customers of a retail bank. This was done using techniques such as Markov chains, genetic algorithms, mathematical programming, and design of experiments. The challenges involved were large problem size, uncertainty around estimates of customer response to product offers, and practical issues in training and implementation. The solution has been implemented in a retail bank and has achieved an estimated financial impact of over $15M, along with many other intangible benefits including structured decision-making, ability to perform what-if analysis, and portability to other markets and portfolios.

■ TD08

C - Room 11A, Level 4

Public Sector Location Modeling 2

Sponsor: Location Analysis
Sponsored Session

Chair: Alan Murray, Professor, Arizona State University, Geographical Sciences and Urban Planning, Tempe, AZ, 85287, United States of America, atmurray@asu.edu

Co-Chair: Mark Daskin, Professor, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, msdaskin@umich.edu

1 - Population Protection: Medical Countermeasures Dispensing and Large-scale Disaster Relief Efforts
Eva Lee, Professor & Director, Georgia Institute of Technology, Center for Operations Research in Medici, Industrial & Systems Engineeriing, Altanta, GA, 30332-0205, United States of America, eva.lee@gatech.edu

A catastrophic health event could cause hundreds of thousands of casualties, weaken the economy, create panic and civil unrest, and threaten national security. It is therefore critical to establish a strategic vision that will enable a level of public health and medical preparedness sufficient to address a range of possible disasters. In this talk, we discuss strategies in setting up service shelters to house and service a large population in need of care and assistance (joint with CDC).

2 - Location Analysis of Farmers' Markets
Daoqin Tong, Assistant Professor, University of Arizona, School of Geography & Development, 408 Harvill Building, Tucson, AZ, 85721, United States of America, daoqin@email.arizona.edu

Farmers' markets are known as recurrent markets at fixed locations where produce is often sold by farmers. The recent surge of consumers' interests in fresh, healthy and environmentally friendly food has brought about a renewed interest in farmers' markets. However, ensuring success of a farmers market is not easy. In particular, poor accessibility has been identified as a major obstacle. This research focuses on a location analysis of such markets. The study is conducted in Tucson, Arizona.

3 - Nonprofit Supply Chain Design with Unreliable Delivery Times and Capacity Constraints
Gemma Berenguer, University of California, Berkeley, Berkeley, CA, United States of America, gemmabf@berkeley.edu, Z. Max Shen

We study a nonprofit supply chain with limited capacities, unreliable operations, and demand variability. The model considers costs and inequity as objective functions and determines the warehouses location, assignments of demand points to warehouses, and the reorder quantity for each warehouse and village. The model is a nonlinear mixed-integer program that we solve via second-order conic mixed-integer programming.

■ TD09

C - Room 11B, Level 4

Competition and Cooperation in Supply Chains

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Greys Sosic, Associate Professor, University of Southern California, Bridge Hall 401, Los Angeles, CA, 90089, United States of America, sosic@marshall.usc.edu

1 - Rethinking Returns Policies: Effects of Used Goods Markets for Durable Products on Channel Returns
Shuya Yin, University of California Irvine, Paul Merage School of Business, Irvine, CA, United States of America, syin@exchange.uci.edu, Mehmet Gumus, Saibal Ray

Channel returns policies have been an integral part of a number of supply chains. However, the recent growth of used goods markets has brought to light new issues - specifically, how such markets would affect returns policies as well as the performance of chain partners. The objective of this paper is to address these issues.

2 - Name-Your-Own-Price as a Competitive Distribution Channel in the Presence of Posted Prices
Xiao Huang, Assistant Professor, Concordia University, 1455 de Maisonneuve Blvd W., Montreal, QC, H3G1M8, 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, one NYOP firm, and a sequence of customers. A customer can either buy directly from some supplier, or bid with the NYOP firm. If the bid is accepted, either product can be assigned to the customer; otherwise, the customer can still buy from the supplier or leave without purchase. We study the channel strategy of the customers and the impact of NYOP on the suppliers.

3 - Incentives for Transshipment in a Supply Chain with Decentralized Retailers

Harish Krishnan, University of British Columbia, 2053 Main Mall, Vancouver, Canada, Harish.Krishnan@sauder.ubc.ca, Jing Shao, S. Thomas McCormick

We examine transshipment incentives in a supply chain (a monopolist sells through independent retailers). We show that the transshipment price determines whether firms benefit from transshipment. Specifically, the manufacturer prefers a high transshipment price, while retailers prefer a low price. Comparing our model with the case of jointly owned retailers, we find that the manufacturer may prefer dealing with the "chain store," and decentralized retailers' profits may be more than the chain's.

4 - Group Buying of Competing Retailers

Rachel Chen, University of California at Davis, Graduate School of Management, Davis, CA, 95616, United States of America, rachen@ucdavis.edu, Paolo Roma

Under group buying, quantity discounts are offered based on buyers' aggregated quantity. Despite the reduced costs, buyers can get hurt from such cooperation. Consider a distribution channel with one seller and two competing retailers. While group buying is always preferable for identical retailers, it can be detrimental to the larger (or more efficient) one for non-identical retailers. Also, group buying is more likely to form when retailers are competitive in different dimensions.

■ TD10

C - Room 12A, Level 4

Supply Chain Economics and Quality Issues

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Yong-Pin Zhou, Michael G. Foster School of Business, Box 353200, University of Washington, Seattle, WA, 98195-3200, United States of America, yongpin@uw.edu

1 - Manufacturer Discounting When Retail Pass-Through Affects Reservation Prices and Stockpiling

Huanhuan Qi, University of California, IEOR Department, Berkeley, CA, 94720, United States of America, yinong4school@yahoo.com, Candace A. Yano

Studies have shown that discounts offered by manufacturers to retailers are not fully passed along to consumers. We analyze the retailer's response to periodic discounts offered by a manufacturer when retail discounts affect customers' reservation price and degree of stockpiling. The retailer's revenue depends upon his pricing strategy and he incurs fixed ordering costs as well as inventory holding costs. We characterize his optimal policy and show how the customer response affects it.

2 - Coordinating the Staffing Level and Service Quality for Outsourcing of a Two Level Service Process

Azin Farzan, PhD Student, University of Washington, Seattle, Box 353200, University of Washington, Seattle, WA, 98195-3200, United States of America, afarzan@uw.edu, Yong-Pin Zhou

We model the cross-selling process of a service firm as two separate tandem stages. Customers are forwarded from the first stage, which is a customer service process, to the second stage, a sales process. At each stage effort affects the customer satisfaction and sales, and staffing levels affect customer waiting and abandonment. We analyze possible mechanisms that can coordinate the effort and staffing levels at both stages for different scenarios with centralized operation and outsourcing.

3 - Preventing Consumer Returns: Quality Investment Under Bilateral Uncertainty

Paolo Letizia, PhD Candidate, Penn State University, 463A Business Building, University Park, PA, 16802, United States of America, pletizia@psu.edu

We address the problem of a manufacturer who has to decide under uncertainty whether to invest in product quality to reduce the number of consumer returns. If the manufacturer invests, he becomes privately informed about the investment outcome before trading with a retailer through a buy-back contract. We find that the manufacturer's quality investment decision depends on the extent of refund entailed by the buy-back contract.

4 - Setting Service Quality and Speed with Repeated Impatient Customers

Haiyan Wang, University of Washington, Seattle, Box 353200, University of Washington, Seattle, WA, 98195-3200, United States of America, haiyan@uw.edu, Yong-Pin Zhou

High quality products and services are essential to the success of a company. While there are many quantitative models for quality control and management in the manufacturing setting, most research on service quality is qualitative. In this paper, we aim to build an analytical model to quantify the impact of service quality on customer behavior and hence on the service provider's profitability, and to help the service provider decide the most appropriate level of service quality.

■ TD11

C - Room 12B, Level 4

Managing Supply and Demand Uncertainty in Supply Chains

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Ling Dong, Associate Professor, Olin Business School, Washington University in St. Louis, One Brookings Drive, Saint Louis, United States of America, dong@wustl.edu

1 - Managing Disruption Risk with Insurance and Operational Strategies

Brian Tomlin, Tuck School of Business at Dartmouth, 100 Tuck Hall, Hanover, NH, 03755, United States of America, Brian.T.Tomlin@tuck.dartmouth.edu, Ling Dong

Business interruption insurance provides firms with a financial mechanism for managing disruption risk. In this talk we explore the role of business interruption insurance and its interplay with operational mechanisms for managing disruption risk.

2 - Value of Processing Flexibility in Uncertain Supply and Demand Environments

Xiaole Wu, Washington University in St. Louis, Olin Business School, Campus Box 1133, St. Louis, MO, 63130, United States of America, x.wu@wustl.edu, Ling Dong, Panos Kouvelis

We consider a refining process that transforms commodity inputs of various quality levels into intermediates and blend them to make various outputs. We focus on a specific type of processing flexibility that is used in the oil refinery industry, that is, converting low quality intermediates to high quality ones. We examine the value of such operational flexibility in environments where input and output prices are volatile.

3 - A Winemaker's Pricing Dilemma: Volatile Market with Flexibility vs. Stable Market with Restrictions

Burak Kazaz, Associate Professor, Syracuse University, Whitman School of Management, 721 University Ave., Syracuse, NY, 13244, United States of America, bkazaz@syr.edu, Scott Webster

This paper considers a winemaker's pricing and production decisions while operating under supply and demand uncertainty. The firm has to choose between selling only to the traditional distribution channel with the flexibility to set the selling price after the grape crop is collected versus expanding its distribution by adding a direct-to-consumer channel through wine club membership in which the selling price is determined before the growing season begins.

4 - Capacity Management for Commodity Processors

Onur Boyabatli, Assistant Professor of Operations Management, Singapore Management University, 50 Stamford Road 04-00, Singapore, 178899, Singapore, oboyabatli@smu.edu.sg, Quang Dang 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 agribusiness where the input and some 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.

■ TD12

C - Room 13A, Level 4

Supply Chain Systems (Consignment Stock)

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Bhaba Sarker, Elton G. Yates Distinguished Professor, Louisiana State University, Department of Industrial Engineering, 3128 Patrick Taylor Hall, Baton Rouge, LA, 70803, United States of America, bsarker@lsu.edu

Co-Chair: Pius Egbelu, Professor, Louisiana State University, Department of Industrial Engineering, 3128 Patrick Taylor Hall, Baton Rouge, LA, 70803, United States of America, pegbelu@lsu.edu

1 - A Supply Chain Policy with Multi-Factored Variable Leadtime
Junfang Yu, Assistant Professor, Southern Methodist University, Department of Eng. Mgt., Info $ Sys., P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, yuj@lyle.smu.edu, Bhaba Sarker, Hengameh Tahmasebi

In this paper an approach is proposed to obtain the optimal policy for an integrated single-vendor, single-buyer inventory system in which the lead time is also a decision variable. The total integrated cost is assumed to be a function of number of deliveries, order size, and multi-factored lead time. Shortages with lost sales are allowed.

2 - A Replenishment Policy for a Three-stage Integrated Systems: Automobile System
Ratkrit Rochanaluk, Graduate Student, Louisiana State University, Department of Industrial Engineering, 3128 Patrick Taylor Hall, Baton Rouge, LA, 70803, United States of America, rrocha1@tigers.lsu.edu, Pius Egbelu, Bhaba Sarker

This paper deals with a three-stage integrated inventory system in the light of automobile business. When retailers are located in the population areas where the prices of land are high led to the higher holding costs, retailers tend to keep their inventory as low as possible to keep the holding cost down. Algorithms are developed to determine the replenishment policy for producer, distributors, and retailers to achieve the lowest total cost.

3 - The Role of Controllable Lead Time in Consignment Stock
Huizhi Yi, Doctoral student, Louisiana State University, Department of Industrial Engineering, 3128 Patrick Taylor Hall, Baton Rouge, LA, 70803, United States of America, hyi1@tigers.lsu.edu, Bhaba Sarker, Pius Egbelu

In the system considered, the lead-time is controllable with an extra investment under a long time agreement between the two trading partners. The objective is to jointly find out the number of shipments, the size of each shipment, the number of delayed shipments, and the lead time, that minimize the joint total expected annual cost of the system.

4 - Consignment Policy for Retailers with Generalized Demand Distributions
Bhaba Sarker, Elton G. Yates Distinguished Professor, Louisiana State University, Department of Industrial Engineering, 3128 Patrick Taylor Hall, Baton Rouge, LA, 70803, United States of America, bsarker@lsu.edu, Junfang Yu, Bingqing Wu, Qinglin Duan

A manufacturer, multi-retailer generic model is developed under stochastic demand. In order to understand the potential benefits of the consignment policy, it is compared to a traditional policy. Models are tested with several demand distributions and the results show that the consignment policy works better than the traditional uncoordinated problem.

■ TD13

C - Room 13B, Level 4

Empirical Service Operations

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Margaret Pierson, Harvard Business School, Morgan Hall, Boston, MA, United States of America, mpp2002@columbia.edu

1 - How do Incumbents Fare in the Face of Increasing Service Competition?
Ryan Buell, Doctoral Candidate, Harvard Business School, Morgan Hall 480, Boston, MA, 02163, United States of America, rbuell@hbs.edu, Dennis Campbell, Frances Frei

Using data from 83,292 customers of a nationwide retail bank, combined with entry data from 656 markets and institution-level service ratings, we find the effect of service competition on customer retention depends on the incumbent's relative service position. If the incumbent offers an above-median service level, its high tenure and balance customers are disproportionately vulnerable to superior service entry. We also show that sustaining an above-median service position improves performance.

2 - Quick Service Restaurant Performance: Understanding Franchisee Operations and its Impact on Execution
Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, serguei.netessine@insead.edu, Marshall Fisher, Nicole DeHoratius

Using data from a single fast-food restaurant chain, we explore the differential performance of company owned and franchised restaurants. We find that the organizational form is associated with differences in sales, drive through service times, and customer satisfaction. Specifically, sales and service time of corporate-owned restaurants outperform those of franchisees. We attribute this performance difference to differences in labor productivity among the two restaurant types.

3 - An Empirical Investigation of the Reneging Process
Donald Lee, Yale School of Management, 135 Prospect St, Box 208200, New Haven, CT, 06520, United States of America, donald.lee@yale.edu

Normative queuing models for customer reneging often adopt a process which does not depend on the evolving state of the queue. In reality the propensity to renege may vary with the time already spent waiting as well as the number of other customers in front of the line. We empirically investigate this relationship within the context of the healthcare setting.

4 - An Empirical IO Study of the Fast-food Drive-thru Industry Based on Structural Estimation Methods
Margaret Pierson, Harvard Business School, Morgan Hall, Boston, MA, United States of America, mpp2002@columbia.edu, Gad Allon, Awi Federgruen

In many service industries firms differentiate themselves by price and waiting time, as well as attributes not determined directly by competition. We conduct a large scale empirical industrial organization study for fast-food drive-thru restaurants to measure to what extent waiting time performance measures impact different firms' market shares and price decisions.

■ TD14

C - Room 14, Level 4

Supply Chain Management VII

Contributed Session

Chair: Jean-Sebastien Tancrez, Post Doctoral Researcher, EPFL Lausanne - TOM, Odyssea 1.16, Station 5, Lausanne, 1015, Switzerland, jean-sebastien.tancrez@epfl.ch

1 - Obtaining a Well Dispersed Solution Set in Multi Objective Binary Problems
Ozgu Turgut, Research Assistant, Wayne State University, 4500 Cass Avenue, APT 922, Detroit, MI, 48201, United States of America, ozgu.turgut@gmail.com, Alper Murat, Ratna Babu Chinnam

In this study we have tried a new methodology to obtain an even representation of Pareto surface in a real world case. The new methodology requires constructing a plane which will eventually help to constrain the search space in order to get a well dispersed solution set. The problem that the new methodology is applied on is a multi objective binary full configuration optimization problem.

2 - Multi-objective Stochastic and Probabilistic Approaches for Supply Chain Design Under Uncertainty

Amir Azaron, Lecturer, Department of Financial Engineering and Engineering Management, Reykjavik University, Reykjavik, Iceland, University College Dublin, Carysfort Avenue, Blackrock, Co. Dublin, Dublin, Ireland, amir.azaron@ucd.ie, Kai Furmans

A multi-objective stochastic programming model is developed to design robust supply chain configuration networks. Demands, supplies, processing, transportation and inventory-holding costs are considered as the uncertain parameters, which will be revealed after building the sites at the strategic level. The proposed model accounts for the maximization of the net present value, and the minimization of the risk, reflected by the variance of the total cost and the downside risk.

3 - Large Supply Chain Network Design: Decomposition and Heuristic

Jean-Sebastien Tancrez, Post Doctoral Researcher, EPFL Lausanne - TOM, Odyssea 1.16, Station 5, Lausanne, 1015, Switzerland, jean-sebastien.tancrez@epfl.ch, Pierre Semal, Jean-Charles Lange

Inspired by the real case of a glass manufacturer, we study the location of distribution centers in a three layer network. Various costs are considered, to reflect the main trade-offs: transportation, inventory, opening and handling costs. A continuous model is proposed, which decomposes into a simple problem (batch sizes) and a linear-like program (locations and flows). An iterative heuristic is then built on this, aiming to solve large realistic problems.

■ TD15

C - Room 15, Level 4

Computer Science-Applications to OR II

Contributed Session

Chair: Gagan Gupta, Post Doctoral Research Associate, University of Illinois Urbana Champaign, 201 N. Goodwin Avenue, Urbana, IL, 61801, United States of America, gagan@illinois.edu

1 - GPU-based Parallel Computing Algorithm Design and Implementation

Likang Ma, University of Houston, E393B Engineering Building, University of Houston, Houston, TX, 77204, United States of America, leonddr@gmail.com, Gino Lim

We discuss GPU-based CUDA parallel computing design and implementation of two parallel algorithms. The first implementation is to solve the p-median problem using two well-known heuristic algorithms. The second algorithm is for optimizing fluence maps in Intensity Modulated Radiation Therapy. The computational results of our proposed approaches show that a significant improvement in solution time can be achieved using GPU computation compared to traditional serial algorithms using CPUs.

2 - On Algorithm Portfolios and Restart Strategies

Oleg Shylo, University of Pittsburgh, Benedum 1046, Pittsburgh, PA, 15261, United States of America, olegio@gmail.com, Oleg A. Prokopyev, Jayant Rajgopal

Randomized algorithms constitute an effective approach for solving computationally challenging problems. Given a set of available algorithms for a particular problem, one can either choose the best performing algorithm and run multiple copies of it in parallel, or choose some subset of algorithms to run in parallel. It has been shown that the latter approach may provide better results. In this talk we provide a theoretical bound on the extent of such improvement.

3 - A Flexible Business Process Simulation Engine

Bing Shao, IBM, Building19, Zhongguancun Software Park, Beijing, China, shaobing@cn.ibm.com, Changrui Ren, Qinhua Wang, Miao He, Jin Dong

A business process simulation engine which provides multiple programming languages support is introduced. Multiple programming languages are used to extend simulation models, and an expression evaluator is implemented to execute them with their own engines which are dynamically embedded. The simulation engine aims at providing flexible and extendable simulation modeling capability and language-independent execution. The engine has been used in an IBM tool named Supply Chain Process Modeler.

4 - A Review of the Offshore Advantage in Software Development

Ryan Panos, Arizona State University, 7802 E Diamond ST, Scottsdale, AZ, 85257, United States of America, rpanos@asu.edu

Arguably more so than many other disciplines of engineering, Software projects come in many shapes and sizes. In many instances, there are strategic and economic advantages to pushing some or most of the development effort offshore. Based on literature currently available, what factors lead to these advantages both in terms of methodologies under the control of management and the specifications determined by the nature of the product.

5 - Effective Parallelization of an Aircraft Allocation Problem

Gagan Gupta, Post Doctoral Research Associate, University of Illinois Urbana Champaign, 201 N. Goodwin Avenue, Urbana, IL, 61801, United States of America, gagan@illinois.edu, Udatta Palekar, Laxmikant Kale

We present our results on the parallelization of a classic example of two stage stochastic programming with linear recourse. This problem, inspired by the military application involves the assignment of aircrafts at various bases so that the subsequent disruptions due to emergencies and variable demands is minimized. We discuss some of the peculiar aspects of the problem (coarse grain computation, dependent solve times, memory contention) and the approaches we take to achieve good speedup.

■ TD16

C - Room 16A, Level 4

Manufacturing I

Contributed Session

Chair: Liang Zhang, Assistant Professor, University of Wisconsin-Milwaukee, 3200 N. Cramer Street, EMS E307, Milwaukee, WI, 53211, United States of America, liangzh@uwm.edu

1 - A Methodology for Selection of Drilling Units for Special Machines

Majid Tolouei Rad, Edith Cowan University, School of Engineering, 270 Joondalup Drive, Joondalup, WA, 6027, Australia, m.rad@ecu.edu.au

Standard drilling units are widely used in special purpose machines for hole-making operations. However, most industries still rely on the expertise of individuals for selection of drilling units. This is risky and inconsistent. This paper describes a methodology for systematic selection of proper drilling units and other accessories needed for hole-making in industrial parts. This provides industries with a reliable and consistent method for equipment selection for these machines.

2 - From Process Mapping to Process Improvement: A Setup Time Reduction Study

Keith Willoughby, University of Saskatchewan, 25 Campus Drive, Saskatoon, SK, S7N 5A7, Canada, willoughby@edwards.usask.ca, Kevin Braid

Excessive setup times hinder system performance. Process mapping assists decision-makers to understand the sequence of activities involved in a process. In their efforts to adopt and implement a Lean production approach, a world leader in the production and development of plastic pipe systems began to investigate its setup times by thoroughly mapping key process activities. We describe the benefits and drawbacks of this tool in helping to facilitate process improvement.

3 - Achieving Lean, Theory of Constraints, and Six-Sigma Through RFID

Jongsawas Chongwatpol, Oklahoma State University, 91 S University PL APT 08, Stillwater, OK, 74075, United States of America, jong.chongwatpol@okstate.edu, Ramesh Sharda

Many organizations adopt different strategies such as Lean, Theory of Constraints, or Six-Sigma to improve their business processes, financial performance, and customer satisfaction. Meanwhile, RFID has been introduced and applied increasingly to support these strategies directly and indirectly. This study presents a conceptual framework to examine how RFID and such strategies can be complimentary in various scenarios.

4 - Studies of Magnetic Properties of Cobalt-Zinc Ferrite Doped with Gadolinium

Mauricio Cabrera-Rios, Assistant Professor, University of Puerto Rico at Mayaguez, P.O. Box 9000, Industrial Engineering Department, Mayaguez, PR, 00681, Puerto Rico, mauricio.cabrera1@upr.edu, Zaimara Hernandez, Silvana Urcia, Oscar Perales-Perez

Cobalt-Zinc Ferrite has high temperature of demagnetization of 350 degC, but when modified with Gadolinium (Gd), this temperature diminishes thus becoming an attractive candidate for magnetocaloric applications. Application of experimental design concepts to study the synthesis procedure will help to statistically characterize the effect of the gadolinium content as well as the precipitant agent (NaOH) to then lead to an experimental optimization in presence of conflict in different properties.

5 - Operation Sequencing in Flexible Production Lines with Bernoulli Machines

Liang Zhang, Assistant Professor, University of Wisconsin-Milwaukee, 3200 N. Cramer Street, EMS E307, Milwaukee, WI, 53211, United States of America, liangzh@uwm.edu, Xiaohang Yue

In flexible manufacturing environment, the performance of a production system is usually affected by the sequence of operations. While performance evaluation, improvement and leanness of production systems have been studied extensively, operation sequencing remains practically unexplored. In this work, in the framework of Bernoulli reliability and quality models, we develop indicators to determine optimal operation sequencing in order to maximize the production rate of the system.

■ TD17

C - Room 16B, Level 4

Analytics for Life

Cluster: OR/MS in India
Invited Session

Chair: Vijay Chandru, Chairman & CEO, Strand Life Sciences, Kirloskar Business Park, 5th Floor, Hebbal, Bangalore, KA, 560024, India, chandru@strandls.com

1 - Advanced Analytics for Health Care System Management

Vijay Chandru, Chairman & CEO, Strand Life Sciences, Kirloskar Business Park, 5th Floor, Hebbal, Bangalore, KA, 560024, India, chandru@strandls.com, Jeremy Shapiro

A merger of BI and Modeling Systems has the potential for creating powerful but easy-to-use decision support systems. We describe the potential in more detail for the specific application in health care supply chains. A case study of a "health city" project in India will be used for illustration.

2 - A Mathematical Model for Predicting Length of Stay After Cardiac Surgery

Goutam Dutta, Professor, IIM- Ahmedabad, Wing 3, PMQ Area, Ahmedbadad, 380015, India, goutam@iimahd.ernet.in, Priyanko Ghosh, Ajay Naik, Dipa Gosai

The length of Stay in an Intensive Care Unit (ICU) after cardiac surgery is an important variable for a hospital providing heart care. We develop a predicting index based on univariate and multivariate logistics regression model with one year data (1270 patients). The model shows that mean length of stay increases with an increase in the risk score as well as mortality. Efficient Utilization of ICU is possible with this type of model.

3 - Capacity Commitment, Competition, and the Ever-greening Decision

Ram Bala, Indian School of Business, Gachibowli, Hyderabad, 500032, India, ram_bala@isb.edu, Sumit Kunnumkal, Milind Sohoni

Firms in innovation-intensive industries, such as pharmaceuticals, have to deal with patent expiration and consequent loss of monopoly position for key blockbuster products. One strategy to beat "patent death" is to introduce line extensions with add-on patents, a strategy referred to as "Ever-greening". However, the process of ever-greening is fraught with uncertainty since these add-on patents are subject to tight guidelines and may also fail other approval processes (such as FDA approval in the case of pharmaceuticals). Thus, firms have to commit to production capacity upfront without clarity on whether the product upgrade will reach the market. Moreover, such capacity commitment is also costly if left unused. In this paper, we compare the impact of capacity commitment on the ever-greening decision under competition from a generic drug manufacturer. We analyze the interplay between the quality of the product upgrade, cost of unused capacity, and the probability of success of the upgrade on the capacity commitment decisions. We also characterize the Nash equilibrium strategies of both the firms under different market conditions.

■ TD18

C - Room 17A, Level 4

Optimization Software

Sponsor: Computing Society
Sponsored Session

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

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - Guidelines for Assessing Ill Conditioning in Linear and Integer Programs

Ed Klotz, IBM, 926 Incline Way, Suite 100, Incline Village, NV, United States of America, klotz@us.ibm.com, Emilie Danna

The simplex method solves square linear systems of equations while optimizing a single linear program (LP). O.R. practitioners can use condition numbers of these systems to assess ill conditioning in an LP. Most literature describes ill conditioned models as having "large" condition numbers, but provides no thresholds for values that indicate an ill conditioned system. We will provide a methodology to define suitable thresholds and assess ill conditioning in linear and integer programs.

2 - Practical Solutions of Optimization Problems with OptQuest

Manuel Laguna, Professor, University of Colorado at Boulder, 419 UCB, Boulder, CO, 80309, United States of America, laguna@colorado.edu

Built on a framework of metaheuristic optimization, over the last ten years, OptQuest has steadily increased its user base and solidified its position as the preferred software for optimizing expensive black boxes and simulations. We discuss and demonstrate recent additions to OptQuest's methodology and functionality, including the ability to tackle multiobjetive optimization problems.

3 - Performance of Optimization Software - An Update

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

We report on the current status of our benchmarking effort for both discrete and continuous optimization software.

■ TD19

C - Room 17B, Level 4

New Directions in Revenue Management and Pricing II

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, ming.hu@rotman.utoronto.ca

1 - Contracts, Biases and Consumption of Services

Ozge Sahin, University of Michigan, 701 Tappan Street, Ann Arbor, MI, 48109, United States of America, ozge@bus.umich.edu, Steve Leider

Recent research shows that the consumer's consumption is affected by the structure of the contract although ex ante the contracts result in the same consumption and expected utility. This suggests that the consumers experience biases while maximizing their surplus from the consumption of services. We study consumption models that take into account behavioral aspects of decision making and test these models with a set of laboratory experiments.

2 - Opt Out or Carry Over: Adding Flexibility to Extended Service Contracts Can be Win-Win

Julie Ward, Principal Scientist, HP Labs, 1501 Page Mill Rd, MS 1140, Palo Alto, CA, 94304, United States of America, jward@hp.com, Ruxian Wang, Guillermo Gallego, Ming Hu, Enis Kayis, Filippo Balestrieri, Jose Luis Beltran, Shailendra Jain

Rapid price declines & technology improvements in industries like consumer electronics make replacing one's product an increasingly viable alternative to buying an extended warranty (EW). We study the design of EWs with flexibility in coverage duration, such as monthly or refundable EW. We show how such services can appeal to a broader market (including frequent-upgraders or budget-constrained customers), can earn more profit for the provider, and can be designed to reduce customer attrition.

3 - Competitive Pricing with Reference Effects

Srinivas Krishnamoorthy, Richard Ivey School of Business, University of Western Ontario, 1151 Richmond Street N., London, ON, N6A 3K7, Canada, skrishnamoorthy@ivey.uwo.ca

We examine the effect of reference prices on the pricing strategies of two competing firms. The analogy drawn within the paper is to the MP3-player market, wherein incumbents have large reference price advantages over effectively equivalent new entrants.

4 - Bid Price Trends in Revenue Management

Ming Hu, Assistant Professor, Rotman School of Management, University of Toronto, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, ming.hu@rotman.utoronto.ca, Oded Berman, Zhan Pang

We characterize the probabilistic properties of the bid price sample paths under the optimal policy in a general revenue management framework: the bid price process has an upward trend before the inventory level drops to one and then strictly declines afterwards. We extend the results to revenue management network problems.

■ TD20

C - Room 18A, Level 4

Cargo Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Darius Walczak, PROS, 3100 Main Street, Suite 900, Houston, United States of America, dwalczak@prosrm.com

1 - Revenue Management in Air Cargo Allotment Planning

Bill Pun, Northwestern University, 1303 Maple Ave Apt 2W, Evanston, IL, 60201, United States of America, billpun@billpun.com, Diego Klabjan

Airlines face a daunting task to determine an optimal capacity split between the allotment and spot market for various air cargo allotments. We propose a quadratic mixed integer model where the quadratic part captures the demand variation between pairs of markets.

2 - Dynamic Pricing in Airline Cargo Industry

Darius Walczak, PROS, 3100 Main Street, Suite 900, Houston, United States of America, dwalczak@prosrm.com, Setareh Mardan

Cargo industry has unique features that challenge traditional revenue management solutions. Lumpy, highly volatile demand and very short booking cycles are some of these features. We discuss these challenges and propose a Dynamic Programming optimization model that adjusts the cargo acceptance criteria in real time with the goal of optimizing financial performance. We present numerical results to illustrate this performance.

3 - Cargo Revenue Management: Bid-Prices for a 0-1 Multi-Dimentional Knapsack Problem

Rommert Dekker, Erasmus University Rotterdam, Burg Oudlaan 50, Rotterdam, 3062 PA, Netherlands, rdekker@ese.eur.nl

In this paper we present an acceptance policy based on offline computed bid-prices for the cargo revenue management problem. The method is based on a greedy algorithm for the deterministic multi-dimensional knapsack problem, which we have adapted for the stochastic nature of our problem. Our results indicate that the presented policy is asymptotically optimal and performs better than traditional (LP-based) bid-price policies.

4 - Dynamic Cargo Revenue Management with Contract and Spot Customers

Bacel Maddah, Assistant Professor, American University of Beirut, P.O. Box 11-0236 Riad El Solh, Beirut, 1107-2020, Lebanon, bm05@aub.edu.lb, Lama Moussawi

We consider a cargo revenue management problem in which cargo capacity is sold on a contracted basis or in the spot market. The problem of determining how much of the total weight and volume capacities to sell on a contracted basis is solved. The remaining capacity is then 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.

■ TD21

C - Room 18B, Level 4

Customer Service Management in Energy & Utility Industry

Sponsor: Service Science
Sponsored Session

Chair: Adiel Almeida-Filho, Assistant Professor, Federal University of Pernambuco, Cx Postal 7471, Recife, PE, 50.630-971, Brazil, atalmeidafilho@yahoo.com.br

1 - The Cost of New Electricity Generation

Seth Borin, Graduate Research Assistant, Georgia Institute of Technology, 402-B Georgia Ave SE, Atlanta, GA, 30312, United States of America, sborin3@gatech.edu, Todd Levin, Valerie Thomas

Future demand for electricity can be met with a range of technologies and fuels as well as with energy efficiency and demand management approaches. Most studies use site specific point estimates for costs using methodologies that are not replicable or do not allow straightforward comparisons between technologies. The approach taken here is to provide a transparent and verifiable analysis based mainly on recent data provided to public utility commissions by electric utilities.

2 - Response-time-focused Supply Chain Design for the Energy and Utilities Industry

Yanjia Zhao, Mr., Tsinghua University, Department of Automation, Tsinghua University, Beijing, 100084, China, zhaoyj@mails.tsinghua.edu.cn, Minmin Qiu, Hongwei Ding, Jin Dong

The Energy and Utilities (E&U) industry has become more and more important nowadays due to the increasing demand for electricity and growing environmental concerns. With the development of smart grids, the energy system has become a large and complicated network, whose performance and security highly depend on the on-time delivery of maintaining equipments. In this work, we formulate an E&U supply chain as an MIP and propose a simulation-based optimal design to guarantee the on-time responses.

3 - A Multi-criteria Model for a Liquefied Petroleum Gas Distributor Customer Relationship Management

Adiel Almeida-Filho, Assistant Professor, Federal University of Pernambuco, Cx Postal 7471, Recife, PE, 50.630-971, Brazil, atalmeidafilho@yahoo.com.br, Ana Paula Costa, Marcos Felipe Sobral

Liquefied Petroleum Gas (LPG) is a fossil fuel used in the production chain of different market segments and it is an important component in the national energy matrix. The process of classifying consumers by LPG distributors is a strategic task and subjected to a set of criteria that need to be observed. This work presents a multi-criteria model to deal with the task of classifying clients in a LPG distribution company allocating the portfolio of clients to a set of ranked classes.

■ TD22

C - Room 18C, Level 4

Joint Session Service/ Supply Chain: Manufacturing vs. Service Operations

Sponsor: Service Science/ Supply Chain
Sponsored Session

Chair: Sechan Oh, IBM Research, 650 Harry Road, San Jose, United States of America, seoh@us.ibm.com

Co-Chair: Yanchong Karen Zheng, PhD Candidate, Stanford University, Huang Engineering Center 338C, 475 Via Ortega, Stanford, CA, 94305, United States of America, yczheng@stanford.edu

1 - A Process Analysis of Global Trade Management: An Inductive Approach

Yanchong Karen Zheng, PhD Candidate, Stanford University, Huang Engineering Center 338C, 475 Via Ortega, Stanford, CA, 94305, United States of America, yczheng@stanford.edu, Alex Thompson, Warren Hausman, Hau Lee, Graham Napier

We develop a detailed process model of the China-US trade process to study the benefit of implementing advanced information technologies in a global trade setting. We collect data on estimated task time reductions for each process step. Estimated profits increase by 28% and 10% for exporters and importers, respectively, under conservative assumptions.

2 - Modeling Discretion, Knowledge and Coordination in Professional Service Systems

Seyed Iravani, Associate Professor, Northwestern University, 2145 Sheridan Road, C210 Tech., Evanston, IL, 60208-3119, United States of America, s-iravani@northwestern.edu

The American economy has been shifting away from traditional manufacturing activities and toward service and professional functions. While in manufacturing (and some service operations) tasks are routine and well-defined, in professional service systems, tasks are not routine; they are knowledge-intensive, they depend on worker's discretion, and they require a high level of coordination. In this talk we introduce new frameworks for modeling such professional service systems.

3 - A Multi-Period, Two-Echelon Inventory System with Dependent Disruptions

Behdad Masih-Tehrani, The Pennsylvania State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, behdad@psu.edu, Soundar Kumara, Susan Xu

We consider multi-supplier, single-retailer, periodic review inventory systems in which the capacities of suppliers are random and positively dependent. Within the class of base stock policies, we show that positive dependence of supply capacities has adverse effects on the performance of a multi-source system, but favorable effects on the performance of an assembly system. We study how the positive dependence of supply capacity affects the optimal base-stock level in each system.

4 - Global Service Supply Chain Modeling

Sechan Oh, IBM Research, 650 Harry Road, San Jose, United States of America, seoh@us.ibm.com, James Rhode, Ruoyi Zhou

Large service enterprises such as IT outsourcing firms deliver their services from globally distributed delivery centers (suppliers) to globally distributed clients (customers). For such firms, coordinating demand and supply is a challenging problem because of the organizational and geographically distance between sales and delivery. To address this problem, we develop a global service supply chain model.

■ TD23

C - Room 18D, Level 4

Joint Session Media Planning/ RMPS: New Models in Online Advertising

Cluster: Media Planning and Optimization/ Revenue Management and Pricing Section
Invited Session

Chair: Kristin Fridgeirsdottir, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, kfridgeirsdottir@london.edu

1 - Social Attention and the Provider's Dilemma

Christina Aperjis, HP Labs, 1501 Page Mill Rd, Palo Alto, 94304, United States of America, christina.aperjis@hp.com, Bernardo Huberman

A content provider with an established audience can increase his revenue through advertisements and subscription fees provided that these inconveniences do not trigger a massive defection from the site. How fast should these inconveniences be introduced in order to maximize revenues? We address this question through the lens of adaptation theory, which states that even though a change initially affects a person's utility, as time goes on people tend to adapt to the new state.

2 - Network Revenue Management with Uncertain Capacity: Application for Online Ad Sales

Nikolay Osadchiy, Emory University, 1300 Clifton Rd NE, Atlanta, GA, United States of America, nikolay_osadchiy@bus.emory.edu, Sridhar Seshadri

We extend the formulation of the classical network revenue management problem to the setting where capacity is uncertain. The extension is motivated by the online ad pricing problem. We show that the bid-price controls are non-monotonic functions of the variance of the capacity, which affects the product mix offered by the seller. We compare the revenue performance of the algorithm to the traditional methods.

3 - Optimal Cost-Per-Click Pricing in Advertising Networks: A Queueing System's Approach

Sami Najafi-Asadolahi, London Business School, Regent's Park, London, NW1 4SA, United Kingdom, snajafi@london.edu, Kristin Fridgeirsdottir

We consider a web publisher facing uncertain demand from advertisers requesting space through an ad network, and an uncertain supply of clicks from viewers. Formulating the problem as a novel queuing system, we show that the general heuristic applied by practitioners to convert between the CPC and CPM pricing schemes using the so-called click-through rate (CTR), can be considerably misleading.

■ TD24

C - Room 19A, Level 4

Operations Research Applications in Disaster Management

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Gino Lim, Associate Professor PhD, University of Houston, E211, Engineering Building 2, Houston, TX, 77204, United States of America, ginolim@uh.edu

Co-Chair: Mohammad Reza Baharnemati, PhD Candidate, University of Houston, W228, Engineering Building 2, Houston, TX, 77204, United States of America, mbaharnemati@uh.edu

1 - Investments in Infrastructure and Forecasting When Facing Hurricane Risk

Seong Dae Kim, Assistant Professor, University of Alaska Anchorage, PM Department at University Center, Room 155, 3901 Old Seward Highway, Anchorage, AK, 99503, United States of America, afsdk1@uaa.alaska.edu, Eric Bickel

When faced with a significant risk, society must decide how much to invest in prediction and response. For example, in the face of hurricane risk how much should we invest in better forecasting versus increased evacuation speed? To address this need, we develop a Markov decision processes model to analyze the interaction between the emergency response system and the emergency forecasting system. The model indicates that the superiority of the investment changes sharply by the lead time.

2 - Decision Support for Hospital Evacuation and Emergency Response

Esra Agca, Graduate Student, Virginia Polytechnic Institute and State University, Grado Department of ISE (0118), Virginia Tech, Blacksburg, VA, 24061, United States of America, esra.vt@gmail.com, Douglas Bish, Roger Glick

Hospital evacuations are difficult logistical problems; to assist with planning and operations, we present a mixed-integer linear program formulation that minimizes the risk inherent in transporting patients from an evacuating hospital to a set of receiving hospitals considering attributes of the threat, the patients, and available transport vehicles, and the current patient load at all hospitals concerned. We illustrate this model using a large-scale case study from a hospital.

3 - A Path-Based Optimization Approach for Evacuation Planning using a Column Generation Approach

Mohammad Reza Baharnemati, PhD Candidate, University of Houston, W228, Engineering Building 2, Houston, TX, 77204, United States of America, mbaharnemati@uh.edu, Gino Lim

We consider a network flow model for evacuation planning. The goal is to maximize the number of evacuees through a fixed set of evacuation paths. The flow rate of each path is assumed to be constant over time. The model determines the paths and their flow rates. A column generation scheme is developed for solving this network optimization model. Due to computational difficulties for obtaining exact solutions, a heuristic algorithm has been developed to expedite the solution process.

■ TD25

C - Room 19B, Level 4

Transportation, Intelligent Systems I

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 - Prediction-based Car-following Algorithm for Automated Vehicle Control

Hao Zhou, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, haozhou@umich.edu

Communication latency is one of the most difficult part in an automated vehicle control algorithm. In this paper, we presents a prediction-based car-following algorithm to significantly reduce the impact of latency in automated vehicle control system. The stability of this algorithm is analyzed, and comparison with traditional algorithms is assessed.

2 - Anonymous Pedestrian Tracking in Special Events using Bluetooth Sensors

Masoud Hamedi, Research Associate, University of Maryland, 1137 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, masoud@umd.edu, Ali Haghani

Tracking pedestrians without compromising their privacy during social events provides valuable information on their route choice and points of interest. Event planners may use the data to prepare pedestrian access plan for future events which ensures safe and efficient movement of pedestrians within the immediate area of the venue. Application of new Bluetooth traffic detectors for studying pedestrian activities during a special event will be presented.

3 - Towards an Autonomic Architecture for Real-Time Traffic Network Management

Khaled Abdelghany, Southern Methodist University, P.O. Box 750340, Dallas, United States of America, khaled@lyle.smu.edu, Hamideh Etemadnia

We present an autonomic architecture for real-time traffic network management. The architecture adopts a hierarchal dynamic framework in which a set of distributed controllers are dynamically configured. Results of an off-line testing of the proposed architecture are presented.

4 - A Distributed Origin-destination Demand Estimation

Hamideh Etemadnia, Southern Methodist University, P.O. Box 750340, Dallas, United States of America, hetemadnia@smu.edu, Khaled Abdelghany

We present a distributed recursive heuristic approach for the origin-destination demand estimation problem. The heuristic is implemented following a hierarchal multi-threading mechanism. The obtained results illustrate that the heuristic can achieve reasonable demand estimation accuracy while maintaining superiority in terms of processing time.

5 - Comparison of Parametric and Nonparametric Models for Travel Time Prediction Based on Bluetooth Data

Wenxin Qiao, University of Maryland - College Park, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, wxqiao@umd.edu, Masoud Hamedi, Ali Haghani

Accurate and 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 paper studies travel time prediction for freeways using real time Bluetooth travel time data. A set of four prediction models including parametric and nonparametric models are implemented. Performance of each model for sample case studies is investigated and reported.

■ TD27

C - Room 4B, Level 3

Large Scale Optimization

Contributed Session

Chair: Sandro Paz, Associate Professor, Pontificia Universidad Catolica del Peru, Av Universitaria 1801 San Miguel, Lima 32, Peru, spaz@pucp.edu.pe

1 - Efficient Approximations for Large-Scale MIP Problems

Yuri Smirnov, Principal Scientist, FICO, 181 Metro Dr, Suite 600, San Jose, CA, 95110, United States of America, yurismirnov@fico.com

Palatable, exact models for some classes of MIP problems have sizes that are prohibitively large for leading commercial solvers to optimize within acceptable time limits. However, it's possible in some cases to simplify the objective function, to construct a fast approximation algorithm or both. Furthermore, a hybrid algorithm can be design that combines the best of both worlds by utilizing efficient heuristics finding local optima to narrow the scope and derive the optimal solution.

2 - A Mathematical Programming Approach for Integrated Large-Scale Retail Decisions

Ahmed Ghoniem, Assistant Professor, UMass Amherst, 121 Presidents Dr., Amherst, 01003, United States of America, aghoniem@som.umass.edu, Bacel Maddah

We investigate the optimization of assortment, pricing, and ordering decisions for a retailer that seeks a most profitable strategy for an anticipated multi-period selling season. We provide modeling insights into a nonlinear MIP formulation along with a hierarchy of increasingly tight linear MIP reformulations. Computational results and managerial insights are discussed in light of retail practices.

3 - Large Scale Optimization Model using Benders Decomposition for a Production and Distribution Problem

Sandro Paz, Associate Professor, Pontificia Universidad Catolica del Peru, Av Universitaria 1801 San Miguel, Lima 32, Peru, spaz@pucp.edu.pe, Luis Chavez-Bedoya, Ruth Murrugarra, Bo Zeng, Monica Puertas

The inclusion of many variables and constraints are characteristics of the problems faced by the energy package industry today. This paper presents the optimization of a large scale integer problem using a variant of Bender's decomposition throughout a numerical study. It can be used for any production planning or scheduling problem in this industry.

■ TD28

C - Room 4C, Level 3

Reliability Applications in Homeland Security

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Jose Ramirez-Marquez, Assistant Professor, Stevens Institute of Technology, Castle Point on Hudson, SSE, Hoboken, NJ, 07030, United States of America, Jose.Ramirez-Marquez@stevens.edu

1 - Optimal Allocation and Scheduling of Container Inspection Operations

Christina Young, Rutgers University, 96 Frelinghuysen Rd, Core Room 201, Piscataway, NJ, 08854, United States of America, cms168@rci.rutgers.edu, Elsayed Elsayed

We consider the problem where containers have specified due times and associated penalties. A port inspection system consists of several inspection stations; we assume each detects one type of undesired material and that risk profiles of multiple categories are given. We discuss the formulation of the inspection system optimization and develop approaches to simultaneously determine the optimal inspection allocation and schedule that minimizes tardiness and the probability of false acceptance.

2 - Design and Protection of Hub-and-spoke Networks Subject to Disruptions

Hugh Medal, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hugh.medal@uark.edu, Chase Rainwater, Manuel D Rossetti, Ed Pohl

Hub-and-spoke networks are prevalent in our world today, with applications in air transportation and less-than-truckload trucking. A key feature of these networks is the presence of consolidation points, or hubs, which receive a high volume of traffic. Although the presence of high-volume hubs does help to reduce costs, they also make networks very vulnerable to disruptions. In this work we present math models for deciding how to design and protect vulnerable hub-and-spoke networks.

3 - Network Reliability and Resiliency

Michael Tortorella, RUTCOR, Rutgers University, 640 Bartholomew Rd., Piscataway, NJ, 08854, United States of America, mtortore@rci.rutgers.edu

A resilient network is one that continues to deliver services in a satisfactory fashion despite possible disruptions in the network infrastructure. This talk proposes a quantitative framework for network resiliency. Key concepts are delivery function and delivery importance. We discuss design principles that promote greater network resiliency. We introduce network resiliency optimization and briefly show how a network interdiction problem can be solved using the network resiliency framework.

4 - Quantitative Resilience Analyses for Security-critical Systems

Devanandham Henry, Stevens Institute of Technology, 906 Broadway Apt 1, Bayonne, NJ, 07002, United States of America, dhenry@stevens.edu, Jose Ramirez-Marquez

The occurrence of various disruptions to security-critical systems in spite of many security measures only show that 100% security is not easily achievable. When a threat actually causes damage, it is the "resilience" of the system that enables it to quickly and effectively return back to its initial levels of service or performance. This presentation introduces a quantitative approach to resilience and defines relevant metrics that would help in building critical systems for resilience.

■ TD29

C - Room 5A, Level 3

IIE Transaction Sponsored Session

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Jianjun Shi, Georgia Institute of Technology, 755 Ferst Dr. NW, Atlanta, GA, United States of America, jianjun.shi@isye.gatech.edu

1 - Statistical Monitoring of Multi-stage Processes Based on Engineering Models

Fugee Tsung, Professor and Head, Department of Industrial Engineering and Logistics Management, Hong Kong University of Science and Tech, Clear Water Bay, Kowloon, Hong Kong - PRC, season@ust.hk

Most manufacturing processes consist of a large number of stages. The modeling of multi-stage processes by considering physical and mechanical laws in a linear state space form is reported in the literature. However, recent research on statistical monitoring of multi-stage processes usually makes little use of this type of approach. A Statistical Process Control (SPC) method is proposed for multi-stage processes described by an engineering state space model.

2 - Robust Eco-design

Irad Ben-Gal, Prof., Tel Aviv University, Tel Aviv, Israel, bengal@eng.tau.ac.il, Yossi Bukchin, Roni Katz

The method of robust design has long been used for the design of systems that are insensitive to noises. We demonstrated how this approach is used to obtain a robust eco-design (ecological design). Robust design principles are applied to design a factory smokestack in various atmospheric conditions. It is demonstrated how to exploit the non-linearity in the ecological model to reach a low pollutant dispersal. Both the manufacturer and the environmentalist viewpoints are discussed and analyzed.

3 - Regression-based Process Monitoring with Consideration of Measurement Errors

Jing Li, Assistant Professor, Industrial Engineering, Arizona State University, Tempe, AZ, United States of America, jing.li.8@asu.edu, Shuai Huang

This paper studies multivariate process control based on data with four major types of measurement errors. The proposed method includes design of new control charts, and identification of the maximum allowable measurement errors to fulfill certain fault detectability requirements. The method is demonstrated in two industrial processes.

■ TD30

C - Room 5B, Level 3

Reliability II

Contributed Session

Chair: Torben Kuschel, University of Wuppertal, Gauflstrasse 20, Wuppertal, 42119, Germany, tkuschel@winfor.de

1 - Inventory-based Optimal Policy Making in the Maintenance of a Single-machine Single-product Toolset

Raha Akhavan-Tabatabaei, Assistant Professor, Universidad de los Andes, Cra 1 Este # 19A-40, Bogotà, Colombia, r.akhavan@uniandes.edu.co, Juan Sebastian Borrero

We present a method to create optimal policies for a single-server single-product workstation using a Markov Decision Process model. The optimal policy determines whether or not to perform the Preventive Maintenance (PM) based on the Work in Process level and the time since the last repair. We present some numerical examples to illustrate the behavior of the optimal policy under different scenarios and compare the results with some common policies such as fixed frequency PM.

2 - Alternatives to Linear Damage Accumulation Models in Accelerated Life Testing

Michael Koskulics, Rutgers Department of Industrial and Systems Engineering, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, mkoskuli@eden.rutgers.edu, Elsayed Elsayed

Accelerated life testing (ALT) is used to obtain failure time data quickly under high stress levels in order to predict product life and performance under the design stress. Most of the previous work designing ALT plans using time-varying stresses assumes damage accumulates linearly, that is the stress loading sequence has no effect on the lifetime prediction. In this presentation we will discuss alternatives to the these models and their applicability in ALT.

3 - Integrating Human-Related Factors Affecting System Reliability Into a Failure Prediction Model

Corey Kiassat, PhD Candidate, University of Toronto, Faculty of Applied Science & Engineering, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, ckiassat@mie.utoronto.ca, Myrto Konstandinidou

In a reliability analysis of a man-machine system, human-related (HR) factors, such as expertise and working conditions, should certainly be considered. HR factors affecting system reliability must be recognized and evaluated. Those found to be significant are integrated into reliability assessment models. A case study demonstrates the identification, quantification, and integration of HR factors into a well-known failure prediction and reliability analysis model, the Proportional Hazards Model.

4 - Prediction of Population Performance Based on Reliability

Lu Lu, Los Alamos National Laboratory, P.O. Box 1663, MS F600, Los Alamos, NM, 87545, United States of America, lulu@lanl.gov, Christine Anderson-Cook

The effective management of a population of units requires understanding the reliability of the entire population. One summary is to predict the probability that a unit randomly selected from the population works. Another summary is to predict the proportion of units with reliability at or above a user-specified threshold. How population summaries can be efficiently obtained from Bayesian estimates of individual reliabilities is illustrated with examples based on Probit and Weibull models.

5 - Tabu Search and Lagrangean Metaheuristics for the Capacitated Planned Maintenance Problem

Torben Kuschel, University of Wuppertal, Gauflstrasse 20, Wuppertal, 42119, Germany, tkuschel@winfor.de, Stefan Bock

The Capacitated Planned Maintenance Problem seeks a maintenance plan with a minimal number of maintenance slots such that the machine does not break down and the maintenance time is never exceeded. A novel Tabu search approach, which features a multi-stage search and a variable neighborhood, is presented and compared to new Lagrangean heuristics. Using duality, the Lagrangean relaxations are solved heuristically because they are NP-hard. Yet valid subgradients of good quality are obtained.

■ TD31

C - Room 5C, Level 3

Data Mining IV

Contributed Session

Chair: Li Zhang, Royal Bank of Scotland, 399 Main Ave., Apt 614, Norwalk CT 06851, United States of America, lieezhang@gmail.com

1 - Balance Optimization Subset Selection (BOSS) for Causal Inference

Alexander Nikolaev, Assistant Professor, University at Buffalo (SUNY), Department of Industrial and Systems Engineering, Buffalo, NY, 14226, United States of America, a-nikolaev@northwestern.edu, Jason Sauppe, Sheldon Jacobson, Edward Sewell, Wendy Tam Cho

The BOSS approach does causal inference based on observational data: it transforms the selection bias reduction problem resulting from matching individual units to a subset selection problem. Unlike currently used methods, BOSS defines the problem structure to directly maximize a measure of covariate balance via discrete optimization.

2 - Scientometrics Method Studies on Strategy and Layout of Standard System

Wei Feng, Wuhan Branch of National Sciences Library, the Chinese Academy of Sciences(CAS), West 25, Xiaohongshan, Wuhan, Hubei, PR, Wuhan, 430071, China, weif@mail.whlib.ac.cn

A new method that scientometrics are used to study the strategy and layout of standard system is put forward. Through the analysis for standard information, basic information characters are obtained, which makes successfully set up the database system of standard management and analysis. Then some information about standard system are studied by the intelligence means of scientometrics and literature searching and by an example of solar technology standards with China and Japan.

3 - Observation of Demographic Heterogeneity in Paris using Shared Bikes as a Probe

Kats Sasanuma, PhD Student, Heinz College, Carnegie Mellon University, 4800 Forbes Ave., Pittsburgh, PA, 15213, United States of America, ksasanum@andrew.cmu.edu, Robert Hampshire

Recent IT and GPS technologies enable us to collect various information related to trajectory data of vehicles. Since the observed mobility patterns are a reflection of the collected human behaviors and decisions made at each geographical position, it is possible to retrieve attributes of human activities from such information. In this talk, we explain how we can observe demographic heterogeneity in Paris using bike sharing data.

4 - ROC Based Apaptive Threshold Approach for Optimal Classification
Changjian Huang, Associate Director, UBS Investment Bank, 399 Main Ave., Apt 614, Norwalk, CT, 06851, United States of America, cjjhuang@gmail.com, Li Zhang

In recent decades, ROC curve are widely used in evaluating and comparing algorithms in the machine learning community in part to the fact that misclassification alone does not perform well in the real world operating environment. In this presentation, we will propose a new ROC based adaptive threshold (ROC-BAT) approach to get optimal threshold values for new cases assuming the class distribution changes drastically without altering the fundamental characteristics of the classes.

■ TD32

C - Room 6A, Level 3

Hard Problems in Learning and Decision-Making

Sponsor: Computing Society
Sponsored Session

Chair: Sanmay Das, Assistant Professor, Rensselaer Polytechnic Institute, Department of Computer Science, 110 8th St, Troy, NY, 12180, United States of America, sanmay@cs.rpi.edu

1 - Learning for Metagenomic Assembly
Scott Clark, Graduate Student, Cornell University, 657 Rhodes Hall, Ithaca, NY, 14853, United States of America, sc932@cornell.edu, Peter Frazier

Metagenomic assembly is the reconstruction of genomes from small sequence "reads" taken from a collection of organisms. Conceptually, it is tantamount to rebuilding many mixed jigsaw puzzles concurrently. We formulate a learning algorithm to determine how to best extend certain reads and rebuild the genomes in a scaffold-like manner. This technique allows us to probabilistically learn chunks of potential genomes while efficiently exploring the space of possible reconstructions.

2 - Teaching Teammates in Ad Hoc Teams
Peter Stone, Associate Professor, The University of Texas at Austin, 1 University Station C0500, Austin, TX, 78712, United States of America, pstone@cs.utexas.edu

Teams of agents are typically developed in a planned, coordinated fashion. However, such coordinated development is not always possible. Rather, as deployed agents become more common, there are increasing opportunities for previously unacquainted agents to cooperate in ad hoc team settings. This talk considers an agent that is to interact repeatedly with a teammate that will adapt to this interaction in a particular suboptimal, but natural way.

3 - Strategic Sequential Voting in Multi-Issue Domains and Multiple-Election Paradoxes
Lirong Xia, Duke University, Department of Computer Science, Durham, 27705, United States of America, lxia@cs.duke.edu, Jerome Lang, Vincent Conitzer

We model sequential voting in multi-issue domains as a complete-information extensive-form game, in which the agents are perfectly rational and their preferences are common knowledge. We focus on domains with binary issues, so that this process leads to a unique outcome under a natural solution concept. We show several multiple-election paradoxes in strategic sequential voting in various setting, even when the profiles are separable, lexicographic or O-legal.

4 - Learning Gaussians From Threshold Signals
Sanmay Das, Assistant Professor, Rensselaer Polytechnic Institute, Department of Computer Science, 110 8th St, Troy, NY, 12180, United States of America, sanmay@cs.rpi.edu, Malik Magdon-Ismail, Mithun Chakraborty

We discuss the problem of learning the mean of a Gaussian distribution when only threshold signals from samples are available. The learner sets two thresholds and then observes which side of the three intervals the sample falls within. We describe an algorithm based on a Gaussian moment matching approximation and prove convergence in expectation and in a high probability setting. We also consider an application to liquidity provision in markets.

■ TD33

C - Room 6B, Level 3

Approximate Dynamic Programming

Sponsor: Computing Society
Sponsored Session

Chair: Sandjai Bhulai, VU University Amsterdam, Department of Mathematics, Faculty of Sciences, Amsterdam, 1081 HV, Netherlands, sbhulai@few.vu.nl

1 - Least Squares Temporal Difference Algorithm for Exploration-Enhanced Learning in MDP
Huizhen Yu, Department Computer Science, University of Helsinki, P.O. Box 68 (Gustaf Hallstromin katu 2b), Helsinki, 00014, Finland, janey.yu@cs.helsinki.fi, Dimitri Bertsekas

We consider approximate policy evaluation for finite state and action Markov decision processes in the exploration-enhanced learning context, called off-policy learning. We introduce the off-policy least squares temporal difference algorithm, LSTD(lambda), and we show its almost sure convergence under mild, minimal conditions.

2 - Explaining Automated Policies for Sequential Decision Making
Pascal Poupart, Associate Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, ppoupart@cs.uwaterloo.ca, Omar Khan

Dynamic programming approaches can harness the computational power of machines to optimize difficult sequential decision making tasks, but users may no longer understand why certain actions are recommended. This is a serious bottleneck currently holding back the widespread use of automated tools in decision support systems. We will present a generic technique to explain policies in arbitrary domains where the sequential decision making problem is formulated as a Markov decision process.

3 - Optimal Personnel Planning and Admission Scheduling in Rehabilitation Facilities
Paulien Koeleman, VU University Amsterdam, Department of Mathematics, De Boelelaan 1081, Amsterdam, Netherlands, paulien@few.vu.nl, Sandjai Bhulai

Due to budgets cuts and increasing demand, rehabilitation facilities face the challenge meet demand with less resources. The question is how to balance the different specialisms in the workforce. We model this problem as a discrete-time Markov chain, and address how patients should be serviced optimally. Due to the large state space of the model, we need approximate dynamic programming to analyse the system. The proposed algorithm gives near-optimal policies, as shown by numerical experiments.

4 - Approximate Dynamic Programming Techniques for the Control of Time-Varying Queueing Systems
Sandjai Bhulai, VU University Amsterdam, Department of Mathematics, Faculty of Sciences, Amsterdam, 1081 HV, Netherlands, sbhulai@few.vu.nl, Dennis Roubos

We apply Approximate Dynamic Programming (ADP) to the control of time-varying queuing systems. We show that the classical state space representation in queuing systems leads to approximations that can be significantly improved upon by increasing the dimensionality of the state space. Moreover, we deal with time-varying parameters by adding them to the state space with an ADP parameterization. The numerical experiments show that our techniques have near to optimal performance.

■ TD34

C - Room 7, Level 3

Joint Session ICS/ Telecom: Network Flows

Sponsor: Computing Society/ Telecommunications
Sponsored Session

Chair: Eli Olinick, Associate Professor, Southern Methodist University, P.O. Box 750123, Dallas, TX, 75275-0122, United States of America, olinick@engr.smu.edu

1 - The Uncapacitated Generalized Time-Space Fixed-Charge Network Flow Problem
Charles Nicholson, Southern Methodist University, Lyle School of Engineering, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, cd.nicholson@sbcglobal.net

We extend our previous work to address the uncapacitated generalized fixed-charge network problem whose spatial nodes are replicated across a time dimension. This problem can be solved using a MIP formulation that includes artificial upper bounds on arcs in the network. We present methodologies to determine values for these upper bounds which are large enough so that the solution space is not reduced, yet small enough to allow for tight linear programming relaxations.

2 - A Rearrangement of Adjacency Matrix Based Approach for Solving the Crossing Minimization Problem

Neng Fan, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, 32611, United States of America, andynfan@ufl.edu, Panos Pardalos

In this paper, we first present a binary linear programming formulation for the crossing minimization problem (CMP) in bipartite graphs. Then we use the models of a modified minimum cost flow problem (MMCF) and a travelling salesman problem (TSP) to approximatively solve the CMP by rearranging the adjacency matrix of the bipartite graph. Our approaches are useful for problems defined on dense bipartite graphs. In addition, we compute the exact crossing numbers for some general dense graphs.

3 - Interval-flow Networks: Models and New Methods

Dick Barr, Southern Methodist University, Dallas, TX, United States of America, barr@smu.edu, Robert Jones

Interval-flow networks are a new category of optimization models that can require a minimum level of flow on any active arcs. Optimizing over fixed and variable costs provides a wide range of applications, including manufacturing and sensor system design. We survey such models and demonstrate the power of a unique extreme-point-search heuristic for solving large-scale problem instances quickly.

4 - Reduced Triples Formulation for the Maximum Concurrent Flow Problem

Eli Olinick, Associate Professor, Southern Methodist University, P.O. Box 750123, Dallas, TX, 75275-0122, United States of America, olinick@engr.smu.edu

The MCFP is a multicommodity flow problem in a congested network where the objective is to maximize the ratio of the flow supplied between a pair of vertices to the predefined demand for that pair. For practical applications, MCFP gives rise to difficult-to-solve LPs and so the problem has received considerable attention in the literature. We present a new formulation yielding significantly smaller LPs for the MCPF than the traditional arc-path or node-arc formulation.

■ TD35

C - Room 8A, Level 3

Pre-Hospital Care

Sponsor: Applied Probability
Sponsored Session

Chair: Shane Henderson, Professor, Cornell University, School of ORIE, Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu

1 - Value of Ambulance Diversion Policies in a Competitive Setting

Alan Scheller-Wolf, Professor, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, awolf@andrew.cmu.edu, Masha Shunko, Soo-Haeng Cho, Paul Enders

It is well documented that emergency departments (EDs) in the US experience crowding. During periods of crowding EDs can send delay signals to ambulance crews to divert incoming patients. We consider a setting in which two major hospitals compete for market share. We analyze the value of the information content of the delay signals and study the impact of different signaling policies on the system performance from social, patient, and hospital perspectives.

2 - Post-decision State Formulation of Approximate Dynamic Programming for Ambulance Redeployment

Matthew Maxwell, Cornell University, School of OR&IE, Ithaca, NY, 14850, United States of America, maxwell.matt@gmail.com, Shane Henderson, Huseyin Topaloglu

We consider two approximate dynamic programming (ADP) policies for ambulance redeployment. Specifically, we present a simulation-based ADP policy and then reformulate this computationally expensive policy around the post-decision state. This reformulation provides orders of magnitude of improvement in computational effort without sacrificing policy performance. We use this post-decision state policy to find better performing value function approximations via direct search.

3 - Optimal Dispatching Policies for Emergency Medical Services

Laura McLay, Assistant Professor, Virginia Commonwealth University, 1015 Floyd Ave, Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu, Maria Mayorga

How to dispatch ambulances responding to 911 calls is a major responsibility of emergency medical service systems. This research provides a model for optimizing dispatching protocols using infinite horizon, average cost Markov decision process models. Our model sheds light on when to dispatch the closest medical unit to a call and when to dispatch a farther medical unit to a call.

4 - Exact Necessary Staffing Requirements Based on Stochastic Comparisons with Infinite-server Models

Fernanda Campello, University of Alberta, School of Business, University of Alberta, Edmonton, AB, T6G2R6, Canada, campello@ualberta.ca, Armann Ingolfsson

We use a non-stationary infinite-server model to determine staffing requirements for an otherwise identical finite-server model. The resulting requirements are necessary: the number of servers in a period must be greater than or equal to that period's requirement to achieve the desired quality of service, regardless of staffing in previous periods. And the requirements are exact: no steady-state approximation is used. We demonstrate the effectiveness of the requirements with numerical examples.

■ TD36

C - Room 8B, Level 3

Panel Discussion: Analytics Curriculum in the Business School. Are We Teaching the Skills Employers Seek?

Sponsor: INFORM-ED
Sponsored Session

Moderator: Curt Hinrichs, Manager, JMP Academic Programs, SAS Institute, Inc., SAS Campus Drive, Cary, NC, 27513, United States of America, curt.hinrichs@jmp.com

1 - Panel Discussion: Analytics Curriculum in the Business School

Panelists: Jerry Oglesby, Director, Global Academic & Certification Programs, SAS Institute, Inc., 100 SAS Campus Drive, Cary, NC, 27415, United States of America, Jerry.oglesby@sas.com, Scott Farris, State Farm, scott.farris.agwy@statefarm.com, J. Michael Hardin, Senior Associate Dean, University of Alabama, Culverhouse College of Commerce and Busi, Box 870223, Tuscaloosa AL 35487-0221, United States of America, mhardin@cba.ua.edu, Tom Grossman, Professor, University of San Francisco, School of Business/Professional Studies, San Francisco CA, United States of America, tagrossman@usfca.edu, James Mendelsohn, Capital One, 1680 Capital One Drive, McLean VA 22102, United States of America, james.mendelsohn@capitalone.com

Business Analytics has seen rapid deployment and adoption in industry but has yet to impact the academic business curriculum. Employers face a persistent shortage of qualified candidates with the analytic skills they need. A key challenge for business schools is to understand what and why these skill sets are needed and how these concepts are best integrated into their curriculums. Each panelist will discuss these issues and offer their perspectives. Q&A will follow.

■ TD37

C - Room 8C, Level 3

Stochastic Models of Manufacturing and Service Systems

Sponsor: Applied Probability
Sponsored Session

Chair: Ivo Adan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, iadan@win.tue.nl

1 - Routing of Correlated Multi-class Traffic

Vidyadhar Kulkarni, University of North Carolina at Chapel Hill, Dept of Stat and Oper Res, Chapel Hill, United States of America, vkulkarn@email.unc.edu, Yasutaka Hirasawa, Nelson Lee

M servers are available to serve customers belonging to N classes. Each server can serve a given subset of customer classes. The overall customer arrival process is Poisson, while the process of the arriving customer classes forms a discrete time Markov chain. The service times are class dependent iid exponentials. We obtain the optimal Bernoulli routing scheme that minimizes the total expected number of customers in the system.

2 - An Analytical Approximation for a Closed Fork/Join Network with Multi-station Input Subnetworks

Erkut Sonmez, Assistant Professor, Boston College, 140 Commonwealth Ave, Boston College, Fulton Hall 350D, 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.

3 - Delivery Lead Time and Flexible Capacity Setting for a Repair Shop with Homogeneous Customers

Cagdas Buyukkaramikli, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600MB, Netherlands, N.C.Buyukkaramikli@tue.nl

We study a repair shop and its customers,who operate m/c's that are prone to failure.Upon a failure,a substitute is hired for L time units and the failed m/c is sent for repair.If repair time exceeds L,a revenue,more expensive than hiring cost,is lost.Shop's capacity affects repair time and unit repair cost.We decide the best L and capacity.Then,we allow cyclical admission of failed m/c's.More flexible capacity use and efficiency in transportation make the new policy an interesting alternative.

4 - Product-form Production Systems with Multi-type Machines and Multi-type Jobs

Ivo Adan, Eindhoven University of Technology, Den Dolech 2, Eindhoven, Netherlands, iadan@win.tue.nl, Gideon Weiss

We consider a production system of parallel multi-type machines, processing multi-type jobs. Process times are exponential and each machine can process a subset of job types. Arrivals are Poisson. The next job to be processed is the first feasible job in the buffer. In case an arriving job finds multiple idle machines, it is assigned to one according to a certain distribution. It is shown that there exist assignment distributions such that this system has a product-form stationary distribution.

■ TD38

C - Room 9A, Level 3

Conic Complementarity Problems and Related Topics

Sponsor: Optimization/Linear Programming and Complementarity (Joint Cluster ICS)
Sponsored Session

Chair: Akiko Yoshise, University of Tsukuba, Tsukuba, Ibaraki 305-6573, Tsukuba, Japan, yoshise@sk.tsukuba.ac.jp

1 - On the Complexity of Computing the Handicap of a Sufficient Matrix

Marianna Nagy, Tilburg University, Warandelaan 2, Tilburg, 5037 AB, Netherlands, m.nagy@uvt.nl, Etienne de Klerk

The sufficient matrix class is important in the study of the LCP problem - some interior point methods (IPMs) for LCPs with sufficient matrices have complexity polynomial in the bit size of the matrix and its handicap. We show that the handicap of a sufficient matrix may be exponential in its bit size, implying that the known complexity bounds of IPMs are not polynomial in the input size of the LCP. We give an SDP based heuristic, that provides a bond on the handicap for P-matrices.

2 - Scalable Multi-stage Stochastic Programming via Interior-point Methods

Cosmin Petra, Argonne National Laboratory, Math and Comp. Science Div., Bdg 240, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, petra@mcs.anl.gov, Mihai Anitescu

The salient features of a parallel solver based on interior-point methods for multi-stage stochastic optimization problems (PIPS) are presented. The parallelism is achieved at the linear algebra level by using the Schur complement technique. Almost linear strong scaling on thousands of cores is demonstrated for two large-scale energy linear programming problems, a building energy system control problem and a unit commitment problem with wind power integration.

3 - Recent Developments in Complementarity Problems Over Symmetric Cones

Akiko Yoshise, University of Tsukuba, Tsukuba, Ibaraki 305-6573, Tsukuba, Japan, yoshise@sk.tsukuba.ac.jp

The complementarity problem over a symmetric cone has received much attention in the last decade. In this talk, we will provide a brief survey on the recent developments related to the problem. The subjects will include interior point algorithms, smoothing or non-smoothing algorithms, new classes of problems, applications and so on.

■ TD39

C - Room 9B, Level 3

Advances in Combinatorial Optimization and Integer Programming III

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Andrea Tramontani, DEIS, University of Bologna, Viale Risorgimento 2, Bologna, 40136, Italy, andrea.tramontani@unibo.it

Co-Chair: Andrea Lodi, DEIS, University of Bologna, Viale Risorgimento, 2, Bologna, 40136, Italy, andrea.lodi@unibo.it

1 - On Lifting Integer Variables in Minimal Inequalities

Amitabh Basu, Carnegie Mellon University, Pittsburgh, PA, United States of America, abasu1@andrew.cmu.edu, Manoel Campelo, Michele Conforti, Gerard Cornuejols, Giacomo Zambelli

This paper contributes to the theory of cutting planes for mixed integer linear programs (MILPs). Minimal valid inequalities are well understood for a relaxation of an MILP in tableau form where all the nonbasic variables are continuous. In this paper we study lifting functions for the nonbasic integer variables. We characterize precisely when the lifted coefficient is equal to the coefficient of the corresponding continuous variable in every minimal lifting.

2 - Computing with Covers, Induced Covers and Lifted Covers for the Precedence Constrained Knapsack Problems

Daniel Espinoza, Universidad de Chile, Av. Republica 701, Santiago, RM, Chile, daespino@dii.uchile.cl, Adrian Diaz

The precedence constrained knapsack problem is a natural sub-structure appearing in problems raging from mining to project planning in general. This problem has received a lot of attention in the literature, and there is a growing set to facets and valid inequalities for it. In this talk we test the impact of some of these cuts, and also use common cuts from the knapsack literature. Extensive computational tests will be presented on instances coming from the open pit scheduling problem.

3 - Generalized Intersection Cuts

Egon Balas, Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, eb17@andrew.cmu.edu, Francois Margot

Intersection cuts are generated from a polyhedral cone and a convex set S whose interior contains no feasible integer point. We replace the cone with a more general polyhedron C. The resulting generalized intersection cuts dominate the original ones. This leads to a new cutting plane paradigm under which one generates and stores the intersection points of the extreme rays of C with the boundary of S rather than the cuts themselves.

4 - Cutting Planes for Some Number Theoretic Integer Programming Models

Sanjeeb Dash, IBM Research, 1101 Kitchawan Rd/RT 134, Yorktown Heights, United States of America, sanjeebd@us.ibm.com, Oktay Gunluk, Ricardo Fukasawa

In this talk, we discuss a few different integer programming models for some number theoretic problems, and derive different classes of cutting planes for these models.

■ TD40

C - Room 9C, Level 3

COIN-OR Under the Hood

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Chair: Kipp Martin, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States of America, kmartin@chicagobooth.edu

1 - COIN-OR: Revving up the Engine

Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu

In this talk, our goal will be to make some sense out of the bewildering array of projects in the COIN-OR repository and to show you how to get the COIN engine running smoothly within your applications.

2 - Build It Your Way: Building COIN with Visual Studio

Lou Hafer, Simon Fraser University, Burnaby, BC, V5A 1S6, Canada, lou@cs.sfu.ca

Plain old 32-bit lib won't do? This talk will discuss the possibilities and limitations for building COIN projects as libs, DLLs, and assemblies with Visual Studio.

3 - Getting Started with Python COIN-OR Software
William Hart, Sandia National Laboratories, P.O. Box 5800, Albuquerque, NM, United States of America, wehart@sandia.gov, Stuart Mitchell

COIN-OR has recently integrated several Python-based modeling packages: PuLP and Coopr. Installing and running Python software is a bit different than traditional software packages. This talk would discuss options for installation, integration with COIN-OR solvers and libraries, and future directions related to CoinAll integration.

4 - Coin Easy
Kipp Martin, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States of America, kmartin@chicagobooth.edu

In this talk we describe the CoinEasy project that is designed to make it easy for users to get up and running with COIN-OR.

■ TD41

C - Room 10A, Level 3

Clique Relaxation Models and Applications

Sponsor: Optimization/Networks
Sponsored Session

Chair: Sergiy Butenko, Associate Professor, Texas A&M University, 236E Zachry Engineering Center, College Station, TX, 77843-3131, United States of America, butenko@tamu.edu

1 - New Developments on the Maximum k-club Problem in Graphs
Baski Balasundaram, Assistant Professor, Oklahoma State University, 322 Engineering North, Stillwater, OK, 74078, United States of America, baski@okstate.edu, Foad Mahdavi Pajouh

Finding clusters of bounded diameters is a common tool used in text mining and other data mining applications in social networks, biological networks and internet graphs. Formally, 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 interesting challenges posed by this nonhierarchical model, present complexity results, algorithms and polyhedral results for this problem.

2 - Identifying Large Robust Network Clusters via New Compact Formulations of Maximum K-club Problems
Alexander Veremyev, University of Florida, 303 Weil Hall, Gainesville, FL, United States of America, averemyev@ufl.edu, Vladimir Boginski

We develop new compact linear 0-1 programming formulations for finding maximum k-clubs that substantially reduce the number of entities compared to the known formulations (O(kn^2) instead of O(n^k)). We also introduce a new related concept referred to as an R-robust k-club and demonstrate its importance in terms of resiliency to network attacks.

3 - An Efficient Heuristic Algorithm for Finding Maximum K-club in an Undirected Graph
Shahram Shahinpour, PhD Student-Industrial & Systems Engineering, Industrial & Systems Engineering Department-Texas A&M University, 241 Zachry 3131 TAMU, College Station, TX, 77843-3131, United States of America, shahinpour@neo.tamu.edu, Sergiy Butenko

Given a graph G, a k-club is a vertex set inducing a subgraph of diameter k. A maximum k-club problem consists of determining maximum cardinality k-club in G. Finding a maximum cardinality K-club is NP-hard. In this paper we propose a heuristic algorithm for maximum K-club problem. Computational results from using the proposed algorithm to solve some of the hardest instances available in the literature show that the algorithm is very efficient.

4 - The Maximum p/q-Clique Problem
Jeffrey Pattillo, Texas A&M University, College Station, TX, 77843, United States of America, wheatonaggie@neo.tamu.edu, Vladimir Boginski, Alexander Veremyev, Sergiy Butenko

Given a simple undirected graph G=(V,E) and fixed positive integers p,q, a subset of vertices is called p/q-clique if it induces a subgraph with the edge density of at least p/q. This concept represents a density-based clique relaxation. We study the maximum p/q-clique problem, which is to find the largest p/q-clique in the graph.

■ TD42

C - Room 10B, Level 3

Stochastic Optimization, Statistics, and Sparsity

Sponsor: Optimization/Stochastic Programming
Sponsored Session

Chair: Constantine Caramanis, The University of Texas at Austin, 1 University Station, Mail Code C0806, Austin, TX, 78712, United States of America, caramanis@mail.utexas.edu

1 - Some Convergence Rate Results for Co-ordinate Descent
Pradeep Ravikumar, Assistant Professor, The University of Texas at Austin, 1 University Station, Mail Code C0806, Austin, TX, 78712, United States of America, pradeepr@cs.utexas.edu

We provide convergence rates for stochastic and cyclic co-ordinate descent that are strictly better than that of gradient descent. We follow this with lower bounds on the convergence rates of such stochastic and deterministic "co-ordinate descent" type algorithms.

2 - Sparse Algorithms are Not Stable: A No-free-Lunch Theorem
Huan Xu, Post doctoral researcher, The University of Texas at Austin, 1 University Station, Mail Code C0806, Austin, TX, 78712, United States of America, huan.xu@mail.utexas.edu, Constantine Caramanis, Shie Mannor

We consider two widely used notions in machine learning, namely: sparsity and stability. Both notions are deemed desirable, and are believed to lead to good generalization ability. We show that these two notions contradict each other: a sparse algorithm can not be stable and vice versa. Thus, one has to tradeoff sparsity and stability in designing a learning algorithm. This implies that, in contrast to l2-regularized regression, l1-regularized regression (Lasso) cannot be stable.

3 - Guaranteed Rank Minimization via Singular Value Projection
Raghu Meka, The University of Texas at Austin, 1 University Station, Mail Code C0500, Austin, TX, 78712, United States of America, raghu@cs.utexas.edu, Inderjit Dhillon, Prateek Jain

Minimizing the rank of a matrix subject to affine constraints is a fundamental problem with many important applications. We propose a simple and fast algorithm SVP, for rank minimization with affine constraints (ARMP) and show that SVP achieves robust recovery for affine constraints satisfying the restricted isometry property (RIP). Our method is simpler to analyze, and faster in practice than other recent trace-norm based methods. We also achieve recovery under strictly weaker RIP assumptions.

4 - Finding Large Approximately Rank-one Submatrices
Xuan Vinh Doan, University of Waterloo, 200 University Avenue West, C & O Department - MC4018D, Waterloo, ON, N2L 3G1, Canada, vanxuan@uwaterloo.ca, Stephen Vavasis, Kim-Chuan Toh

We propose a tractable method to find large approximately rank-one submatrices which can be used in nonnegative matrix factorization. We apply a proximal point algorithm to solve the resulting optimization problem which is formulated with the nuclear norm and l1-norm. We report numerical results on realistic datasets of decomposable bitmap images and nearly separable corpus.

■ TD43

C - Room 1, Level 2- Mezzanine

Optimization and Data Mining in Healthcare Research

Sponsor: Health Applications
Sponsored Session

Chair: Bo Zeng, Assistant Professor, University of South Florida, Department of IMSE, Tampa, FL, 33620, United States of America, bzeng@usf.edu

1 - Support Vector Machines for Toxicological Evaluation of Nanoparticles
Erhun Kundakcioglu, Assistant Professor, University of Houston, E209 Engineering Bldg. 2, Houston, TX, 77204, United States of America, erhun@uh.edu

In the present study, Raman spectroscopy is employed to assess potential toxicity of chemical substances. The database is constructed on healthy cells, Triton-X100, and etoposide exposed cells. Support Vector Machine classifiers and proposed extensions show that titania nanoparticles display cytotoxicity after 36 hours of exposure and heat effect results in apoptotic death. The results were confirmed by MTT assay and are in agreement with existing literature on the matter.

2 - Patient Satisfaction Evaluation using Rough Sets Theory
Shengyong Wang, Assistant Professor, University of Akron, OH, United States of America, wangs@uakron.edu, Yuerong Chen, Chien-Chung Chan

Hospitals are paying more and more attention to improving their service levels in order to create an overall pleasant experience to the patients. Patient satisfaction surveys are widely used to measure patient's satisfaction level. Usually, the surveys are analyzed using simple statistical methods. This paper presents a novel approach, namely, the rough set approach, to derive a set of useful rules, based on which the hospital obtains insightful suggestions for operational improvements.

3 - Discrete Optimization Model and Algorithm for Biological Network Alignment
Bo Zeng, Assistant Professor, University of South Florida, Department of IMSE, Tampa, FL, 33620, United States of America, bzeng@usf.edu, Xiaoning Qian

Network alignment provides significant insights to understand gene/protein functional modules. In this talk, we will present an integer programming model to extend traditional one-to-one mapping to allow multiple-to-one mapping. We develop Lagrangian relaxation method to compute the solution for large-scale real biological network. Numerical results will be presented to reveal the effectiveness of the model as well the efficiency of the algorithm.

■ TD44

C - Room 2, Level 2- Mezzanine

Optimization in Healthcare Scheduling and Planning

Sponsor: Health Applications
Sponsored Session

Chair: Nan Kong, Assistant Professor, Purdue University, West Lafayette, IN, United States of America, nkong@purdue.edu

1 - Capacity Planning of Publicly Funded Community Based Care for Older Adults in the U.S.
Feng Lin, Weldon School of Biomedical Engineering, 206 S. Martin Jischke Drive, West Lafayette, IN, 47907, United States of America, linf@purdue.edu, Mark Lawley, Nan Kong

Long-term care(LTC) provides various services to people with chronic disease or disability, many of who are elderly eligible for publicly funded LTC. The public funding sources are under increasing financial pressure. LTC can be delivered in a nursing home or in the community. We formulate an optimal control problem to determine the capacity for community-based LTC from a cost saving viewpoint. This model is tested using Indiana's dementia patients.

2 - Planning Intervention for Hemodialysis Patients - A Stochastic Control Approach
Santanu Chakraborty, Purdue University, 315 N. Grant Street, West Lafayette, In, 47907, United States of America, santanu@purdue.edu, Mark Lawley, Kumar Muthuraman

This work focuses on computing the optimal intervention time for hemodialysis patients, who suffer from dialysis access stenosis. According to statistics stenosis is the primary causes of morbidity among these patients. But no precise guideline exists delineating an optimal treatment plan. We employ a novel approach where the stenosis growth is modeled as Gomperz diffusion process and the treatment time is computed by solving an optimal stopping problem, in order to maximize a patient's QALY.

3 - A Mixed Integer Linear Programming Model for Improving Appointment Scheduling in a Women Clinic
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, Laquanda Leaven

Appointment scheduling is an essential part of the daily routine from hospitals to outpatient clinics to private practices. In this study, we investigated the current appointment scheduling system at a local women clinic, and recognized the problems with the current scheduling template. After that, we developed a Mixed Integer Linear Programming (MILP) model, which maximizes resource utilization in the clinic. Using the MILP model, a better scheduling template was proposed for the clinic.

4 - Scheduling Surgeries in a Constrained Environment
Pratik Parikh, Assistant Professor, Wright State University, 3640 Col Glenn Hwy, 207 Russ Eng Center, Dayton, OH, 45435, United States of America, pratik.parikh@wright.edu, Bharathwaj Vijayakumar

We focus on the surgical department of a public healthcare system and consider the problem of scheduling surgeries. Real-world constraints such as patient priorities, availability of surgeons, nurses, equipment, and operating rooms, and performance of the surgeons are considered. We have developed an optimization model and a heuristic algorithm to maximize the number of surgeries performed during a time-horizon.

■ TD45

C - Room 6, Level 2- Mezzanine

Joint Session HAS/ SPPSN: Analyses of Several Public Health Problems and Solutions

Sponsor: Health Applications/ Public Programs, Service and Needs Sponsored Session

Chair: Nilay Argon, University of North Carolina, Department of Statistics and OR, 333 Hanes Hall, CB#3260, Chapel Hill, NC, 27514, United States of America, nilay@email.unc.edu

1 - Evaluating the Impact of Legislation Prohibiting Hand-held Cell Phone Use While Driving
Sheldon Jacobson, Professor, University of Illinois at Urbana-Champaign, Department of Computer Science, 201 N. Goodwin Ave., Urbana, IL, United States of America, shj@illinois.edu, Alexander Nikolaev, Matthew Robbins

Numerous legislative efforts are under way to restrict hand-held cell phone use while driving. This study statistically analyzes the impact of hand-held cell phone use on driving using public domain automobile accident rates and driver density data for New York State. Implications of the results for other states are discussed.

2 - A Tale of Two Models: Estimating the Health Benefits of HIV Vaccination in the United States
Elisa Long, Assistant Professor, Yale School of Management, 135 Prospect Street, New Haven, CT, 06520, United States of America, elisa.long@yale.edu

Approximately 56,000 new HIV infections occur in the U.S. each year. In 2009, a clinical trial in Thailand concluded that an HIV vaccine may reduce transmission by 31%. Using two independent models (a deterministic compartmental model and a stochastic network model), we estimated the population-level health benefits and cost-effectiveness of implementing a mass vaccination program in the U.S. Given an imperfect vaccine, we also explored the effects of behavior disinhibition post-vaccination.

3 - ReSTART: A Resource-based Method for Mass-Casualty Triage
Alex Mills, University of North Carolina at Chapel Hill, Statistics and Operations Research, Hanes Hall CB#3260, Chapel Hill, NC, 27599-3260, United States of America, amills@unc.edu, Serhan Ziya, Nilay Argon

The most widely used standard for triage, START, relies on a fixed priority ordering among the different classes of patients, and does not explicitly consider resource limitations. We construct a fluid model of patient triage in a mass casualty incident with limited resources and develop a simple dynamic priority policy, Resource-based START (ReSTART). Using simulation, we show that ReSTART vastly outperforms START under realistic conditions.

4 - Performance-based Contracting for Outpatient Medical Services
Zhan Pang, Lecturer, Lancaster University Management School, Lancaster, LA1 4YX, United Kingdom, z.pang@lancaster.ac.uk, Houyuan Jiang, Sergei Savin

We model a setting in which a government agency (principal) contracts an independent provider (agent) to perform outpatient medical services subject to a target service level. The principal chooses a reimbursement scheme and the agent selects the best-response service capacity management policy. As a motivating example, we consider the "Choose-and-Book" outpatient appointment system used by the UK National Health Service.

■ TD46

C - Room 7, Level 2- Mezzanine

Panel Discussion: Skills and Career Paths in Industry

Cluster: Invited Panels on Professional Issues
Invited Session

Moderator: Ranganath Nuggehalli, Principal Scientist, UPS, 2311 York Road, Timonium, MD, 21093, United States of America, RNuggehalli@ups.com

1 - Panel Discussion: Skills and Career Paths in Industry

Panelists: Ranganath Nuggehalli, Principal Scientist, UPS, 2311 York Road, Timonium, MD, 21093, United States of America, RNuggehalli@ups.com, Douglas A. Samuelson, President and Chief Scientist, InfoLogix, Inc., Annandale VA, United States of America, samuelsondoug@yahoo.com, Jack Levis, Director of Process Management, United Parcel Service, 2311 York Road, Timonium MD, United States of America, jlevis@ups.com, Jeff Camm, Professor, University of Cincinnati, QAOM Dept, Mail Location 0130, Cincinnati OH 45221, United States of America, jeff.camm@uc.edu, Gul Ege,R&D Director, SAS Institute Inc, SAS Circle, Cary NC 27513, United States of America, Gul.Ege@sas.com

A panel of managers of leading OR/MS groups in industry will discuss the skill set needed to practice OR/MS and career paths available for practioners of OR/MS discipline in their organizations.

■ TD47

C - Room 8, Level 2- Mezzanine

Teaching Project Management with Computer Simulations

Cluster: Topics in Project Management
Invited Session

Chair: Jeffrey Rummel, Associate Professor, Emory University, Goizueta Business School, 1300 Clifton Road, Atlanta, GA, 30322, United States of America, jeff_rummel@bus.emory.edu

1 - Simulating Project Management

Jeff Pinto, Morrow and Black Chair in Management of Technology, Penn State Erie, Station Road, Erie, PA, 16563, United States of America, jkp4@psu.edu, Diane H. Parente

Teaching project management can take many forms. One approach is to discuss only theory and ignore any "hands-on" work. Alternatively, one can have students do project plans for "toy" projects. The professor will critique the work and there is some discussion of the plan. Estimates are done on budgets and timetables, but it is not clear how these truly relate to personnel allocation and task assignment. In a programming-oriented curriculum, the project plan may be sued while actually building a project over some period of time. This approach tends to focus more on implementation issues than actual project management. Another approach is to place a student in the workplace as an apprentice to a person deemed a good project manager. While this approach is often used in industry, the content knowledge reinforced by this method is not controlled by the professor. Further, while on the job experience is nice, it is costly and difficult to control. Pinto and Parente developed a simulation that has been in widespread use over the past eight years. It is flexible and allows customization by the professor to enable both hands-on and non-repeatable experiential learning in the classroom. The professor is also able to focus on content areas appropriate to their class emphasis.

2 - Project Management Task Master Game

Edie Schmidt, Professor, Purdue University, 1311 Kingswood Rd. West, West Lafayette, IN, 47906, United States of America, schmidte@purdue.edu, Jonathan Davis, Jeremy Johns

This session will give participants an opportunity to play a board game developed by graduate students at Purdue Univesity. Objective: Your company has been leading R&D in the industry. Unfortunately other companies are not far behind, so you need to get to market first. First player to "market" receives Bonus; play continues until all "markets" needs are met. Players with extra resources will be deducted $$$ at end of game. Winner declared by person with most $$$ at end.

3 - Avoiding Failure: using @RISK for Project 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 for Project 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.

■ TD48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - SAS - Building and Solving Optimization Models with SAS

Ed Hughes, Product Manager, SAS Institute, Inc., 500 SAS Campus Dr., Cary, NC, 27513, United States of America, Ed.Hughes@sas.com, Ron Pratt

OPTMODEL from SAS enables you to build and solve optimization models (including LP, MILP, QP, and NLP) and supports a range of standard and customized algorithms. We'll demonstrate modeling and solving a business problem using OPTMODEL in conjunction with SAS data, analytic, and reporting capabilities. We'll also illustrate how you can deploy this solution in a web-based interface with SAS.

2 - Oracle - Crystal Ball

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. Crystal Ball is used in universities and schools worldwide to teach financial risk analysis, valuation, engineering, portfolio allocation, cost estimation, and project management. Join us for an overview of Crystal Ball and our teaching resources.

■ TD49

C -Room 10, Level 2- Mezzanine

Social Network Dynamics

Sponsor: Information Systems
Sponsored Session

Chair: Param Singh, Professor, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, psidhu@andrew.cmu.edu

1 - Why We Share? A Structural Model of Knowledge Sharing Within an Enterprise

Yingda Lu, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, United States of America, yingdal@andrew.cmu.edu, Param Singh, Baohong Sun

With the advent of Web 2.0, information technology platforms have been widely adopted for promoting knowledge sharing within an enterprise. The focus of this study is to investigate the employee incentives for knowledge sharing and seeking, and to identify design issues for the platform that would enhance knowledge sharing. We present a structural model of knowledge sharing within an enterprise expertise sharing forum. We run several policy simulations and provide important design implications.

2 - Some Evidence of Homophily in Online Peer-to-peer Lending

MingFeng Lin, University of Maryland, College Park, Van Munching Hall, College Park, MD, 20742, United States of America, mingfeng@rhsmith.umd.edu, Siva Viswanathan, Hank Lucas

We empirically study the phenomenon of homophily in an online peer-to-peer lending website. We find evidence that investors are more likely to trust those who are more similar to themselves in terms of demographics, and contribute to the literature by examining the ex post performance of such behaviors. Additional evidence from natural experiments on the site further supports these findings.

3 - Cohesion, Cascades and Contagion in Online Social Networks

Anjana Susarla, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, anjanas@andrew.cmu.edu, Jeong-Ha Oh, Yong Tan

Cascades emerge in networks where a large number of individuals converge in their behavior, leading to large-scale popularity in a trend or idea. This research aims to identify the process of sequential information transmission and network structures that leads to the formation of cascades in online social networks.

■ TD50

C -Room 11, Level 2- Mezzanine

Cloud Computing Management

Cluster: Cloud Computing
Invited Session

Chair: Mark Squillante, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, mss@us.ibm.com

1 - Asymptotically Optimal Resource Allocation in Cloud Computing
Yingdong Lu, IBM T. J. Watson Research Center, Yorktown Heights, NY, 10598, United States of America, yingdong@us.ibm.com, Mark Squillante, David D. Yao

We consider resource allocation under uncertainty and different cost considerations motivated by cloud computing. In particular, based on a random walk approach, we derive estimates of key performance metrics (e.g., shortage & inventory) for both loss systems and systems with backlogging. Asymptotically optimal policies are derived with respect to minimizing cost under each setting. Our analysis also addresses issues regarding the relationship between such loss systems and backlogging systems.

2 - Estimating Long Strange Delays in Cloud Computing
Souvik Ghosh, Columbia University, Department of Statistics, 1255 Amsterdam Avenue 1011 SSW, New York, NY, 10027, United States of America, ghosh@stat.columbia.edu, Soumyadip Ghosh

Cloud-computing providers must meet customer expectations of low latency while extracting high utilization of server resources shared amongst users. We model the workload process of a cloud server and characterize the capacity required to ensure that average workload does not exceed a preset threshold over long time segments. This can be used to provide service guarantees on avoiding long durations of high latency. As part of the analysis, we provide a new uniform large-deviation principle.

3 - On Distributed Resource Allocation for Information Management
Young Myoung Ko, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, ymko@tamu.edu, Natarajan Gautam

We present strategies for optimally allocating resources in a distributed framework that uses minimal information exchange between nodes in a network. For this we formlulate a distributed and dynamic stochastic game to iteratively arrive at the optimal strategy. We present applications to energy management in data centers as well as issues in cloud computing.

4 - Distributed Resource Allocation for Fork and Join Processing Networks in Cloud Computing
Cathy Xia, Associate Professor, The Ohio State University, 210 Baker Systems Engineering Bldg, 1971 Neil Ave, Columbus, OH, 43210, United States of America, xia.52@osu.edu, Don Towsley, Chuck Zhao, Zhen Liu

This paper addresses the problem of distributed resource allocation in general fork and join processing networks arising from distributed information processing in cloud computing. The different types of semantics and complicated processing requirements introduce complex interdependence between various data flows within the network. We propose a unified framework that enables the development of distributed resource allocation solutions that maximize the total system utility.

■ TD51

C -Room 12, Level 2- Mezzanine

Technology Intelligence and Strategy Through Methods

Sponsor: Military Applications
Sponsored Session

Chair: Ann-Marie Lamb, ajlamb@pdx.edu

1 - Frontier Analysis for New Technologies using Decision Support Methodologies
Matthew Durchholz, Dr., Lockheed Martin Aeronautics Company, P.O. Box 748, Mail Zone 8848, Fort Worth, TX, 76101, United States of America, matthew.durchholz@lmco.com

This methodology uses a trades modeling approach that blends the voice of the customer, military usefulness, economic and business considerations to provide decision analysis capabilities when pursuing best architectures. The approach identifies an efficient frontier for best known technology mix, identifies any technology shortfall in meeting known requirements and allows rapid insertion of new technologies into the model to determine impact of that technology on system architecture trades.

2 - Technology Forecasting of Turbofan Jet Engines
Timothy Anderson, Associate Professor, Portland State University, P.O. Box 751, Portland, OR, 97207-0751, United States of America, tima@etm.pdx.edu, Marc Britton

This paper examines four decades of turbofan jet engine development by using technology forecasting to revisit an application from Bulla and Cooper. Using past data to predict new technology trends, new product development specifications are examined with TFDEA.

3 - Using Technologies to Detect Suicide Bombers
Bill Fox, Professor, Naval Postgraduate School, Monterey, CA, 93943, United States of America, wpfox@nps.edu

We used a Doppler radar to collectdata from a standoff distance of about 50 meters of the following: human subjects, subjects wearing a wire loop, subjects wearing a simulated vest with wire loops. The best metric was the VV/HH ratio of radar cross section. We found that the ratio for people wearing wires was statistically different from people without wires at a level of significance a =0.05.The simulation picked the person with wires with a success rate of 83.4%.

■ TD52

C -Room 13, Level 2- Mezzanine

Port and Border Security II

Cluster: Homeland Security and Defense
Invited Session

Chair: Gary Gaukler, Texas A&M University, TAMU-3131, College Station, TX. United States of America, gaukler@tamu.edu

1 - Balancing Congestion and Security in the Presence of Strategic Applicants with Private Information
Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu, Xiaofang Wang

Security screening plays an important role in many fields including visa issuance, cargo inspection, and airport screening. In-depth screening reduces the risk of being attacked, but might create delays that affect normal applicants. We develop a model to determine the optimal screening policy to maximize the reward from admitting normal applicants net of the penalty from admitting bad applicants. We provide both analytical solutions and numerical illustrations.

2 - A Hybrid Inspection Strategy for Securing Seaborne Container
Yu Ding, Texas A&M University, Industrial & Systems Engineering, College Station, TX, 77843-3131, United States of America, yu-ding@tamu.edu, Chenhua Li, Gary Gaukler

In this talk, we develop and analyze appropriate policies for inspecting container cargo for nuclear materials at sea ports. Our inspection policy combines aspects of the ATS system and a proprietary "hardness" measure based control policy. In addition, we incorporate realistic background radiation levels into the model, which are obtained from MCNP simulations.

3 - Primary and Secondary Screening of Cargo Containers for Nuclear Security
Rebecca Dreiding, Virginia Commonwealth University, Statistical Sciences & Operations Res., 1015 Floyd Ave, Richmond, VA, 23284, United States of America, dreidingra@vcu.edu, Laura McLay

We introduce an optimization framework for screening cargo containers for nuclear material at security stations throughout the United States using knapsack problem models. The approach investigates how to define a system alarm given that a set of screening devices is available for primary and secondary screening. The model sheds light on optimal, risk-based portfolios for screening cargo entering the United States.

4 - Heuristic Algorithms in Critical-infrastructure Protection: A Realistic Case Study
Sinan Tas, UW-Madison, 1513 University Avenue, Madison, United States of America, sinantas@gmail.com, Vicki Bier

Two- and three-level optimization models have been proposed for critical-infrastructure protection. However, these models make significant assumptions regarding adversary objective functions, and do not always identify robust, cost-effective hardening strategies. As an alternative, we evaluate some plausible heuristic algorithms, and test them on a realistic power network.

■ TD53

C -Room 14, Level 2- Mezzanine

Models of Multi-Category Choice Behavior

Sponsor: Marketing Science
Sponsored Session

Chair: Nitin Mehta, Associate Professor, University of Toronto, 105 St. George Street, Toronto, ON, m5s3e6, Canada, Nmehta@Rotman.Utoronto.Ca

1 - Empirical Analysis of Firms' Pricing Strategies with Complementary Product Lines

Yu Ma, Assistant professor, University of Alberta, ym2@bus.ualberta.ca

We estimate a multi-category demand model using scanner data on cake mix and frosting. Using the estimated demand model as an input, we investigate whether retail prices in the two categories are consistent with joint-category profit maximization on part of the retailer and whether manufacturers' pricing behavior is consistent with maximizing the sum of profits of brands in both categories. Lastly, we investigate the nature of channel interactions between the manufacturers and the retailer.

2 - Complementarities and the Demand for Home Broadband Internet Services

Ting Zhu, Assistant Professor, University of Chicago, 5807 S Woodlawn Ave, Chicago, IL, 60637, United States of America, tzhu@chicagogsb.edu

Before the deregulation of DSL services in 2005, phone companies were required to share their DSL bandwidth with independent DSL providers. Despite the large number of independent providers that entered the market, phone companies accounted for 95.3% of all DSL subscribers in 2005. In this paper, we look for a demand-side explanation for this outcome based on the demand not just for broadband services but also for related services such as cable TV and local phone.

3 - A Multi-category Model of Consumer's Purchase Incidence, Quantity and Brand Choice Decisions

Nitin Mehta, Associate Professor, University of Toronto, 105 St. George Street, Toronto, ON, m5s3e6, Canada, Nmehta@Rotman.Utoronto.Ca

We propose a multi-category model of consumers' incidence, quantity and brand-choice decisions, in which we model cross-category effects of promotions in both components of the primary demand and use a flexible functional form of consumer's utility to accurately measure those effects. To demonstrate the importance of doing so, we investigate two issues of relevance to retailers: how they should (a) allocate promotional expenditures and (b) coordinate timings of promotions across categories?

■ TD54

C -Room 15, Level 2- Mezzanine

Contemporary Issues in Technology and Knowledge Management - II

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Aravind Chandrasekaran, The Ohio State University, 2100 Neil Avenue, Columbus, OH, 43210, United States of America, chandrasekaran.24@osu.edu

1 - Inside the Learning Curve: Opening the Black Box of the Learning Curve

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

The learning-curve phenomenon is well known. However, the process that leads to actual learning is often treated as a black box. There is a process inside the learning curve. Experience can foster learning. Learning can yield better organizational knowledge. Better organizational knowledge can persuade organizational members to modify behavior. Changed behavior, in turn, can improve organizational performance. I review empirical studies of these steps, and identify questions for future research.

2 - An Analysis of Environmental Sustainability Measures in the US Hospitality Industry

Nitin Joglekar, Boston University, 595 Commonwealth Ave., Boston, MA, United States of America, joglekar@bu.edu, Jie Zhang, Rohit Verma

Using an 8-year panel of 984 US hotel sites, we develop factors that measure environmental sustainability (ES). We test a stochastic frontier model that deploys these ES factors within a service supply chain consisting of operators, owners, and guests using a performance frontier framework (Schmenner & Swink 1998). Technical efficiency and operating performance are influenced by these factor measures, along with the market segmentation and infrastructural constructs.

3 - Interplay Between Operational Emphasis and Innovation Orientation on Process Formalization

Adrian Choo, Robinson College of Business, Georgia State University, 35 Broad St., Suite 1044, Atlanta, GA, 30303, United States of America, achoo@gsu.edu, Chinawut Chinaprayoon

We investigate how operational emphasis and innovation orientation affect the likelihood of ISO 9000 adoption among Thai manufacturers. Our initial findings suggest that both operations and innovation work can benefit from formalizing and codifying tasks under certain conditions. We will present implications on managing process formalization in organizations.

■ TD55

C -Room 16, Level 2- Mezzanine

Developing and Appropriating Value from Innovation

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Sanjiv Erat, University of California San Diego, San Diego, CA, United States of America, serat@ucsd.edu

1 - The Equity vs. Royalty Dilemma in University Technology Transfer

Niyazi Taneri, Judge Business School, University of Cambridge, Cambridge, United Kingdom, n.taneri@jbs.cam.ac.uk, Nicos Savva

Universities use a combination of equity and royalties when they license out technology to venture capital backed spin-outs. The use of royalties is a puzzle as it is generally accepted that royalties, as opposed to equity, cause distortions. We develop a model, based on asymmetric information, which provides a rational explanation for the persistent use of royalties alongside equity. The model also generates other findings that are consistent with empirical observations.

2 - Managing Product Transitions Under Technology Uncertainty

Sreekumar Bhaskaran, Assistant Professor, Southern Methodist University, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, sbhaskar@mail.cox.smu.edu, Ankur Goel, Karthik Ramachandran

End-of-life inventory decisions of existing products are often made before technological uncertainties about a new product are resolved. We model the inventory planning and introduction timing decisions surrounding product rollovers of innovating firms. Optimal inventory & launch policies are characterized for competitive markets with single and dual rollovers.

3 - The Effect of Team Diversity and Structure on Project Management

Stylianos Kavadias, Associate Professor, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, United States of America, Stylianos.Kavadias@mgt.gatech.edu, Nektarios Oraiopoulos

We analyze the impact of new information interpretation (interpretive diversity) on project termination decisions. We view NPD teams as small groups of decisions makers with varying interpretive capabilities, who may result in different proposals regarding project continuation. Our results reveal that depending on the information regime (average interpretive capability) diverse teams may decide differently. We offer an alternative explanation to escalation phenomena.

■ TD56

C - Room 1, Level 1

Agent-based Simulation Modeling Theory and Practice

Sponsor: Simulation Society
Sponsored Session

Chair: Xu (Cissy) Yang, Postdoctoral Research Associate, MIT Center for Transportation & Logistics, 77 Massachusetts Avenue, E40-211, Cambridge, MA, 02139, United States of America, xu_yang@mit.edu

1 - A Simulation-optimization Approach to Supply Chain Operation
Gerald Evans, Professor, University of Louisville, Louisville, KY, United States of America, gwevan01@gwise.louisville.edu

This presentation will discuss the development of a simulation model interfaced with an optimization algorithm for the determination of inventory policy variables for a supply chain distribution system. The system consists of suppliers, a warehouse and retail outlets. The simulation model represents orders from the retail outlets and the warehouse to the suppliers, and shipments of product from the suppliers to the warehouse and retail outlets and from the warehouse to the retail outlets.

2 - Considerations of Real-time Decision Support Systems(RTDSS) for Healthcare Systems
Yepeng Sun, PhD Student, University of Louisville, 789 Eastern Pkwy., Louisville, KY, 40217, United States of America, y0sun010@louisville.edu, Gerald Evans, Sunderesh Heragu

Instead of applying global optimization by traditional analytical models, the research and development of RTDSS for healthcare systems will adopt a new solution framework called Multi-agent systems, in which every agent representing an autonomous decision maker seeks for a local optimal solution through communicating and coordinating with other agents, but result in a well-accepted Satisficing solution.

3 - How to Select your Suppliers? An Agent-based Simulation Application
Xu (Cissy) Yang, Postdoctoral Research Associate, MIT Center for Transportation & Logistics, 77 Massachusetts Avenue, E40-211, Cambridge, MA, 02139, United States of America, xu_yang@mit.edu, Gerald Evans, Sunderesh Heragu

We focus our study on the application of an agent-based simulation approach to select suppliers. The initial solution is given by an optimization model and it provides us a good starting point of the actual planning. However, we still need to deal with the dynamic changes occurring in the execution phase. Our objective is to keep the good features of the optimal solution and apply multi-agent technique to search for a fast and good solution responding to the dynamic changes.

4 - Modeling and Analysis of Hospital Non-Emergency Operations
Yang Liu, University of Louisville, 602 Ruggles Pl, Unit 316, Louisville, KY, 40208, United States of America, optimumyang@gmail.com, Jingshan Li

We present a simulation model for the UK A.B. Chandler Hospital non-emergency operations. This model provides insight of the patient's deterioration time, which is from the moment a patient's medical condition deteriorates to the moment a final decision about where the patient should go (such as ICU, Tele-monitoring) is made by a doctor or a nurse. Both the mean and variance of the patient's deterioration time can be obtained to help improve the healthcare operations.

■ TD57

C - Room 2, Level 1

Research in Credit, Liquidity and Contagion

Sponsor: Financial Services Section
Sponsored Session

Chair: Bruce Moore, University of Michigan, Ann Arbor MI 48502, United States of America, moorebw@umich.edu

1 - When to Rebuild and When to Recalibrate Scorecards
Lyn Thomas, Professor, University of Southampton, United Kingdom, L.Thomas@soton.ac.uk, Gimun Jung

Credit scorecards "age" and need recalibrating and rebuilding from time to time. This is similar to the maintenance and replacement problem which has become standard for physical equipment. We identify a simple way of describing the state of the scorecard in terms of two parameters which are used to construct the log odds to score graph, and then model the dynamics of these parameters from real data sets.

2 - Impact of Contagion Flow on High Yield Bond Portfolio Optimization
Wendy Roth, University of Tennessee, Knoxville, United States of America, Wendy-Roth@utc.edu, Aparna Gupta, Chanaka Edirisinghe

Connections between firms can allow the spread of contagion, which can potentially result in widespread impact on firms in a network, specifically adversely affecting the riskiness of debt issued by the firms. A model is developed to assess and manage contagion related excess risk in portfolio of high-yield debt instruments.

3 - Adverse Selection in Credit Card Pricing Under the Impact of the Basel Accord Rules
Bo Huang, University of Southampton, Highfield, Southampton, SO17 1BJ, United Kingdom, bh904@soton.ac.uk

Variable pricing is an attractive way of improving the profitability of credit cards. However it can lead to adverse selection and nowadays must consider the impact of the Basel Accord rules for regulatory capital. We develop pricing models that deal with both their effects.

4 - Robust Liquidity Risk Management
Michael Dziecichowicz, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, mjd404@lehigh.edu

Optimization techniques in liquidity risk management are limited. Further, traditional asset valuation approaches rely on precise knowledge of the underlying probability distributions. In practice, such information is difficult to obtain because multiple factors affect asset values, and in periods of illiquidity asset prices are subject to downward-spiral contagion. We propose an approach to liquidity risk management in a robust optimization setting.

■ TD58

C - Room 3, Level 1

Portfolio Selection

Cluster: Quantitative Finance
Invited Session

Chair: Victor DeMiguel, Associate Professor, London Business School, Regents Park, London, United Kingdom, avmiguel@london.edu

1 - Covariance Estimation in Portfolio Allocation: A Realized Single Factor Model
Barbara Ostdiek, Rice University, 2500 Main Street, Houston, United States of America, ostdiek@rice.edu, Lada Kyj, Kathy Ensor

We investigate the performance of a realized single factor model as a covariance conditioning technique applied to a GMV portfolio of the 30 DJIA stocks. The single factor model, with a smoothed covariance estimate, outperforms the fully estimated realized covariance in one-step ahead forecasts. Furthermore, a mixed-frequency single-factor model - with factor coefficients estimated using low-frequency data and variances estimated using high-frequency data - performs better than the realized single-factor estimator. The mixed-frequency model is parsimonious and avoids estimation of high-frequency covariances.

2 - A Robust CVaR Portfolio using Factor Model-Based Uncertainty
Jun-ya Gotoh, Chuo University, 1-13-27 Kasuga, Bunkyo-ku, Tokyo, Japan, jgoto@indsys.chuo-u.ac.jp, Keita Shinozaki

The conditional value-at-risk (CVaR) has gained growing popularity in financial optimization, but its solution can be fragile when the number of observations is limited. In this talk, we propose a simple robust approach for the CVaR minimization. We show that a robust counterpart of the minimization is equivalent to a norm-constrained CVaR minimization. Employing an uncertainty set based on the traditional factor model, the reformulation becomes a tractable convex optimization problem.

3 - Optimal Portfolios with Minimum Capital Requirements
Francisco J Nogales, Associate Professor, Universidad Carlos III de Madrid, Department of Statistics, Madrid, Spain, FcoJavier.Nogales@uc3m.es, André A. P. Santos, Esther Ruiz, Dick J. C. van Dijk

We propose a novel approach to active risk management based on the Basel II regulations to obtain optimal portfolios with minimum capital requirements. In order to avoid regulatory penalties due to an excessive number of value-at-risk (VaR) violations, capital requirements are minimized subject to a given number of violations over the previous trading year. An empirical application demonstrates an improved balance between capital requirement levels and the number of VaR exceedances.

4 - Stock Return Serial Dependence and Out-of-Sample Portfolio Performance

Victor DeMiguel, Associate Professor, London Business School, Regents Park, London, United Kingdom, avmiguel@london.edu, Francisco J Nogales, Raman Uppal

We use a vector autoregressive (VAR) model to capture stock return serial dependence. We characterize (analytically) the expected return of an arbitrage (zero-cost) portfolio based on the VAR model. We evaluate (empirically) three investment (positive-cost) portfolios that exploit stock return serial dependence and show that they outperform the unconditional portfolio. We show how a norm constraint can be used to reduce the turnover of the portfolios that exploit stock return serial dependence.

■ TD59

H - Salon A, 4th Floor

Decision Support Systems II

Contributed Session

Chair: Daniela Gonzales, Staff, Mississippi State University, Dept of Industrial & Systems Engineering, Mississippi State, MS, 39762, United States of America, dsg42@msstate.edu

1 - Integrated Flexible Inspection System for Port-of-Entry Container Inspection

Liangjie Xue, Arizona State University, Suite #553, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, ljxue@asu.edu, Rene Villalobos

Since inspection resources available at the ports of entry are scarce, full inspection on every container is not feasible. In this study, a model is developed to generate inspection strategies for containers such that the available inspection resources are utilized optimally. The figure of merit that is proposed to optimize captures the traditional inspection costs and also those costs associated with with container waiting times. A computational demonstration is presented.

2 - Modeling Consumer-directed Substitution

Hajnalka Vaagen, Researcher, SINTEF, Technology and Society, SP Andersens vei 5, Trondheim, 7465, Norway, hajnalka.vaagen@sintef.no, Stein Wallace, Michal Kaut

We discuss the challenges when modelling consumer-directed substitution, and propose heuristic solutions suited for large problems with complex uncertainty and dependency patterns. Despite the single-period newsvendor model we use, our substitution process is an approximation of the dynamic product choice. The decision-independent substitution measures applied do not require inventory or sales transaction data, but reflect understanding on the demand driver attributes.

3 - Release Planning in Software Product Lines

Jaewook Yoo, Senior Engineer, Samsung Electronics, Banwol-dong, Hwaseong-si, Gyeonggi-do, 445-330, Korea, Republic of, jay4646.yoo@samsung.com

An optimization methodology is developed for assigning the most cost-effective features to release for software product lines (SPL). A multi-dimensional 0-1 knapsack problem with the important technical resource, risk and budget constraints regarding SPL characteristics is formulated to maximize the objective functions depending on the value of the release, importance of stakeholders, urgency of a feature and its value to stakeholders. The solution approach is a dynamic programming.

4 - Cooperative Planning in Carrier Networks - Fairness and Awareness

Ulrich Derigs, Professor, University of Cologne, Pohligstr. 1, Koeln, D 53797, Germany, derigs@informatik.uni-koeln.de, Sascha Dahl

For a carrier network there are two critical success factors: the partners have to experience incentives to contribute actively to the network, which is the problem of finding a fair cost/profit allocation schema for order exchanges, and, the partners have to be aware of specific consolidation potentials, which is an optimization and communication problem. In this paper we discuss the experience with a DSS for a specific cooperation network focusing on these two issues.

5 - An Excel-based Decision Support System for Supply Chain Design and Management of Biofuels

Daniela Gonzales, Staff, Mississippi State University, Dept of Industrial & Systems Engineering, Mississippi State, MS, 39762, United States of America, dsg42@msstate.edu, Ambarish Acharya, Sandra Eksioglu

We present an excel-based decision support system (DSS) that helps decision makers with designing and managing of biomass-to biorefinery supply chains. We have identified and solved a number of optimization problems that arise when using the DSS. We demonstrate the usefulness of the system through our computational analysis.

■ TD60

H - Salon B, 4th Floor

Risk Preference and Time Preference - From Theory to Practice

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 - Valuing Risky Income Streams From Consumption Preferences

Casey Lichtendahl, Assistant Professor of Business Administration, University of Virginia, Darden School of Business, P.O. Box 6550, Charlottesville, VA, 22906, United States of America, lichtendahlc@darden.virginia.edu, Samuel Bodily

We propose an income valuation method that is based indirectly on a decision maker's preferences for consumption streams. The consumption preferences we consider generalize the popular additive exponential preferences. We compare our income valuation method to existing methods, including the standard direct method (i.e., choose the project with the highest expected utility of income NPV).

2 - A Corporate Risk Appetite Foundation for Good Hedging Decisions

Robert Stibolt, Managing Director, Galway Group LP, 3050 Post Oak Blvd., Suite 1300, Houston, TX, 77056, United States of America, bob.stibolt@stanfordalumni.org

The debate surrounding the recent passage of the Dodd-Frank financial reform bill has highlighted the additional costs it is likely to impose on the enormous volume of hedging transactions routinely executed by corporates as an integral component of their risk management programs. How do these corporates typically make such hedging decisions and how should they? This paper proposes a framework for making good hedging decisions as well as examining the implications of higher transactions cost.

3 - Certain Euqivalent and a Quantified Risk Tolerance - Just Like NPV

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

It is time to cut through the theoretical clutter and popularize the use of a quantified risk preference to communicate and apply a corporations risk appetite. Use of a discount rate for time preference and the NPV calculation provides a great parallel. While there are many theoretical debates and refinements, virtually every corporation discounts for time with linear time preference and uses NPV as an important decision criterion. The presenter will make a recommendation for adoption — now.

4 - Normative Corporate Risk Preference

Eric Bickel, Assistant Professor, The University of Texas at Austin, Operations Research / Industrial Enginee, 1 University Station, C2200, Austin, TX, 78712-0292, United States of America, ebickel@mail.utexas.edu

Why haven't corporations adopted utility (UT)? First, standard corporate finance (SCF) argues that UT and decision analysts (DAs) are misguided. Second, SCF makes normative statements regarding corporate preferences, while DAs view preference as subjective. Finally, DAs don't know what utility function companies should use even if they agreed to adopt one; under current practice, DAs recommend and use utility functions with risk tolerances that differ by at least several orders of magnitude.

■ TD61

H - Room 400, 4th Floor

Operations Management IV

Contributed Session

Chair: Henny van Ooijen, Prof., Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600MB, Netherlands, h.p.g.v.ooijen@tue.nl

1 - Outsourcing to Suppliers with Unknown Capabilities

Hubert Pun, University of Western Ontario, 1151 Richmond Street North, London, ON, Canada, hpun@ivey.ca, Seb Heese

We investigate a manufacturer's make-buy decision when facing multiple suppliers with unknown capabilities. The manufacturer only has an a priori belief about the capabilities of the suppliers, but it can audit the suppliers to gain information regarding their capabilities. We consider possible applications of the general model to illustrate our findings.

2 - Simultaneous Resource Allocation, Cost Minimization and Crashing in Project Scheduling

Osman Oguz, Associate Professor, Bilkent University, Department of IE, Bilkent University, Ankara, 06800, Turkey, ooguz@bilkent.edu.tr

We present a new linear programming model for minimizing the cost of resource usage,allocation of resources and making crashing decisions. Resource constraint satisfaction can also be achieved to a large extend with the same model.The model can be enhanced by introducing some integer variables if desired.

3 - The Impact of Continuous Improvement on Performance in Organizations in Vietnam

Phuong Anh Nguyen, PhD Candidate, University of Massachusetts, Amherst, 121 Presidents Drive, Amherst, MA, 01003, United States of America, pnguyen@som.umass.edu, Alan Robinson

This paper examines continuous improvement (CI) practices in organizations in Vietnam. Based on a survey study of 490 respondents and extensive interviews in six leading firms in that country, it investigates the factors influencing CI effectiveness and the impact of CI on performance. The study offers important implications for Vietnamese managers, for foreign companies investing in Vietnam, and for academics interested in understanding Vietnamese management practices.

4 - How to Allocate Resources for Risk Management: Modeling and Optimization

Yuji Sato, Professor, Graduate School of Policy Science, Mie Chukyo University, 1846 Kubo, Matsusaka, Mie, 515-8511, Japan, ysatoh@mie-chukyo-u.ac.jp

This study considered how to allocate resources for risk management. Developing a risk management system in conjunction with decision-making on strategic investments for safety is complicated because of the subjective factors that enter into in the inspection of chemical plants and the choice of appropriate safety measures. AHP and LP were applied to these problems and how to quantify inherent risks within the plants and how to optimize the budget plan for safety within the company were shown.

5 - Periodic Capacity Management Under a Lead Time Performance Constraint

Henny van Ooijen, Prof., Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600MB, Netherlands, h.p.g.v.ooijen@tue.nl, Cagdas Buyukkaramikli, Will Bertrand

We discuss a production system with random arrival and service times, operating under a lead time performance constraint. In order to reduce the capacity needed the production system uses a flexible periodic capacity policy. Flexible capacity has in general two cost components: a fixed cost for running a flexible capacity system and a variable cost related to the capacity used. We investigate under what (market) circumstances the cost of using a flexible capacity policy is beneficial.

■ TD62

H - Room 402, 4th Floor

Aviation Applications II

Contributed Session

Chair: John Ferguson, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States of America, jfergus3@gmu.edu

1 - System Complexity Metric for Aerospace Systems

Shashank Tamaskar, Graduate Research Assistant, Purdue University, 400 North River Road, Apartment 1712, West Lafayette, IN, 47906, United States of America, stamaska@purdue.edu, Dan DeLaurentis

In the proposed metric, the system is modeled as a network with components as nodes and the interactions as links. Complexity of each node and link is assigned based on factors such as level of abstraction, complexity of sub-components and functions, reliability and uncertainty in the system. A "roll-up" operation is defined where the complexity of nodes and links are combined to produce a single measure for the complexity of the system.

2 - A Congestion Pricing Model to Handle "Day of Operations" Airport Capacity Reductions Due to Weather

Abdul Qadar Kara, Graduate Research Assistant, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States of America, akara@gmu.edu, Karla Hoffman, John Ferguson, Lance Sherry

We present congestion pricing model for use as a demand management tool for dealing with reductions in airport capacity due to inclement weather. These prices are based on both the congestion cost that flights impose on other flights needing the same resources and on the profitability of each flight. We present results for Philadelphia airport.

3 - A Weighted-alarm Security System for Multi-level Passenger and Baggage Screening

Xiaoliang Xu, PhD Candidate, University of Houston, Department of Industrial Engineering, E206 Engineering Building 2, Houston, TX, 77004, United States of America, xxu4@mail.uh.edu, Qianmei Feng

With constant terrorism threats to the air transportation, the effectual passenger and baggage screening prior to boarding an aircraft becomes increasingly crucial to airport security system. This paper proposes a general weighted alarm security screening system for multiple threat classes of passengers, where the goal is to minimize the false alarms of the system and maximize the detection of possible threats in the passenger and baggage security screening.

4 - Solving Large System of Linear Inequalities and its Application to Aviation

William Niedringhaus, The Mitre Corporation, 7515 Colshire Drive, McLean, VA, 22102, United States of America, wniedrin@mitre.org, Paul T.R. Wang, Matt McMahon, Scott Bai

We present three algorithms, which, used in tandem, can solve large numbers of linear inequalities. They exploit a recursive decomposition of a very large but very sparse LP used to analyze en route traffic complexity and workability across continental US airspace. The algorithms, respectively, reduce total infeasibility, worst infeasibility, and number of infeasibilities. We present timing results for large air traffic control applications.

5 - Forecasting Domestic Flight Schedules for Congested Airports in the Presence of Economic Shifts

John Ferguson, George Mason University, 4400 University Drive, Fairfax, VA, 22030, United States of America, jfergus3@gmu.edu, Abdul Qadar Kara, Karla Hoffman, Lance Sherry

Governments have been exploring approaches such as technology and market-based methods to address the pervasive delays in the air transportation system. This analysis describes the results from an optimization model to determine possible airline responses to increasing fuel costs and capacity limits at the New York and San Francisco airports.

■ TD63

H - Room 404, 4th Floor

Behavioral Decision Theory

Sponsor: Decision Analysis
Sponsored Session

Chair: Cade Massey, Yale University, 135 Prospect St., New Haven, United States of America, cade.massey@yale.edu

1 - Probability and Time Trade-off

Manel Baucells, Universitat Pompeu Fabra, Ramon Trias Fargas 25-27, Barcelona, 08005, Spain, manel.baucells@upf.edu, Franz Heukamp

We consider preference conditions on prospects of the type: receiving outcome x with probability p at time t. We characterize preferences by means of three real valued functions. The concavity of the psychological distance function explains both the common ratio and the common difference effects. A decreasing probabilistic discount rate accounts for the magnitude effect. The discount rate and the risk premium depend on the shape of the three functions.

2 - Dynamic Purchase Decisions Under Regret: Price and Availability

Wenjie Tang, INSEAD, Boulevard de Constance, Fontainebleau, France, wenjie.tang@insead.edu, Nils Rudi, Enrico Diecidue

We introduce a two-period model where consumer can buy forward with a discount or on the spot at full price. Two types of regret are considered: the regret for the money a consumer paid in excess of its valuation when buying forward and the regret for the money a consumer paid in excess when not buying forward. We compare consumer behavior with and without regrets and we qualify and quantify the impact of regrets on demand and surplus. We conclude by studying time consistency under regrets.

3 - Demand Forecasting Behavior: System Neglect and Change Detection

Enno Siemsen, University of Minnesota, 3-150 Carlson School of Management, 321 - 19th Ave S, Minneapolis, MN, 55455, United States of America, siems017@umn.edu, Mirko Kremer, Brent Moritz

We analyze time series forecasting in a controlled laboratory experiment. We find that forecasters over-react to errors in relatively stable environments, but under-react in relatively unstable environments. Surprisingly, performance loss due to systematic biases is lower in unstable environments. To mitigate these biased reaction patterns, we reduce the demand signal salience by requiring forecasts for multiple time series in parallel. This simple intervention improves forecasting performance.

4 - Revising Beliefs While Holding a Preferred Conclusion

Cade Massey, Yale University, 135 Prospect St., New Haven, United States of America, cade.massey@yale.edu, Erica Dawson

We investigate how people revise their beliefs given both the opportunity to learn and a preferred conclusion. We focus on the stationarity of the underlying process. We suggest that people are motivated in their reasoning about stationarity, leading to a distinct and well-established pattern of optimistic biases. Consistent with this model, we find in a variety of settings that when people have strong preferences, their predictions underweight historical outcomes.

■ TD64

H - Room 406, 4th Floor

Health Care, Modeling and Optimization IV

Contributed Session

Chair: Sangdo(Sam) Choi, TAMU, Department of Industrial and Systems Eng, College Station, United States of America, samuel4u@tamu.edu

1 - Patient Scheduling in a Proton Therapy Facility

Ridvan Gedik, PhD Student, University of Arkansas, 4207 Bell Engineering Center, Department of Industrial Engineering, Fayetteville, AR, 72701, United States of America, rgedik@uark.edu, Ehsan Salari, Chunhua Men, Chase Rainwater, Edwin Romeijn

Due to the effectiveness of proton therapy, the demand for this treatment is extremely high compared to the available capacity. To address this problem, we present a mathematical model that determines an outpatient schedule while maximizing the number of fractions delivered over a planning period. The consequences of strategic patient mix preferences, as well as effects of operational choices and constraints are assessed through a computational study.

2 - IR Modulation Optimization for Critical Organs

Yasaman Khodadadegan, PhD Student, Arizona State University, 699 S. Mill Avenue, Suite #553, Tempe, AZ, 85281, United States of America, ykhodada@asu.edu, Teresa Wu, William Pavlicek, Muhong Zhang

Interventional Radiology (IR) is an invasive diagnostic subspecialty which comprises a wide range of image guided therapeutic procedures. However, radiation exposure from IR is high and may result in high organ doses in patient body. The purpose of this study is to optimize the modulation for IR scans to lower the radiation dose to critical organs while maintaining the image quality at a reasonable level for diagnosis. The preliminary simulation results of dose reduction are presented.

3 - Combining Equity and Efficiency in Health Care

John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu, H. P. Williams

We combine utilitarian and Rawlsian (maxmin) objectives for the distribution of resources. The n-group social welfare function gradually switches from Rawlsian to utilitarian as equity becomes too expensive, with the break points given by a single parameter with a natural interpretation. We present a mixed integer formulation of the model and show it provides a convex hull relaxation. We illustrate the model with a realistic problem in the distribution of health care resources.

4 - Two Perishable Inventory Systems with One-way Substitution

Liqiang Liu, Eindhoven University of Technology, 1.03 Laplace Gebouw, Den Dolech 2, Eindhoven, 5612AZ, Netherlands, liu@eurandom.tue.nl

Motivated by blood bank operations, we consider two perishable inventory systems operating under a correlated management. Each inventory holds items of a type. The demands for each type are modeled as independent Poisson processes. A demand of one type, when it is not satisfied by the inventory of its type, may be satisfied by the other. We formulate our steady-state analysis with the notion of stochastic fluid model and study the performance of the two systems with such a one-way substitution.

5 - Criteria to Schedule Surgeries

Sangdo(Sam) Choi, TAMU, Department of Industrial and Systems Eng, College Station, United States of America, samuel4u@tamu.edu, Wilbert Wilhelm

To assess the total cost of an OR-room schedule, this paper derives closed-form expressions for the expected values of patient waiting time, OR-room idle- and surgeon waiting-time between surgeries, and end-of day idle- and over- times. We show that smallest-variance-first rule is optimal for some surgery-time distributions but that the smallest-mean-first rule is optimal for others.

■ TD65

H - Room 408, 4th Floor

Inventory Management IV

Contributed Session

Chair: Stefan Minner, University of Vienna, Bruenner Strasse 72, Vienna, 1210, Austria, stefan.minner@univie.ac.at

1 - Production-inventory Control Policy with Advance Demand Information and Early Fulfillment

Sourish Sarkar, Doctoral Candidate, Virginia Tech, 106 Durham Hall, Blacksburg, VA, 24061, United States of America, sourish@vt.edu, John Shewchuk

We consider a production-inventory system for a single product with two demand classes, where one class only provides advance demand information. Early fulfillment occurs when an order is fulfilled before it is due. Previous work rarely considers early fulfillment in the context of advance demand information. We investigate inventory rationing policies and show that advance demand information can offer significant benefit when early fulfillment is used.

2 - Dual Sourcing for Perishables in a Retail Environment

Rob Broekmeulen, TU Eindhoven, P.O. Box 516, Pav. E10, Eindhoven, 5600 MB, Netherlands, r.a.c.m.broekmeulen@tue.nl, Simme Douwe Flapper, Dave Lardinois

We study the value of an emergency sourcing opportunity for perishables in a retail environment, compared to a single sourcing supply mode that is controlled by a modified order-up-to policy to correct for expected outdating. We investigated a policy with standing orders and dual-index policies. Using simulation, the performance of these dual sourcing policies relative to a single sourcing policy is examined in situations with periodic review, lost sales, and fixed case pack sizes.

3 - Converting Lost Sales into Profit: An Inventory Model with an Option of Deferred Delivery

Richard Ehrhardt, Professor, University of North Carolina at Greensboro, UNCG, Greensboro, NC, 27402, United States of America, r_ehrhardt@uncg.edu, Joyendu Bhadury

We consider a dynamic inventory model in which customers are offered a choice between drawing a full-price item immediately or a discounted-price item with delayed delivery. We show that for a given price discount the optimal stocking policy follows that of a generalized newsvendor model, and then find the profit-maximizing value of the discount for assumed elasticity functions. We present empirical results and offer ideas for generalization to a multi-location environment.

4 - Inventory Optimization with Correlated Uncertainty

Abhilasha Aswal, Infosys Technologies Limited, 44 Electronics City, Bangalore, India, abhilasha_aswal@infosys.com, G. N. Srinivasa Prasanna

Inventory optimization under uncertain correlated demands for different goods preclude direct use of EOQ type methods. We use Math Programming, with concave costs, and correlations specified as linear/quadratic constraints, for modeling a richer set of economically meaningful scenarios (compared to Bertsimas-Sim-Thiele Budget of Uncertainty). For small problems, vertex enumeration yields max/min cost bounds, & Lagrange multiplier & simulated annealing heuristics yield bounds for larger problems.

5 - A One Warehouse, Multiple Retailer Distribution Inventory System for Perishable Products

Stefan Minner, University of Vienna, Bruenner Strasse 72, Vienna, 1210, Austria, stefan.minner@univie.ac.at

In perishable item inventory systems, base-stock policies are no longer optimal. The combination of multi-echelon and perishable item problems in food distribution has not received much attention. We present a periodic review multi-echelon model and determine optimal order quantities and the allocation of incoming orders under service level constraints. We compare different rationing policies and analyze the impact of perishability on the optimal degree of inventory centralization.

■ TD66

H - Room 410, 4th Floor

Supply Chain, Competition II

Contributed Session

Chair: Ilsoo Lee, PhD Candidate, Penn State University, 102 Ferguson Hall, White Course APT, University Park, PA, 16802, United States of America, ixl118@psu.edu

1 - Selling Television Commercial Times Under Competition: An Equilibrium Analysis

Suman Mallik, School of Business, University of Kansas, 1300 Sunnyside Ave, Lawrence, United States of America, suman@ku.edu, Qin Geng

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. We present a game theoretic model to solve this problem.

2 - First-Mover Disadvantage: Information Leakage

Weixin Shang, Assistant Professor, School of Management, Fudan University, 670 Guoshun Road, Yangpu District, Shanghai, 200433, China, shangwx@fudan.edu.cn

It is well known that the first mover benefits from moving ahead of the rival in a leader-follower game. However, when both players have some private information, the first mover may leak his private information to the other, which benefits the follower and harms the leader. We consider a supply chain that consists of a manufacturer and a retailer, and compare firm payoffs under different decision sequences. This study provides conditions under which the players prefer to be the second mover.

3 - Quality Positioning and Marketing Effort in Private Label and National Brand Competition

Yingjue Zhou, Oklahoma State University, 502 Engineering North, Stillwater, OK, 74078, United States of America, yingjue.zhou@okstate.edu, Tieming Liu

This paper examines a supply chain with a retailer selling a private label product and a national brand product. Assuming a natural quality advantage for the national brand and a natural marketing advantage for the retailer, the retailer determines the quality positioning of the private label, while the national brand manufacturer seeks its optimal marketing efforts. We study how the natural quality and marketing advantages impact the two players' decision.

4 - Modeling Disruption in Dynamic Supply Chains

Ilsoo Lee, PhD Candidate, Penn State University, 102 Ferguson Hall, White Course APT, University Park, PA, 16802, United States of America, ixl118@psu.edu, Terry Friesz, Tao Yao, Cheng-Chang Lin

This paper models a dynamic supply chain network as a differential Nash game, formed by considering the appropriate extremization of each individual agent's profit or cost. The model is fashioned to allow consideration of supply chain disruption threats. A simple numerical example is presented illustrating how the model may be used to assess the resilience of supply chains to disruptions.

■ TD67

H - Room 412, 4th Floor

Revenue/Yield Management

Contributed Session

Chair: Jian Yang, Yahoo! Inc, 4301 Great America Parkway, Santa Clara, CA, 95054, United States of America, jianyang@yahoo-inc.com

1 - Dynamic Nonlinear Approximation for Network Capacity Control

Sam Kirshner, PhD Candidate, Queen's School of Business, Queen's University Goodes Hall, Room 401, Kingston, Canada, skirshner@business.queensu.ca

We present a nonlinear programming (NLP) approximation for network revenue management problems motivated by Adelman's dynamic bid price LP approach. The primary benefit of the NLP model is that is has much smaller number of constraints than the dynamic LP while generating bid prices of comparable quality. Numerical experiments show that the NLP approach for finding dynamic bid prices is computationally efficient and produces higher revenues in comparison to the static LP bid pricing policy.

2 - Estimating Unconstrained Demand Rate Functions using Customer Choice Sets

Alwin Haensel, VU University Amsterdam, Department of Mathematics, De Boelelaan 1081A, Amsterdam, 1081 HV, Netherlands, ahaensel@few.vu.nl, Ger Koole

A good demand forecast should be at the heart of every Revenue Management model. Yet most demand models do not incorporate customer choice behavior under offered alternatives. We are using the ideas of customer choice sets to model the customer's buying behavior. A demand estimation method based on maximum likelihood and the expectation maximization (EM) method is presented. Using this demand information per choice sets, the revenue manager obtains a clear view of the underlying demand.

3 - Alternative Booking Methodology for Airlines: Reduction in Overbooking and Bumped Passengers

Ritesh Joshi, Graduate Student, University of Florida, 3230 SW Archer Rd, Apt # N269, Gainesville, Fl, 32608, United States of America, ritesh.joshi@ufl.edu

The proposal is to incorporate an option into the booking system wherein a passenger can decide at the time of booking whether or not he is willing to vary his schedule by few hours if given some monetary reward at time of flight or before it i.e. If he agrees and need arises then he will be paid the promised amount and his schedule will be altered. This is a promising proposal as many travellers try to take best price option rather that fixed schedule option.

4 - Inventory Allocation for Online Advertising with Malleable Supply

Jian Yang, Yahoo! Inc, 4301 Great America Parkway, Santa Clara, CA, 95054, United States of America, jianyang@yahoo-inc.com

In inventory allocation for online advertising, the supply is sometimes malleable: the supply volume can be increased by lowering the threashold. But that increase may come with a cost of the supply quality, which could impact the advertiser's ROI, and eventually the publisher's revenue. We model the malleable supply by introducing a cost function and add it to a multi-objective framework, which can be solved to achieve different business goals by specifying different parameters.

■ TD68

H - Room 415, 4th Floor

Business Process Reengineering

Contributed Session

Chair: Sukgon Kim, Assistant Professor, Northern Illinois University, 590 Garden Road, EB230, Sycamore, IL, 60115, United States of America, skim11@niu.edu

1 - Assessing Alternative R&D Investment Projects Under Uncertainty

Motoh Tsujimura, Associate Professor, Ryukoku University, Fukakusa, Fushimi-ku, Kyoto, 612-8577, Japan, tsujimura@econ.ryukoku.ac.jp

In this paper we examine a firm's R&D investment problem under uncertainty. Suppose that the firm's problem is to maximize expected total discounted profit. Further, there are two kinds of technologies distinguished by the level of productivity and their associated costs, such that one technology increases quantity of output more than alternative technology. To solve it, we formulate it as an optimal stopping problem.

2 - Relational Embedded IPO Firms and Value Creation

Fiona Xiaoying Ji, PhD Candidate, Virginia Tech, Management 0233, R.B. Pamplin College of Business, Blacksburg, VA, 24060, United States of America, fiona.jixy@gmail.com, Hung-Wen Lan

Obtaining and appropriating external knowledge is critical to firm's success. We develop and test how those collaborations can impact post-IPO alliances formation and performances. Increasing number of same activity alliances may impede entrepreneur rent for new ventures whereas enhancing relational rent. A multi-level longitudinal analysis is used. Results support pre-IPO partnerships in same resources base will decrease the likelihood of new ventures to seek similar partnership after IPO.

3 - A Production Capacity Investment Model with Time-to-build and Demand Information Updates

Ming Yuen, PhD Candidate, UC Berkeley, IEOR, Berkeley, CA, 94720, United States of America, mingkyuen@gmail.com, Phil Kaminsky, Xin Guo

We consider a capacity investment problem where a manufacturer reviews her product's R&D progress. To avoid lost sales, she wants to invest before her product is proven effective. However, since the investment cost is irreversible, she may want to wait for more positive results. We develop a stochastic process to model the R&D progress and the optimal investment strategy, which demonstrates the trade-off between the two opposing forces. We also study the manufacturer's investment behavior.

4 - Optimal Capacity Design in Failure Prone Lifeline Networks
Shahrzad Azizzadeh, PhD Student, North Carolina State University, 431 Mann Hall, Stinson Drive, Raleigh, NC, 27695, United States of America, sazizza@ncsu.edu, Ranji Ranjithan

Attention on the vulnerability of lifeline networks due to disruption caused by natural hazards is growing. We present a network flow model-based approach for optimal capacity design, considering a fixed number of potential failure modes, which are characterized by their impact on the level of availability of individual components and demand levels between node pairs. The model aims to achieve a target level of satisfied demands under the set of failure modes considered.

5 - Location-Allocation for Congested Facilities using Clearing Functions
Sukgon Kim, Assistant Professor, Northern Illinois University, 590 Garden Road, EB230, Sycamore, IL, 60115, United States of America, skim11@niu.edu

The idea of clearing function, a function of Work-In-Process Inventory representing capacity available, was utilized to model congestion in a facility location problem with congestion consideration. Its benefits in terms of modeling and computation, and applicability will be discussed.

■ TD69

H - Salon F, 6th Floor

Transportation, Freight I

Contributed Session

Chair: Chris Caplice, Executive Director, MIT Center for Transportation and Logistics, 77 Massachusetts Ave. E40-276, Cambridge, MA, 02139, United States of America, caplice@mit.edu

1 - Multi Period Production Planning and Outbound Transportation: Utilization of Inbound Vehicles
Utku Koç, Bilkent University, Bilkent University EA 325, Bilkent, Ankara, Turkey, utkukoc@bilkent.edu.tr, Aysegul Toptal, Ihsan Sabuncuoglu

We study production planning and outbound transportation in a supply chain with production capacities while utilizing inbound vehicles for outbound transportation to minimize transportation and inventory holding costs. For each combination of factors (consolidation/splitting allowed or not and size of orders), we develop a pseudo-polynomial algorithm for general cost structure or prove no such algorithm exists even for linear cost structure. Computational experience is also discussed

2 - Optimal Private Fleet Allocation Planning
Francisco Jauffred, Research Affiliate, MIT Center for Transportation and Logistics, 77 Massachusetts Av. E40-276, Cambridge, MA, 02139, United States of America, jauffred@mit.edu, Chris Caplice

Most large retailers have private fleets. They complement their capacity using third party carriers. Contracts to carriers are awarded in cycles during which there is uncertainty in the weekly demand. An optimal transportation plan will minimize empty miles while accounting for the demand uncertainty during the planning horizon. We model the service level in the logistics network using stochastic linear programming. We test and validate our model using data from Wal-Mart's U.S. network.

3 - Intermodal Transport of Perishable Goods
Rob Zuidwijk, Rotterdam School of Management, P.O. Box 1738, Rotterdam, Netherlands, RZuidwijk@rsm.nl, Michael Ketzenberg

An important parameter in the transport of perishables is the remaining shelf life of the product. This parameter is often uncertain, so transport decisions are guided by "the sooner, the better", leaving truck transport as the main alternative. We explore the possibilities of using other transport modes that are slower but cheaper and more environmentally benign. We consider policies under various levels of information and incorporate product price levels that depend on remaining shelf life.

4 - Estimating the Impact of Business Policies and Practices on Freight Transportation Rates
Chris Caplice, Executive Director, MIT Center for Transportation and Logistics, 77 Massachusetts Av. E40-276, Cambridge, MA, 02139, United States of America, caplice@mit.edu

Even though shippers spend over $660B annually procuring truck transportation services, it is very difficult for an individual shipper to evaluate their own rates. Shippers have unique characteristics and geographies that make direct comparisons to other firms very hard. We developed econometric models to estimate the impact of geographies, volume, policies, and other factors on rates. We present the result of 5 years of analysis on more than $15B of annual transportation transactions.

■ TD70

H - Salon G, 6th Floor

Discrete Choice Modeling for Airline Scheduling Problems

Sponsor: Aviation Applications
Sponsored Session

Chair: Laurie Garrow, Georgia Institute of Technology, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, laurie.garrow@ce.gatech.edu

1 - Multi-choice Models Based on Minimum Thresholds: An Analysis of Destination Choice
Laurie Garrow, Georgia Institute of Technology, 790 Atlantic Drive, Atlanta, GA, 30332, United States of America, laurie.garrow@ce.gatech.edu, Michel Bierlaire, David Post, Alexandre Khelifa, Misuk Lee

We develop a new discrete choice model based on the concept of minimum thresholds. We use this model to predict destination exclusion probabilities data from an opaque product offered by a European airline. Customers are willing to accept uncertainty in their final travel destination, but for a fee may exclude one or more destinations. Preliminary results show destination exclusion probabilities are sensitive to geographic boundaries.

2 - Passenger Delay Impacts of Airline Scheduling
Vikrant Vaze, Massachusetts Institute of Technology, 77, Massachusetts Avenue, 1-245, Cambridge, MA, 02139, United States of America, vikrantv@MIT.EDU, Douglas Fearing, Cynthia Barnhart

Though many existing methods for evaluating an airline's on-time performance are based on flight-centric measures, significant passenger delays result from other factors such as flight cancellations and missed connections. Passenger delays are also affected by scheduling practices, network structures, and passenger connections. Using a discrete-choice methodology, we analyze and present advantages and disadvantages of different airline networks and schedules in terms of passenger delay impacts.

3 - A Discrete Choice Model of the Airport Runway Configuration Selection Process
Varun Ramanujam, Student, Massachusetts Institute of Technology, 218 Broadway, Cambridge, MA, 02139, United States of America, varunr@mit.edu

Airport capacity, or the number of arrivals and departures that can be served in a given time period, depends on the runway configuration being used. From among feasible runway configurations, the exact choice of configuration is guided by weather, operational factors, and policy. We propose a discrete choice model with nested logit structure for the configuration selection process, and demonstrate its predictive value. We also estimate the impact of configuration changes on airport capacity.

■ TD71

H - Salon H, 6th Floor

Airports, Regional Policy and DEA

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Nicole Adler, Hebrew University of Jerusalem, msnic@huji.ac.il

1 - Benchmarking Airports From a Managerial Perspective
Nicole Adler, Hebrew University of Jerusalem, msnic@huji.ac.il, Vanessa Liebert, Ekaterina Yazhemsky

Previous analyses treated airport production technology as a black box or assessed terminal and airside activities individually. We assess the relative efficiency of 42 European airports over time using network-DEA, avoiding the problems of separation, identifying peers through dynamic clustering according to predefined characteristics and partially restricting changes in the capital inputs to achieve more meaningful benchmarks. In addition, strategies are assessed with respect to aeronautical and commercial activities not only separately but also in combination.

2 - Measuring the Efficiency of Mexican Airports with Data Envelopment Analysis
Jose H Ablanedo-Rosas, Assistant Professor, University of Texas at El Paso, 500 W University Avenue, El Paso, TX, 79968, United States of America, jablanedorosas2@utep.edu, Leopoldo A Gemoets

This research analyzes the empirical operational performance of 37 major airports in Mexico. Three different analyses are performed: constant return to scale composed by technical and scale efficiency, variable return to scale based on pure technical efficiency, and a ratio of these two aimed to measure scale efficiency. There are 3 Mexican airports that achieved overall efficiency. Some hypotheses are tested to validate managerial recommendations and derive policy implications.

3 - Investigating the Applicability of Data Envelopment Analysis in Philippine Regional Policy Making

Maria Carmela Pato, Tokyo Institute of Technology, O-okayama, Meguro-ku, Tokyo, Japan, pato.m.aa@m.titech.ac.jp, Shinji Mizuno

Philippine regional policy is based on a national program. However, each region's situation is different, presenting the need for a tailored development program. This paper investigates the applicability of DEA as a basis for regional policy. Using development criteria such as economic output, education, peace and order, health, and poverty, the situation in each region can be analyzed. The result is used to make a program for each region, which contains specific regional targets.

■ TD72

H - Salon J, 6th Floor

Facility Logistics Panel: Physical Internet Initiative

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Russell Meller, Hefley Professor of Logistics and Entrepreneurship, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, rmeller@uark.edu

1 - Physical Internet Initiative Research Panel

Russell Meller, Hefley Professor of Logistics and Entrepreneurship, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, rmeller@uark.edu

The Physical Internet combines standardized, modular and intelligent containers with new logistics protocols and business models, which results in a collaborative, highly-distributed, and highly-leveraged logistics and distribution system. On-going research will be summarized by the panelists and then a wide-ranging discussion will ensue.

2 - The Emergence of the Physical Internet Initiative

Benoit Montreuil, Université Laval. Québec, Québec, Canada G1V 0A6,benoit.montreuil@cirrelt.ulaval.ca

The Physical Internet offers a breakthrough vision for achieving significant and sustainable improvements in the economic, environmental and societal performance of transportation, handling, storage, sourcing, realization and usage of physical objects worldwide. The presentation outlines the essence of the Physical Internet, its key characteristics and principles. Then it highlights the Physical Internet Initiative aiming to foster its large-scale scientific and field-based exploration.

3 - Physical Internet: Towards a New Network Topology for Logistics Services

Eric Ballot, Professor, Mines ParisTech, 60, Bd Saint-Michel, Paris, 75006, France, eric.ballot@mines-paristech.fr, Frédéric Fontane, Benoit Montreuil

Within the framework of definition of a new logistic organization based on the principle of an interconnection of logistics networks (a physical internet), one of the expected changes is a more effective logistics network topology. The network topology of a Physical Internet is compared to traditional network topologies found in logistics services: point-to-point, multi-pick or drop, hub and spoke, or pooling. Several criteria were used: distance covered, time and use of transport means.

4 - Physical Internet Initiative: Establishing the Logistics System Gain Potential

Kimberly Ellis, Associate Professor, Virginia Tech, Industrial and Systems Engineering, Blacksburg, VA, 24060, United States of America, kpellis@vt.edu, Russell Meller

The Physical Internet Initiative (PI2) involves the intelligent standardization of shipments and coordination of resources to facilitate system-wide efficiency in a networked economy much in the way that the digital internet is based on transmitting standards packets of information. Before industry and transportation organizations are willing to fully consider such a transformation, a rigorous assessment of the logistics system gain potential of the Physical Internet Initiative is required.

5 - Physical Internet Facilities

Russell Meller, Hefley Professor of Logistics and Entrepreneurship, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, rmeller@uark.edu, Benoit Montreuil

How would the PI facilities be configured and how will they be operated? We discuss the different types of facilities that will be needed in the PI^2, the material handling requirements and opportunities of such facilities, and ask what optimization and throughput models will be helpful in the design and operation of such facilities.

■ TD73

H - Salon K, 6th Floor

Maritime Inventory Routing

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Kevin Furman, ExxonMobil, 3120 Buffalo Speedway, Houston, TX, United States of America, kevin.c.furman@exxonmobil.com

1 - Nested Column Generation for Maritime Split Pickup Split Delivery Problems

Björn Nygreen, Professor, Norwegian University of Science and Technology, Department of Industrial Economics, Trondheim, NO 7491, Norway, bjorn.nygreen@iot.ntnu.no, Frank Hennig, Marco Lübbecke

In this talk we discuss a multiproduct industrial shipping problem with several loading ports and several discharging ports for each product. The non-predetermined amount of a given product shipped from a loading port time window to a discharging port time window can be split between several ships. The distances between the ports are such that it is natural to discharge a ship completely before loading it again. Our solution approach is based on nested column generation and SCIP.

2 - The Fixed-Charge Transportation Problem with Linear Blending

Dimitri Papageorgiou, Georgia Tech, 1270 Mayfair Dr. NE, Atlanta, GA, 30324, United States of America, djpapag@gatech.edu, Alejandro Toriello, Martin Savelsbergh, George L. Nemhauser

We introduce the fixed-charge transportation problem with linear blending constraints and discuss two facet classes which admit polynomial-time separation. We present computational experiments to illustrate that these facets are effective at significantly reducing the integrality gap. This study was motivated by an inventory routing application.

3 - Approximate Inventory Valuation for Time-Expanded Inventory Routing

Alejandro Toriello, Georgia Tech, 765 Ferst Drive NW, Atlanta, United States of America, atoriello@gatech.edu, Martin Savelsbergh, Jin-Hwa Song, George L. Nemhauser

We study an inventory routing problem modeled as a mixed-integer program in a time-expanded network. We use approximate dynamic programming and data fitting techniques to generate approximate inventory value functions for each supplier and consumer, which can be used to quickly generate solutions. We discuss challenges related to the use of time-expanded networks, and present computational examples from maritime inventory routing instances used in the petrochemical industry.

4 - Intermodal Transportation in the Mexican Pacific Ports

Jaime Mora Vargas, Tecnológico de Monterrey, Research and Graduate Division, Campus Estado de México, Mexico, jmora@itesm.mx]

The past, present and future for intermodal transportation at Mexican pacific ports is presented, special attention regarded to Manzanillo and Lázaro Cárdenas since their importance in global commerce with Asia. A long with the historic evolution of intermodal transportation in those ports, several governmental and private initiatives are discussed. Applications and opportunities areas for management sciences and operations research techniques are analyzed in order to achieve synergies between academic and business sectors.

■ TD74

H - Room 602, 6th Floor

Traffic Signals Systems and Traffic Flow Characteristics

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Yanfeng Ouyang, Assistant Professor, UIUC, 1209 Newmark Civil Engineering Laborator, MC-250, 205 N. Mathews Ave., Urbana, IL, 61801, United States of America, yfouyang@illinois.edu

1 - Moving towards Green-Transportation: A Multi-Objective Model to Minimize CO Emission & Travel Delay

H. M. Abdul Aziz, Graduate Researcher, Purdue University-West Lafayette, 550 StadiumMall Drive, Civil Engg. Bldg, West Lafayette, IN, 47907, United States of America, haziz@purdue.edu, Nick Maxemchuck, Satish Ukkusuri

At network level, it is important to achieve objectives related to environment(e.g. emission concentration reduction, fuel consumption etc.). Here we formulate and solve a multi objective problem that accounts for minimization of CO emission along with minimization of travel time through signal optimization and system optimal objectives. Gaussian dispersion model for cell based finite line emission source is used to consider emission. We implemented the formulation in a test network.

2 - Effects of Left Turn Policies on Network Performance

Ali Hajbabaie, PhD Candidate, University of Illinois at Urbana - Champaign, 205 N mathews Ave., room 3150, Urbana, IL, 61801, United States of America, ahajbab2@illinois.edu, Rahim F. Benekohal

The objective of this study is to evaluate the effects of permitting or restricting protected left turns at some or all intersections on the performance of a transportation network. A Genetic Algorithm based method have been developed to determine near optimal signal timing parameters for each case (restricting or permitting left turns) and three network performance indices, delay, throughput, and number of stops, were used for comparison.

3 - Characterization of Traffic Oscillation Propagation Under Nonlinear Car-Following Laws

Xiaopeng Li, University of Illinois at Urbana-Champaign, B156 Newmark Civil Engineering Laborator, 205 N. Mathews Ave, Urbana, IL, 61821, United States of America, li28@illinois.edu, Yanfeng Ouyang

We present a mathematical framework that is capable of quantifying the frequency response of nonlinear car-following laws based on nonlinear control theory. Numerical examples show that the proposed method provides an accurate prediction of oscillation propagation in a vehicle platoon. Insights are drawn on how driver behavior and physical constraints influence propagation and growth of oscillations.

Wednesday, 8:00am - 9:30am

■ WA01

C - Ballroom D1, Level 4

Multi-stage Stochastic Optimization Applied to Energy Planning

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Steffen Rebennack, Assistant Professor, Colorado School of Mines, Division of Economics & Business, Boulder, CO, United States of America, steffen@ufl.edu

1 - Quasi-Monte Carlo Methods for Hydroelectric Energy Planning

Tito Homem-de-Mello, University of Illinois at Chicago, Chicago, IL, United States of America, thmello@uic.edu, Erlon Finardi, Vitor de Matos

We study a multi-stage stochastic programming model for hydroelectric energy planning in Brazil. Sampling techniques are used to generate scenario trees from the stochastic process defining the water inflows, and also to select scenarios within that tree. We analyze the use of Quasi-Monte Carlo methods for the problem. We also discuss statistical performance measures that allow us to compare methods, and present numerical results to evaluate the effectiveness of the proposed approach.

2 - Reservoir Hydropower Operations: Valuing Flexibility

Stein-Erik Fleten, Professor, NTNU Norway, Department of Industrial Economics and Technology Management, Trondheim, Norway, Stein-Erik.Fleten@iot.ntnu.no, Martin Prokosh, Camilla Kolsrud

In this talk we provide insights into how storage flexibility impacts the expected revenue of hydropower plants. Using daily data going back ten years from 14 different hydropower plants with significant seasonal reservoir capacity, and who operate in a well-functioning market, we conduct an empirical analysis of the different factors affect the ability of hydropower producers to exploit high prices. Storage flexibility on average accounts for 22% of actual revenues, ranging from 0 to 40%.

3 - Optimal Control of Energy Storage using the Knowledge Gradient with Nonparametric Beliefs

Warren Powell, Professor, Princeton University, Sherrerd Hall, Princeton, NJ, 08544, United States of America, powell@princeton.edu, Emre Barut

We consider different natural gas and pumped hydro storage problems as stochastic control problems which can be solved using tunable policies governed by tunable parameters. We present a novel stochastic search algorithm using the knowledge gradient adapted to nonparametric beliefs, which produces policies that are easy to implement. We demonstrate that the logic produces policies that slightly outperform actual performance.

4 - Decomposition Approach for G-T Expansion Planning with Implicit Multipliers Evaluation

Fernanda Thome, PSR, Rio de Janeiro, Brazil, fernanda@psr-inc.com, Marcia H.C. Fampa, Luiz Carlos da Costa Jr., Silvio Binato

Algorithms solving stochastic hydrothermal operation problems usually take computational advantages in the elimination of constraints whose explicit representation does not affect the problem's optimal solution. This work presents a new methodology for solving generation-transmission expansion planning problems based on Benders decomposition technique and the evaluation of the Lagrange multipliers associated to those non-explicit constraints and required in the construction of the Benders cuts.

■ WA02

C - Ballroom D2, Level 4

Refinery Operations with Spot and Forward Markets

Cluster: Energy: Modeling the Interface Between Markets and Operations

Invited Session

Chair: Simin Huang, Tsinghua University, Department of Industrial Engineering, Beijing, China, huangsimin@mail.tsinghua.edu.cn

1 - Considering the Effect of Outside Options in the Capacity Planning for Hydrogen Fueling Station

Ruwen Qin, Assistant Professor, Missouri University of Science and Technology, Department of Engineering Management, Rolla, United States of America, qinr@mst.edu, Scott Grasman, Kevin Martin

We model and analyze the effect of an outside option in determining the optimal capacity for hydrogen fueling stations. Through assessing the economic consequence of the decision, this study suggests opportunities for gaining additional profits.

2 - Financial Engineering for Refinery Operations: Challenges and Opportunities

Li Zheng, Professor, Tsinghua University, Department of Industrial Engineering, Beijing, 100084, China, lzheng@tsinghua.edu.cn

Over the past decade, the world has witnessed the extreme price volatility from both crude supply and final product market. Financial engineering tools have been used to hedge the financial risk in refinery operations recently. In this talk, we present the challenges of the problem and provide some potential ideas for future research.

3 - Integrated Financial and Operational Model for Crude Oil Procurement in Refineries

Zhen Liu, Assistant Professor, Missouri University of Science & Technology, United States of America, zliu@mst.edu, Simin Huang

The world seems to have entered into an era of higher crude oil price volatility. As the crude oil cost is about 90% of the refinery input cost, there has been significant volatility in the margins and profitability of any petroleum refinery. An integrated financial and operational model is developed to hedging the financial risk.

4 - Financial Engineering Model for Crude Transportation in Refineries

Zhihai Zhang, Associate Professor, Tsinghua University, Department of Industrial Engineering, Beijing, 100084, China, zhzhang@tsinghua.edu.cn

The crude transportation cost in refineries could be up to several billion dollars and the volatility of freight rates can be substantial. A decision-making model for optimal oil tanker selection procedure is developed to help refining companies manage the freight market risk.

■ WA03

C - Ballroom D3, Level 4

Challenges for the US Biofuels Industry: Economic and Technological Uncertainties

Sponsor: Energy, Natural Resources and the Environment//Forestry Sponsored Session

Chair: Hayri Onal, University of Illinois at Urbana-Champaign, Dept Agricultural and Consumer Economics, Urbana, IL, 61801, United States of America, h-onal@illinois.edu

1 - Modeling Uncertainty in Biomass Greenhouse Gas Emissions with the Calculating Uncertainty in Biomass

Aimee Curtright, Physical Scientist, RAND Corporation, Pittsburgh, PA, 15213, acurtrig@rand.org, Henry Willis, David Johnson, Costa Samaras

The greenhouse gas (GHG) intensity of biofuels depends on how feedstocks are produced, transported, and processed. This paper will describe the Calculating Uncertainty in Biomass Emissions (CUBE) model, a tool developed for the National Energy Technology Laboratory to examine uncertainties in bio-feedstock GHG estimates. The limits on the precision of results, the value of additional emissions information, and the sources and magnitude of uncertainty will be discussed.

2 - Ecosystem Costs in a Logistical Model of Cellulosic Ethanol Production

David Lambert, Professor and Head, Department of Agricultural Economics, Kansas State University, lambertd@k-state.edu, Jason Bergtold, Elizabeth Canales

Network models of biomass use for cellulosic ethanol production often ignore ecosystem opportunity costs. Building upon an existing MIP model, we incorporate ecosystem opportunity costs arising from soil erosion, loss of organic and inorganic matter, and carbon sequestration values associated with crop residue and energy crop harvest for ethanol production.

3 - Strategic Biofuel Supply Chain Planning Under Supply, Demand, and Technology Uncertainties

Yueyue Fan, University of California-Davis, Davis, CA, 95616, United States of America, yyfan@ucdavis.edu

This talk focuses on modeling and computational challenges in strategic biofuel supply chain planning under supply, demand, and technology uncertainties. Using a case study based on California settings, the economic feasibility, infrastructure requirements, and the environmental impact of converting biowastes to fuel are analyzed.

4 - Projections for US Flex-fuel Vehicle Structure and Renewable Fuel Standards

Xirong Jiang, Senior consulting decision analyst, Lumina Decision Systems, Inc, 26010 Highland Way, Los Gatos, CA, 95033, United States of America, xirong@lumina.com, Surya Swamy, Max Henrion, Costa Samaras

We use ATEAM (Analytica Transportation Energy Assessment Model) to explore a variety of scenarios to see how rapidly the US needs to adopt flex-fuel vehicles to consume the volume of biofuels productions set by the 2010 revision of the Renewable Fuel Standard, including high-blend E15 or E20 options.

■ WA04

C - Ballroom D4, Level 4

Decision Analysis II

Contributed Session

Chair: John Mamer, UCLA Anderson Grad. School of Mgmt., 110 Westwood Plaza, D518, Los Angeles, CA, 90095-1481, United States of America, jmamer@anderson.ucla.edu

1 - Value of Information in Spreadsheet Monte Carlo Simulation Models

Mike Middleton, Decision Toolworks, 2105 Buchanan St, San Francisco, United States of America, Mike@DecisionToolworks.com

For a spreadsheet planning model with uncertain inputs, value of information about each input is useful for evaluating information-gathering efforts and for comparing their importance. This paper describes non-macro computation methods for spreadsheet Monte Carlo simulation, calculation of value of information for each uncertain input, charts for presenting the results, and insights to be gained.

2 - The Role of Supply Chain Structure in the Food vs. Biofuel Tradeoff

Adaora Okwo, Georgia Institute of Technology, 765 Ferst Dr., Atlanta, United States of America, aokwo@gatech.edu

We present a micro model of the food vs biofuel tradeoff. Most macro models informing the policy discussion fail to incorporate contracting and downstream market power in the agricultural supply chain; both of which can significantly influence a farmer's decisions on which crops to supply and in which quantities. We present a two-echelon decentralized supply chain model to illustrate the impact of contract parameters and market power on the equilibrium supply response for food and energy crops.

3 - Corn Ethanol Plant Investment using Real Options Analysis

Dexin Luo, Geogia Institute of Technology, 765 Ferst Drive, Atlanta, GA, United States of America, dexin.luo@gatech.edu, Valerie Thomas

We apply real options analysis of entry-exit decision to corn ethanol plants with two different processes: dry-milling and wet-milling. We incorporate uncertainties regarding ethanol and corn prices and technical change. The study shows the influence of technical change on the investment decision of individual firms with comparison to the increase of dry-milling plants in the U.S.

4 - Dealing with the Growth of Knowledge

Norimasa Kobayashi, Assistant Professor, Tokyo Institute of Technology, 2-12-1 Ookayama, Meguro-ku, Tokyo, 152-8552, Japan, nkoba@valdes.titech.ac.jp

Binmore (2009) criticizes that our real decision environments are so essentially "large" that the complete state space assumption of Bayesianism does not hold. I model the growth of knowledge formalizing Popper (1935), and discuss how well the decision on incomplete decision analytic models perform in different circumstances. Particularly, I discuss that in non-cooperative games, incomplete mental models may result both in inefficiency and efficiency.

5 - Fire Sales and Search

John Mamer, UCLA Anderson Grad. School of Mgmt., 110 Westwood Plaza, D518, Los Angeles, CA, 90095-1481, United States of America, jmamer@anderson.ucla.edu, Steven Lippman

We study a model of asset sales via search with semi-rational buyers. A seller has a finite (or infinite) number of items to sell, independent buyers arrive according to a Poisson process. Each potential buyer knows the price of the last sale, and offers the minimum of his reservation value and the price of the last sale. As a result, the seller faces a falling offer distribution, each sales price setting the maximum offer for subsequent sales.

■ WA05

C - Ballroom D5, Level 4

Multicriteria Decision Making

Contributed Session

Chair: Judit Lienert, Dr., Eawag: Swiss Federal Institute of Aquatic Science and Technology, Ueberlandstrasse 133, P.O. Box 611, Duebendorf, CH-8600, Switzerland, judit.lienert@eawag.ch

1 - A Method for Multiobjective Optimization using Trust Region Method

Jong-hyun Ryu, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, ryuj@purdue.edu, Sujin Kim

We propose a method for approximating the Pareto front in a blackbox multiobjective problem. At each iteration, each objective function on a certain region (trust region) is approximated by a quadratic function, and a scalarization method is applied to collect points to approximate the Pareto front. The region is iteratively updated so as to maintain the spread of solutions. Numerical results are presented to demonstrate the effectiveness of the proposed algorithm.

2 - Evolutionary Computation-based Multi-objective Approach to Rehabilitate Interconnected Infrastructure

Avery White, Student, Texas A&M University, 3136 TAMU, College Station, TX, United States of America, sacredfaith@tamu.edu, Emily Zechman, Lufthansa Kanta, Alex Sprintson

In the event of urban fires, cascading failures between water and electrical distribution infrastructure systems may exacerbate municipal losses. Under-designed water distribution systems may be further disabled through power loss. This research takes an evolutionary computation-based approach to identify pipe replacement strategies for urban fire scenarios to provide fire flows, maintain water quality for normal operating conditions, and minimize pipe replacement costs.

3 - Application of Dynamic Multiobjective Programming to Supply Chain of Crude Oil

Moses Olusola Okesola, Student, University of South Africa, 9,Solomon Okonkwo Street, Unity Estate, Egbeda, Lagos, 234, Nigeria, okesolaj@yahoo.com

The Dynamic Multiobjective Programming (DMP) has been largely deficient in decision problems related to integrated supply chain of crude oil in literature.We tend to review developed methods for solving MOPP using DP technique and identify their deficiencies.The research will focus on upstream supply chain of crude oil in Nigeria by treating each activity along the supply chain separately with the grand objective to optimize return function from one stage to another.

4 - Reducing Pharmaceuticals in Hospital Wastewater - MCDA Multi-stakeholder Elicitation Challenges

Judit Lienert, Dr., Eawag: Swiss Federal Institute of Aquatic Science and Technology, Ueberlandstrasse 133, P.O. Box 611, Duebendorf, CH-8600, Switzerland, judit.lienert@eawag.ch, Peter Reichert, Nele Schuwirth

Pharmaceuticals in water bodies are of concern; they can be reduced by point source measures. In a project with engineers, natural, and social scientists, we studied two exemplary hospitals. We used MCDA to support the decision between 68 technological and organizational alternatives to reduce medicals. We elicited preferences from 26 stakeholders. Our elicitation procedure reduces the time demand, but remains methodologically satisfactory. We present elicitation challenges and main results.

■ WA06

C - Ballroom E, Level 4

Tutorial: New Developments for Solving Real World Optimization Problems by Marrying Simulation and Optimization

Cluster: Tutorials
Invited Session

Chair: Fred Glover, CTO, OpTek Systems, Inc., 1919 Seventh Street, Boulder, CO, 80302, United States of America, glover@opttek.com

1 - New Developments for Solving Real World Optimization Problems by Marrying Simulation and Optimization

Manuel Laguna, Professor, University of Colorado at Boulder, 419 UCB, Boulder, CO, 80309, United States of America, laguna@colorado.edu, Jay April, Marco Better

Companies invest billions of dollars each year in applications that can be handled by combining simulation and optimization. These notably include problems that involve uncertainty and complex nonlinearities, as in the areas of capital investment, workforce composition and management, energy resource and transmission planning, health care systems, financial portfolio optimization, production and inventory systems, security and emergency response planning. We identify latest advances and applications in these areas from combining simulation and optimization, together with opportunities for future applications.

■ WA07

C - Ballroom F & G, Level 4

Supply Chain Optimization I

Contributed Session

Chair: Shuang Chen, PhD Candidate, University of Florida, 285 Corry Village Apt 13, Gainesville, United States of America, scljj@ufl.edu

1 - A News-Vendor Model With External Fund Availability

Benjamin Melamed, Professor, Rutgers Business School - Newark and New Brunswick, 94 Rockafeller Rd., Piscataway, 08554, United States of America, melamed@rbs.rutgers.edu, Junmin Shi, Michael N. Katehakis, Ben Sopranzetti

The classical news-vendor (NV) problem is to find the optimal order quantity which maximizes the expected profit in a probabilistic demand framework. In this talk we present studies when there is external funding available. We treat the corresponding optimization problem as a capital-asset portfolio problem, and obtain the optimal ordering strategy. In addition, some risk issues, such as bankruptcy risk, have are discussed.

2 - A Model for Planning and Operating the Norwegian Seafood Value Chain

Peter Schütz, SINTEF Applied Economics, S.P. Andersens vei 5, Trondheim, Norway, peter.schutz@sintef.no, Kristin Uggen, Kjetil Midthun

We discuss a model for planning the slaughtering and processing of farmed salmon. The model also includes the operations of the well boats, such as loading conditions at the cages and cleaning before assigning them to new regions. The problem is subject to uncertainty, as the number of fish in a cage, their weight and size can only be estimated, but is unknown until the fish is slaughtered.

3 - The Optimum Base-Stock Levels in a Two-Echelon Supply Chain with Service Level Constraints

Yat-wah Wan, National Dong Hwa University, Institute of Logistics Management, Shou-Feng, Hualien, 974, Taiwan - ROC, ywan@mail.ndhu.edu.tw, Tsung-Shung Chang

In a two-echelon supply chain of non-zero replenishment lead times, retailers adopt base-stock policies and set minimum service levels. The objective is to find globally optimal base-stock inventory levels of the whole chain. Such levels are found from (i) the sample-path monotone properties of ordered quantities and of inventories on hand with respective to base-stock levels, and (ii) in some cases, the local optima of the objective function are decreasing with respect to base-stock levels.

4 - Optimizing the Kenya Coffee Supply Chain

Rose Karimi, Rutgers University, 1 Washington Park, Newark, NJ, 07102, United States of America, kiwanuka@pegasus.rutgers.edu, Yao Zhao

We compare the profitability of two models: the inventory control model and the selling-through model.In the first model based on current price information, a decision is made to either sell all or a portion of the coffee, or to hold the coffee in expectation of a more favorable price in the future while in the second model all coffee is sold.

5 - Case Pack Configuration and Procurement Planning

Shuang Chen, PhD candidate, University of Florida, 285 Corry Village Apt 13, Gainesville, United States of America, scljj@ufl.edu, Joseph Geunes

We consider a retail planning problem where retailers must order in case packs containing multiple individual products. We simultaneously consider case pack configuration and procurement decisions. We first solve this quadratically constrained quadratic program with integer variables using an exact linear method. Then we propose an integrated approach combining module design and lot sizing decisions, as well as an iterative heuristic. Our approaches perform very well compared to solver Baron.

■ WA08

C - Room 11A, Level 4

Joint Session Location Analysis/ MIF: Public-Sector Facility Location

Sponsor: Location Analysis/ Minority Issues
Sponsored Session

Chair: Michael Johnson, Associate Professor, University of Massachusetts Boston, Department of Public Policy/Public Affairs, 100 Morrissey Blvd., Boston, MA, 02125-3393, United States of America, michael.johnson@umb.edu

1 - A Multi Objective Available Coverage Model

Hari Rajagopalan, Assistant Professor, Francis Marion University, School of Business, P.O. Box 100547, Florence, SC, 29501, United States of America, hrajagopalan@fmarion.edu, Cem Saydam, Elizabeth Sharer, Kay Lawrimore

Demand for ambulances fluctuates spatially and temporally. Recent advances in computing and spatial data have enabled EMS managers to practice dynamic redeployment plans. In this paper we address the issue of redeployment by explicitly considering the number of redeployment trips to be made while meeting the coverage requirements with nearly minimal fleet size and develop fast heuristics. We present computational statistics using real data from Charlotte, NC.

2 - Equity Across Groups in Facility Location

Tammy Drezner, Professor, California State University, Fullerton, 800 State College Blvd., Fullerton, CA, 92834, United States of America, tdrezner@Exchange.fullerton.edu, Zvi Drezner

An equity model between groups of demand points is proposed. The set of demand points is divided into two or more groups. For example, rich neighborhoods and poor neighborhoods, urban and rural neighborhoods. We wish to provide equal service to the different groups by minimizing the deviation from equality among groups. The objective function, to be minimized, is the sum of squares of differences between all pairs of service distances between demand points in different groups.

3 - Solving a Multi-Period School Location Problem with Capacity Constrains using Tabu Search

Eric Delmelle, Assistant Professor, University of North Carolina at Charlotte, Department of Geography and Earth Scienc, Charlotte, NC, 28223, United States of America, Eric.Delmelle@uncc.edu, Jean-Claude Thill

In rapidly expanding areas, it may be necessary to build additional schools to meet anticipated demand. A tabu search algorithm is used to solve a multi-period capacitated p-median model, applied to a a school network location problem. The model is flexible as it allows facility closure.

4 - Foreclosed Housing Selection using Multi-Criteria Decision Models

Michael Johnson, Associate Professor, University of Massachusetts Boston, Department of Public Policy/Public Affairs, 100 Morrissey Blvd., Boston, MA, 02125-3393, United States of America, michael.johnson@umb.edu, David Turcotte, Rachel Drew

Acquisition of foreclosed housing for redevelopment is a key element of U.S. housing policy. This task requires balancing multiple criteria and assessing decision-maker preferences, which can be difficult to quantify. We describe a multi-criteria decision model for acquisition of real-estate-owned foreclosed housing in which we adapt methods from stochastic processes, urban economics and facility location to rank candidates for acquisition by a community-based organization.

■ WA09

C - Room 11B, Level 4

Empirical Studies in Operations Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, serguei.netessine@insead.edu

1 - Global Sourcing and Operational Performance
Karan Girotra, INSEAD, Boulevard De Constance, Fontainebleau, France, Karan.GIROTRA@insead.edu, Marcelo Olivares

This study aims to provide the first large-scale empirical estimates on the consequences of global sourcing on firm-level inventory performance. We compile a novel data-set by merging data from US customs manifests and public data on firm-level inventory performance. We estimate the impact of imports on inventory performance and the benefit of oft prescribed operational strategies: importing intermediate products (postponement) and importing low variability products.

2 - The Inventory Billboard Effect
Gerard Cachon, The Wharton School, 3730 Walnut St., JMHH Suite 500, Philadelphia, PA, 19104, United States of America, cachon@wharton.upenn.edu, Santiago Gallino, Marcelo Olivares

The challenges associated with identifying an inventory billboard effect are discussed. Then, using detailed data from car dealerships, we measure the extent that inventory drives sales.

3 - Organizational Structure, Trust and Sourcing
Anupam Agrawal, University of Illinois at Urbana-Champaign, Wohlers Hall, Champaign, IL, 61820, United States of America, anupam@illinois.edu

This paper focuses on the linkages between the organizational structure of a buying firm, its relationships with its suppliers, and the resultant incoming quality of components - how do these change dynamically? The research is based on ongoing practices at a leading automobile manufacturer. The sourcing related organizational arrangements are different in the car and truck making units of this firm, and lead to different results on the above two dimensions (quality and relationships).

4 - An Empirical Analysis of Service-based Strategies in the Automotive Industry: The Role of Warranties
Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, serguei.netessine@insead.edu, Morris Cohen, Jose Guajardo

We empirically analyze the role of warranties as part of the competitive strategy of car manufacturers, using data from the US automotive industry. Challenges in estimation, as well as implications for firms and consumers are discussed.

■ WA10

C - Room 12A, Level 4

Operations Economics

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Fuqiang Zhang, Washington State University in St. Louis, One Brookings Drive, St. Louis, MO, 63130, United States of America, fzhang22@wustl.edu

1 - Competition and the Value of Additional Replenishment Opportunity
Yen-Ting Lin, University of North Carolina, Kenan-Flagler Business School, Chapel Hill, NC, United States of America, Yen-Ting_Lin@unc.edu, Ali Parlakturk

We consider a manufacturer serving two competing retailers who sell their products during a selling season. The retailers place a regular order before the selling season begins. In addition, quick response allows a retailer to place a second order after better demand is obtained. We examine the value of this additional ordering opportunity for the retailers, manufacturer as well as the whole supply chain.

2 - Dynamic Price and Lead Time Quotation for MTO Systems with Contract Customers and Spot Purchasers
Baykal Hafizoglu, Arizona State University, Industrial Engineering, SCIDSE, 699 S. Mill Ave., #501, Tempe, AZ, 85281, United States of America, baykal@asu.edu, Esma Gel, Pinar Keskinocak

We consider dynamic price and lead time quotation for a MTO company with demand from contract customers and spot purchasers. Contract customers are offered a uniform price and lead time, and prioritized service. Spot purchasers are subject to dynamically quoted price and lead times, which they accept or reject with known probability. We discuss the potential of dynamic quotation, various properties of optimal control policies and the optimal mix of contract customers and spot purchasers.

3 - Horizontal Alliances and Mergers in Multitier Supply Chains
Soo-Haeng Cho, Assistant Professor, Tepper School of Business, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15215, United States of America, soohaeng@andrew.cmu.edu

Supply chains often consist of multiple tiers in each of which one or more firms compete. Firms that belong to the same tier often form alliances or merge together. The primary objective of such alliances or mergers is to reduce marginal costs through economies of scale in R&D and production. In this paper, we examine the effect of the cost-reducing alliances and mergers in one tier on non-participating firms in the same tier and on firms in the upstream or downstream tiers.

4 - Coordinating Capacity Investments in Joint Ventures
Philippe Chevalier, Professor, CORE, Université catholique de Louvain, Voie du Roman Pays 34, Louvain-la-Neuve, 1348, Belgium, Philippe.Chevalier@uclouvain.be, Guillaume Roels, Ying Wei

We model a strategic alliance between several manufacturing firms that decide to pool their resources so as to hedge their profits against demand variability. We propose a type of contract that coordinates capacity investments and compare this contract with several other contracts proposed in the literature.

■ WA11

C - Room 12B, Level 4

Finance/Operations Link: Flow Models

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Nico Vandaele, Professor, Katholieke Universiteiet Leuven, Naamsestraat 69, Leuven, Belgium, Nico.Vandaele@econ.kuleuven.be

1 - A Newsvendor Perspective on Value-based Performance and Risk Management
Gerd Hahn, Catholic University of Eichstaett-Ingolstadt, Auf der Schanz 49, Ingolstadt, 85049, Germany, gerd.hahn@kuei.de, Heinrich Kuhn

Economic Value Added (EVA) as a prevalent indicator of shareholder value creation is applied to the well-known newsvendor or cost-volume-profit model. An integrated approach to performance and risk management is developed exploiting properties of the EVA concept. We provide a managerial framework for decision-making considering the risk preference of the newsvendor. A numerical example is utilized to highlight implications of the presented approach.

2 - Working Capital Decisions in Supply Chains Under Consideration of Cost of Capital Rates
Erik Hofmann, Senior Lecturer, University of St. Gallen, Dufourstrasse 40a, LOG-HSG, St. Gallen, 9000, Switzerland, erik.hofmann@unisg.ch

In this paper, working capital decisions are extended to supply chains, due to the deficiencies resulting from a single-company perspective. The weighted cash conversion cycle (WCCC) is combined with the weighted average cost of capital (WACC) model. The amount of funds in an inter-organizational setting is considered, transforming the WACC from an exogenous into an endogenous decision figure. A numerical study illustrates several performance impacts on supply chain companies.

3 - Linking Operations and Finances: The Stochastic Lot Sizing Problem
Lien Perdu, Katholieke Universiteit Leuven, Naamsestraat 69, Leuven, 3000, Belgium, lien.perdu@kuleuven-kortrijk.be, Nico Vandaele

In contrast with a traditional cost model, we integrate a financial flow dimension in the stochastic lot sizing problem. The original model was built to optimize lead times and whereas the new objective function is based on the Economic Value Added concept, which allows a broader applicability.

4 - Analysis of Card Based Flow Control in a Make-to-Order Production Shop
Steven Harrod, Assistant Professor, University of Dayton, 1143 Ashburton Dr, Dayton, OH, 45459, United States of America, steven.harrod@udayton.edu, John Kanet

We examine the performance of a make-to-order production shop when a "pull" regimen (Kanban, Conwip, or POLCA) is enforced. After simulating random job routings, we conclude that flow control approaches do in fact reduce the number of jobs in process but total system inventory (including ready jobs) increases. Further we find that selection of priority rule has a greater influence on shop WIP than selection of a particular card based flow control system.

■ WA12

C - Room 13A, Level 4

Tactical and Operational Issues in Supply Chain Management

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Sila Cetinkaya, Professor, Texas A&M University, Industrial and Systems Engineering, College Station, TX, United States of America, sila@tamu.edu

Co-Chair: James Lavin, NC State University, 1321 Crab Orchard Dr #002, Raleigh, 27606, United States of America, jalavin@ncsu.edu

1 - Uniform vs Retailer-Specific Pricing in a Supply Chain
Asoo Vakharia, Professor, University of Florida, Department of ISOM, Gainesville, FL, 32611-7169, United States of America, asoo.vakharia@warrington.ufl.edu, Lan Wang

Should a supplier adopt a uniform or a retailer-specific price when selling a product to retailers with differing capabilities? Would the choice between these pricing strategies be moderated by the competitive market structure? Insights into this problem are provided for the cases of deterministic and stochastic end-product demand.

2 - An Order-up-to-level (OUL) Inventory Model with Stochastic Demand and Lead Times
Daniel Silva, OR Sr. Analyst, Kimberly Clark, Latin American Operations, KR 11A no 94 - 45, Piso 5, Bogota, Colombia, daniel.f.silvaizquierdo@kcc.com, Germàn Riaño

We extend a periodic review, stochastic demand model to include stochastic lead times. We assume Normally distributed lead-time demand and solve for expected fill-rate, we achieve a better approximation than traditional methods. There is no closed form solution for the optimal OUL, but the fill rate function is convex and we use iterative methods to solve. Simulation results confirm fill rate goals are met by our model, while traditional models over-shoot. Real data results will be presented.

3 - Stochastic Perturbed Demand Inventory Model
James Lavin, NC State University, 1321 Crab Orchard Dr #002, Raleigh, 27606, United States of America, jalavin@ncsu.edu, Anita Vila-Parrish, Russell King

Stockouts cause customers to lose faith in a retailer and potentially turn elsewhere to meet their future demands. Most inventory models use a penalty cost when a stockout occurs. An alternative first proposed by Schwartz (1966) instead discounts expected demand when stockouts occur through use of a "disappointment factor." We extend Schwartz's model for the case with stochastic demand.

4 - A Supply-side Rationale for a Firm to Bundle
Qingning Cao, PhD Candidate, University of Texas at Dallas, 800 West Campbell Road, Richardson, TX, 75080-3021, United States of America, qxc071000@utdallas.edu, Jun Hang, Kathryn Stecke

This paper examines a retailer's two-product bundling decision when the supply of one product is limited. This paper derives the retailer's optimal prices, stocking levels, and profits under unbundling and bundling. Demonstrating that limited supply can induce the retailer to bundle, this paper highlights a new supply-side rationale for bundling.

■ WA13

C - Room 13B, Level 4

Incentives in Service Operations

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Nitin Bakshi, Assistant Professor, London Business School, Sussex Place, London, NW1 4SA, United Kingdom, nbakshi@london.edu

Co-Chair: Sang-Hyun Kim, Assistant Professor, Yale University, 135 Prospect Street, New Haven, CT, 06520-8200, United States of America, sang.kim@yale.edu

1 - Optimal Preventive Maintenance Under Contracting
Sang-Hyun Kim, Assistant Professor, Yale University, 135 Prospect Street, New Haven, CT, 06520-8200, United States of America, sang.kim@yale.edu

We investigate how various maintenance service contracts impact the optimal structure and performance of well-known preventive maintenance policies, such as age replacement and block replacement policies. We focus on comparing the results with those found in the classical reliability theory literature.

2 - Delaying the Delay Announcements
Achal Bassamboo, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, a-bassamboo@kellogg.northwestern.edu, Gad Allon

This paper studies the impact of postponement of delay announcement on the ability of the firm to communicate non-verifiable congestion information to its customers as well as on the profits and utilities for the firm and the customers respectively. We show that this postponement can help the firm create credibility and augment the equilibrium language. However, in other settings this delay can also detract the equilibrium language.

3 - An Auction Mechanism for Optimal Procurement From Multiple Suppliers with Asymmetric Information
Yimin Yu, Assistant Professor, City University of Hong Kong, Hong Kong, yiminyu@cityu.edu.hk, Saif Benjaafar

We study a retailer offering a procurement contract through a sealed auction to multiple suppliers. The production cost and the capacity of each supplier are private information. We design a modified VCG type auction to achieve the first best such that it is a dominant strategy for each supplier to reveal its true information. Furthermore, this auction has the following appealing properties: (1)Individual rational; (2)No free riding; (3)Budget balanced; (4)Coalition proof for the retailer.

4 - Strategic Diagnosis and Pricing in Expert Services
Mehmet Fazil Pac, PhD Candidate, Wharton School of Business, University of Pennsylvania, 3730 Walnut Street, Jon M. Huntsman Hall, Office 527.6, Philadelphia, PA, 19104, United States of America, mpac@wharton.upenn.edu, Senthil Veeraraghavan

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.

■ WA14

C - Room 14, Level 4

Supply Chain Management VIII

Contributed Session

Chair: Wanxi Li, University of Wisconsin Milwaukee, 3202 N. Maryland Ave., Milwaukee, WI, 53201, United States of America, wanxili@uwm.edu

1 - The Influence of Psychological Contract Violation on Supply Chain Decision-Making Behaviors
Stephanie Eckerd, Ohio State University, 4943 Common Market Place, Dublin, United States of America, eckerd.2@osu.edu

Conflict is an inevitable phenomenon in buyer-supplier relationships. In the face of varying types of conflict, individuals may respond differently depending on the level of psychological contract violation experienced. We report the results of a behavioral experiment that determines how those in boundary-spanning roles respond to conflict in the supply chain, specifically evaluating their economic decisions before and after an occurrence of conflict.

2 - Procurement and Pricing in a Decentralized Multi-tier Assembly System
Wanxi Li, University of Wisconsin Milwaukee, 3202 N. Maryland Ave., Milwaukee, WI, 53201, United States of America, wanxili@uwm.edu, Xiang Fang

In a decentralized multi-tier assembly system, an assembler needs sets of modules produced by different module sub-assemblers, and each module needs multiple components purchased from different suppliers. The assembler faces stochastic demand. We characterize the equilibrium order quantity and pricing decisions, based on which we provide insights on the design of such multi-tier assembly systems.

■ WA15

C - Room 15, Level 4

Continuous Optimization

Contributed Session

Chair: John Carlsson, Assistant Professor, University of Minnesota, 111 Church St SE, 130C, Minneapolis, MN, 55455, United States of America, jgc@me.umn.edu

1 - The Scalar Equivalence of Optimization Criteria

Surachai Charoensri, University of Texas at Arlington, Arlington, TX, 76019, United States of America, surachai.charoensri@mavs.uta.edu, H. W. Corley

We show that existing optimization criteria are equivalent to the maximization of a real-valued function in a one-dimensional Euclidean space. All and only solutions to an optimization problem in the original criterion can be obtained by scalarization without the typical convexity/concavity assumptions on the original objective functions. Examples include minimax, Pareto, and set-valued optimization, as well as cone-ordered optimization in abstract spaces.

2 - Computational Studies of Randomized Multidimensional Assignment Problems

Mohammad Mirghorbani, The University of Iowa, 208 Engineering Research Facility, 330 S. Madison Street, Iowa City, IA, 52240, United States of America, smirghor@engineering.uiowa.edu, Paul Krokhmal

We propose a new heuristic approach for solving randomized multidimensional assignment problems (MAPs) with linear sum or bottleneck objectives that is based on recently obtained asymptotical properties of optimal value of random MAPs. The approach allows for drastic reduction of search space while guaranteeing high quality of the solution, and transforms the original problem into a maximum clique problem in multipartite graphs.

3 - Convex Relaxations for Cubic Polynomial Problems

Helder Inacio, Student, Georgia Institute of Technology, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, hinacio@isye.gatech.edu, Shabbir Ahmed, Matthew Realff

We study convex relaxations for problems with polynomial constraints with degree less than or equal to 3. Specifically for terms of the form x^2 y we derive convex nonlinear underestimators in a similar fashion to McCormick underestimators for bilinear terms. We compare these estimators with other convex underestimators.

4 - A Non-convex Geometric Partitioning Algorithm for Multi-vehicle Routing

John Carlsson, Assistant Professor, University of Minnesota, 111 Church St SE, 130C, Minneapolis, MN, 55455, United States of America, jgc@me.umn.edu

We consider a stochastic vehicle routing problem in which vehicle depot locations are fixed and client locations in a service region are unknown, but are assumed to be i.i.d. samples from a given probability density function. We present an algorithm for partitioning the service region into sub-regions so as to minimize the maximum workload of any vehicle when the service region is simply connected and point-to-point distances follow some "natural" metric, such as any L^{p} norm.

■ WA16

C - Room 16A, Level 4

Manufacturing II

Contributed Session

Chair: Paul E "Gene" Coffman, Jr, Technical Leader, Ford Motor Company, 6100 Mercury Drive, Dearborn, MI, 48126-2746, United States of America, gcoffman@ford.com

1 - Optimization of Stochastic Flow Lines using Exact Linear Programming Formulations

Raik Stolletz, Associate Professor, Technical University of Denmark, Department of Management Engineering, Lyngby, Denmark, raist@man.dtu.dk

Several sampling approaches have been proposed to analyze stochastic flow lines with finite buffer capacities. If the number of buffers is given, the performance can be evaluated via a Linear Programming formulation. This presentation shows linearization approaches if the number of buffers is a decision variable. We develop a two-step optimization approach, where a discrete time approximation is used to get a first solution to speed up the solution of the exact linearization.

2 - Forecasting Stochastic Lead Times

Jack Hayya, Professor Emeritus, Penn State University, School of Business, University Park, 16802, United States of America, jch@psu.edu, Uttarayan Bagchi

Consider the case of iid lead times, which theoretically cannot be predicted. However, these lead times are subject to order crossover which transforms the iid lead times to an AR(1) process. But this AR(1) process contains outliers which make the residuals nonnormal. So we fit an ARCH(1) model with t-residuals.

3 - Virtual Manufacturing at Ford Motor Company

Paul E "Gene" Coffman, Jr, Technical Leader, Ford Motor Company, 6100 Mercury Drive, Dearborn, MI, 48126-2746, United States of America, gcoffman@ford.com

Eight years ago, Ford launched a Virtual Manufacturing Center and initiated a strategy to significantly reduce launch concerns by verifying new vehicles virtually before physical prototypes are built and by simulating manufacturing operations early in a new vehicle program. Ford's recent success in customer satisfaction surveys is due in part to the 80% reduction in launch concerns achieved to date. We will describe the key elements of the strategy and the tools used to achieve these results.

■ WA17

C - Room 16B, Level 4

OR For Infrastructure Development in India

Cluster: OR/MS in India

Invited Session

Chair: Ashok Mittal, Professor, IIT Kanpur, IME Dept., IIT Kanpur, Kanpur, UP, 208016, India, mittal@iitk.ac.in

1 - Modeling Complex Aerospace Supply Chain With Delivery Guarantees

Dinesh Kumar, Professor, Indian Institute of Management Bangalore, Bannerghatta Road, Bangalore, Ka, 560076, India, dineshk@iimb.ernet.in

Aerospace has one of the complex supply chains that deals with assembly of millions of parts sourced from multiple vendors across the globe. Aircraft manufacturers expect their suppliers to deliver the parts just in time at their manufacturing facilities. In this paper we have used queueing models to analyse an assembly type manufacturing system with an objective to maximize the probability of on-time delivery of the parts.

2 - Optimal Route Selection in a Computer Integrated Raw Material Handling Complex of an Integrated Steel Plant

Salil K Dutta, SAIL- Durgapur Steel Plant India, TQM Deptt, Durgapur, 713203, India, salil_kumar_dutta@yahoo.co.in

For efficient operation of Raw Materials Handling Complex of an Integrated Steel Plant, a PC based System is conceptualized. Two interactive modules: i) Optimal Blend-mix Module based on a mathematical programming model ii) Route Selection and Prioritization Module based on a integer programming model in conjunction with a Heuristic, has been proposed.

3 - Understanding Passanger Switching Behavior and Yield Management for Indian Railways

Ashok Mittal, Professor, IIT Kanpur, IME Deptt, IIT Kanpur, Kanpur, UP, 208016, India, mittal@iitk.ac.in, Rahul Sharma

Indian rail provides different type of accomodation to rail passangers. For most of the trains seats in the choice class are not available until booked well in advance. We model the switching behavior of the passanges classified in different need categories. We use this behaviour to model yield management for Indian railways.

■ WA18

C - Room 17A, Level 4

OR in Practice I

Sponsor: CPMS, The Practice Section
Sponsored Session

Chair: Laura Galli, DEIS University of Bologna, Viale Risorgimento, 2, Bologna, 40136, Italy, l.galli@unibo.it

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - OR at Ford
Erica Klampfl, Technical Leader, Ford Research & Advanced Engineering, RIC Building, MD 2122, 2101 Village Rd, Dearborn, MI, 48124, United States of America, eklampfl@ford.com

I will provide a sampling of OR problems in areas such as Sustainability, Manufacturing, Purchasing, Product Development, Marketing, and Finance. We apply an analytical approach to understand the environmental implications of our products, enhance the sustainability of our business, and provide sound scientific input for corporate strategy and regulatory interactions.

2 - Robust Planning and Online Re-scheduling for the Train Routing Problem
Laura Galli, DEIS University of Bologna, Viale Risorgimento, 2, Bologna, 40136, Italy, l.galli@unibo.it, Alberto Caprara, Leo Kroon, Gabor Maroti, Paolo Toth

Train Routing is a problem that arises in the early phase of the passenger railway planning process. However, train delays often disrupt the routing schedules thus railway nodes are responsible for a large part of the delay propagation. In this paper, we propose robust models and re-scheduling algorithms for train routing, and design a simulation framework to evaluate and compare their effectiveness. We present computational results based on real-world data from the Italian railways.

3 - Combinatorial Model for Crew Scheduling in Train Transportation
Hector Ramirez Cabrera, CMM, Universidad de Chile, Avda. Blanco Encalada 2120, Santiago, Chile, hramirez@dim.uchile.cl, Jorge Amaya, Paula Uribe

This crew scheduling problem can be expressed as follows: given a set of crew teams (a pair composed by a driver and an assistant) and a set of trips (travel from one station to another one), the aim is to find an optimal allocation of these crews to the given trips satisfying operational constraints, such as labor laws, specific contract conditions, among others. The objective of our problem is to equilibrate the number of working hours realized by each crew in a given period of time.

■ WA19

C - Room 17B, Level 4

Computational and Robust Approaches to Inventory and Revenue Management

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Dan Iancu, IBM T.J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, dan.iancu@us.ibm.com

1 - A Dynamic Near-optimal Algorithm for Online Linear Program with Application to Revenue Management
Zizhuo Wang, Stanford University, 14 Comstock Cir, Apt 106, Stanford, United States of America, zzwang@stanford.edu, Yinyu Ye, Shipra Agrawal

We study a network revenue management problem where the customers come sequentially and decisions are made online. Our approach is distribution-free. We only assume that the customers come in a random order. By using a dynamic pricing algorithm where the prices come from the solution of a series of linear program, our algorithm is near-optimal given the initial inventory is large enough. This algorithm can be applied to a wide range of revenue management and resource allocation problems.

2 - A Geometric Characterization of the Power of Finite Adaptability in Multi-stage Stochastic Optimization
Andy Sun, Massachusetts Instititute of Technology, Operations Research Center, 50 Memorial Drive, Cambridge, MA, United States of America, sunx@mit.edu, Vineet Goyal, Dimitris Bertsimas

We show a significant role that geometric properties of the uncertainty sets, such as symmetry, play in determining the power of robust and finitely adaptable solutions in multi-stage stochastic and adaptive optimization problems. We propose good approximation solution policies with performance guarantees that depend on the geometric properties of the uncertainty sets. To the best of our knowledge, these are the first approximation results for the multi-stage problems in such generality.

3 - Distributionally Robust Pricing and Replenishment Decisions for Multiple Products
Dan Iancu, IBM T.J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, dan.iancu@us.ibm.com

In the current presentation, we discuss formulations and computational aspects related to determining pricing and replenishment policies for multiple products under uncertain customer demand. In particular, we look for policies directly parameterized in the model disturbances. Preliminary computational results, based on both synthetic, as well as real data from a large US retailer, are very promising, with adjustable policies considerably improving over open-loop decisions.

■ WA20

C - Room 18A, Level 4

Challenges and Perspectives in Price Demand Relationship

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Aihong Wen, PROS Holdings, Inc., 3100 Main St Suite 900, Houston, TX, 77002, United States of America, awen@prospricing.com

1 - Using Forecasts of Competitor Prices to Increase Sales
Evan Brott, Scientist, PROS, 3100 Main Street #900, Houston, TX, 77025, United States of America, EBROTT@prosrm.com

Accurate predictions of competitor prices are invaluable for developing pricing strategies. By analyzing market conditions and recent pricing actions, we show a method of calculating an array of expected future competitor prices. Businesses may utilize this array to position themselves at a preferred position relative to a major competitor. Additionally, we show how the array can be used as input into rank-based optimization, to maximize margins subject to the expected competitive landscape.

2 - A General Framework for using Customer Sensitivity to Execute Pricing Strategies
Ed Gonzalez, Associate Scientist, PROS, 3100 Main St, Suite 900, Houston, TX, 77002, United States of America, EGonzalez@prosrm.com

In this presentation, we demonstrate a general framework which allows for the automation of pricing strategies based on both business rules and fiscal goals. The main components of this framework are (1) developing price sensitivity (2) optimizing over given constraints and (3) measuring the effects of a pricing strategy at both the macro and micro level.

3 - Data Mining Techniques in Modeling Price Elasticity
Aihong Wen, PROS Holdings, Inc., 3100 Main St Suite 900, Houston, TX, 77002, United States of America, awen@prospricing.com

Modeling price elasticity has always been a key step in pricing optimization. This presentation discusses the motivation behind seeking data mining tools for this challenging task, as well as our proposals and case study.

■ WA21

C - Room 18B, Level 4

Carbon Reduction Policy Analysis

Sponsor: Service Science
Sponsored Session

Chair: Brian Jacobs, Assistant Professor, Michigan State University, Supply Chain Mgt Dept, N349 North Business Complex, East Lansing, MI, 48824-1122, United States of America, jacobsb@bus.msu.edu

1 - Investment Planning for Electricity Generation Expansion Under CO2 Emission Reduction Policies
Dong Gu Choi, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, doonggus@gatech.edu, Valerie Thomas

As electricity demand increases and existing power plants age, electricity generators decide on supply technologies for new investment. This talk addresses the effects of CO2 emission reduction policies on the investment decision of an electricity generating firm. A dynamic programming model,incorporating policy uncertainty, is developed for technology investment choice.

2 - China's Regional CO2 Emissions: Characteristics and Emission Reduction Policies

Lei Meng, Xi'an Jiaotong University, Box 1875, No.28 Xianning West Road, Xi'an, 710049, China, mleenig@gmail.com, Yong Xue, Ju'e Guo

This paper analyzes the characteristics of regional CO2 emissions in China, using province level panel data from 1997 to 2007. The results show that there're remarkable regional disparities among eastern coastal, midland and western areas. In view of uneven regional development and reverse distribution of energy resources and consumption, the CO2 emission reduction policies need customized combination of tax, price, investment and transfer payment to meet the actual situation in various areas.

3 - Shareholder Value Effects of Voluntary Emissions Reductions

Brian Jacobs, Assistant Professor, Michigan State University, Supply Chain Mgt Dept, N349 North Business Complex, East Lansing, MI, 48824-1122, United States of America, jacobsb@bus.msu.edu

Recent empirical evidence has demonstrated that the stock market reacts negatively to firm announcements of voluntary emissions reductions. In this work, we study how certain contextual factors influence the market reaction. Factors include the type of emission (regulated or unregulated), firm and industry characteristics, energy prices, and whether the firm's announcement was standalone or part of a government or NGO initiative.

4 - Optimal Fuel Conversion Strategy of Power Plant Under Different Carbon Policies

Xiaohua Wu, Rensselaer Polytechnic Institute, 903 Peoples Ave Apt 3, Troy, NY, 12180, United States of America, wux4@rpi.edu, Aparna Gupta

The carbon policy will accelerate the fuel type conversion process. In this paper, a general model of optimizing the long term fuel conversion strategy of a generator under different carbon policies is built and analyzed. The stochastic price evolutions of fuels, electricity and carbon emission are modeled to identify the impact of market fluctuations. Key decision factors are optimized to achieve the generator's best economic performance and create a framework to assess policy impact.

■ WA23

C - Room 18D, Level 4

Optimization in the Service Sector

Sponsor: Service Science
Sponsored Session

Chair: Ada Barlatt, Assistant Professor, University of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, abarlatt@uwaterloo.ca

1 - Public School's Meal Program: Finding the Best Cost-effective Menu

Betzabe Rodriguez, Assistant Professor, University of Puerto Rico at Mayaguez, Call Box 9000, Mayaguez, PR, 00681, Puerto Rico, betzabe.rodriguez@upr.edu, Magaly Gonzalez

Meal's assortment highly affects the operational costs in the supply chain for the Puerto Rico School's Meal Program (PRSMP). The government must comply with nutritional and service requirements while balancing delivery frequencies and transportation costs. We have developed a mathematical formulation for the operational costs of the food supply chain, with the objective to find a low cost meal's assortment for the PRSMP.

2 - Applying Value-at-Risk and Conditional Value-at-Risk to the Selective Newsvendor

Arleigh Waring, University of Michigan, 1205 Beal Ave, Ann Arbor, MI, 48109, United States of America, awaring@umich.edu

The selective newsvendor considers a single product firm that sells to several different markets in a single selling season. The firm decides which markets to serve and the total inventory to procure a priori. We evaluate the selective newsvendor using two common risk measures: Value-at-Risk and Conditional Value-at-Risk. We show the optimal order quantity and describe a selection criterion for the markets to serve and then compare the inherent tradeoffs between the two methods.

3 - Evaluating Tradeoffs in Implementing Alternative Workweek Schedules

Ada Barlatt, Assistant Professor, University of Waterloo, Department of Management Sciences, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, abarlatt@uwaterloo.ca, Juan Vera

Climate change, 24/7 retail outlets, and technological advances have led to changes in the way people work. Around the globe, employees are switching to from the traditional 9AM to 5PM schedule to alternative workweek (AWW) schedules. In this presentation we will discuss the models developed to evaluate the tradeoffs between the benefits (e.g., increased operating hours) and the concerns (e.g., facilitating employee communication) in implementing AWW schedules.

■ WA24

C - Room 19A, Level 4

Network Models for Counterterrorism

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Susan Martonosi, Assistant Professor, Harvey Mudd College, Department of Mathematics, 301 Platt Boulevard, Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu

1 - A Network Flow Approach to Terrorist Network Disruption

Susan Martonosi, Assistant Professor, Harvey Mudd College, Department of Mathematics, 301 Platt Boulevard, Claremont, CA, 91711, United States of America, martonosi@math.hmc.edu, Doug Altner

We present a new network disruption technique that tries to make otherwise secretive members of a terrorist group more visible. Through vertex deletion, this technique forces the secretive members to increase their participation in network communication. This talk will illustrate our disruption metric based on network flows, address graph-theoretic characteristics of promising vertices to target and discuss some computational challenges.

2 - Diverting Communication Through a Clandestine Leader in a Social Network

Doug Altner, Assistant Professor, United States Naval Academy, United States of America, altner@usna.edu, Susan Martonosi

This talk investigates the following optimization problem: given a social network with a key vertex and a finite budget for deleting vertices, which vertices should be deleted to maximize the amount of communication that must be sent through the key vertex if the amount of communication between each pair of vertices equals the maximum flow between them? We present a meta-heuristic approach to this problem as well as computational results.

3 - Tradeoffs in the Structure of Terrorist Networks

Alexander Gutfraind, Postdoctoral Fellow, Los Alamos National Laboratory, Theoretical Division, Mail Stop B284, Los Alamos, NM, 87545, United States of America, gfriend@lanl.gov

Terrorist groups and other secret societies have a network structure reflecting their objectives of survival and attack. This talk will introduce a model that quantifies those using discrete optimization. Solving the model shows that the optimal structure of such networks is based on cells. Open non-violent activism pays under just two conditions: extreme tolerance and extreme repression. The model can also be used to design vital infrastructure networks.

4 - Counter-Radicalization Influence Campaigns and Social Networks: What Does the Data Say?

Richard Colbaugh, Sandia National Laboratories/New Mexico Tech, 22 Camino Don Carlos South, Santa Fe, NM, 87506, United States of America, rcolbau@sandia.gov, Kristin Glass

This talk presents results of a model-based, empirically-grounded study of social networks and influence campaigns and summarizes the practical implications of these findings. Interestingly our investigation reveals that some conventional wisdom regarding social networks and influence is either incomplete or incorrect. We consider two main topics: 1.) understanding influence generation/propagation/-measurement as network dynamics phenomena, and 2.) roles for social media in influence campaigns.

■ WA25

C - Room 19B, Level 4

Transportation, Intelligent Systems II

Contributed Session

Chair: Ali Guner, Research Assisstant, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, arguner@wayne.edu

1 - A Real Time Dynamic Rideshare System

Ali Haghani, Professor, University of Maryland, College Park, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, haghani@umd.edu, Keivan Ghoseiri, Hadi Sadrsadat, Masoud Hamedi

This paper presents an optimization model for a real-time dynamic rideshare system. The model maximizes the overall system performance in real time subject to ride availability, capacity, and passenger and driver time window constraints while considering users' preferences. Model formulation and results are presented.

2 - Robust Multiple Priority Traffic Signal Control with Vehicle-to-Infrastructure Communication Systems

Qing He, University of Arizona, 1127 E James E. Rogers Way, Tucson, AZ, 85721, United States of America, heqing@email.arizona.edu, Larry Head, Jun Ding

This paper examines the multiple priority problems in traffic signal control under the condition that vehicle-to-infrastructure communication is available. Given the current multiple priority request information from on-board equipment (OBE), a robust MILP is developed with actuated control integrated to mitigate the delay for both vehicles with priority and passenger cars. A numerical experiment with VISSIM and GAMS shows the effectiveness of proposed approach.

3 - Relationship of Pretrip Traveler Information System to Non-motorized and Public Traffic in China

Yi Zhang, School of Transportation Engineering, Tongji University, No.4800 Cao'an Road, Shanghai, China, Shanghai, China, darrenzhy@gmail.com, Meiping Yun, Xiaoguang Yang

Traveler information system is able to change travelers' travel behavior and alleviate congestion. Based on a Travel Desire Survey in Zhongshan City, China, the relationship of pretrip traveler information system to non-motorized and public traffic was examined. The commuters' propensity to change travel mode from private car to non-motorized and public traffic was obtained. It is also showed that the propensity would vary in the context of different trip distance and travelers' characteristics.

4 - Dynamic Routing in Stochastic Time-Dependent Networks for Milk-Run Tours with Time Windows

Ali Guner, Research Assisstant, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, arguner@wayne.edu, Ratna Babu Chinnam, Alper Murat

JIT requires frequent and reliable pick-ups and deliveries within specified time windows. However, growing congestion on road networks is increasing variability in travel times, making it difficult to achieve efficient and reliable deliveries. We investigate the impact of utilizing real-time ITS information to route the vehicle. Our dynamic routing algorithm handles milk-run tours under a TSP framework, while modeling congestion on arcs as stochastic and time-dependent congestion states.

■ WA26

C - Room 4A, Level 3

Data Mining and Knowledge Discovery in Health Care

Sponsor: Data Mining
Sponsored Session

Chair: Durai Sundaramoorthi, Assistant Professor, Missouri Western State University, 4525 Downs Drive, Saint Joseph, MO, 64507, United States of America, dsundaramoorthi@missouriwestern.edu

1 - An Adaptive Pain Management Framework

Ching-Feng Lin, Student, UTA, 212 S Cooper St. #220, Arlington, TX, 76013, United States of America, ching-feng.lin@mavs.uta.edu, Victoria Chen, 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 this 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.

2 - The Role of Insurance Claims Databases in Healthcare Research

Yihan Guan, PhD Candidate, Stanford University, Huang Engineering Center 212F, Stanford, CA, 94305, United States of America, yihan@stanford.edu, Margret Bjarnadottir

Health insurance claims data have been used in a wide spectrum of health care research during the past two decades, including studying drug therapy outcomes, assessing quality of care, estimating population disease burden, predicting health care cost, and detecting adverse drug effects. This talk discusses the evolution of applications of claims data, the current research frontier associated with claims data, and some future opportunities.

3 - Analyzing Patient Discharge Data From an Urban Hospital using Data Mining Techniques

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, Xiaochun Jiang, Lauren Davis

As aging is beginning to impact the baby boom generation, they begin to experience more chronic diseases and need more inpatient care. To deal with this trend, hospitals need to reduce the average length of stay (ALOS). In this study, data mining techniques were used to analyze the inpatient discharge data from an urban hospital. Four models were built to predict ALOS. Our results indicated that the Ensemble model was the best fit and age and chronic disease were the important predictors.

4 - Examining Relationships Between Medical Home and Patient Experience

Sharon Johnson, Associate Professor, Worcester Polytechnic Institute, Department of Management, 100 Institute Road, Worcester, MA, 01566, United States of America, sharon@wpi.edu, Edward Westrick, Lori Pelletier

The Patient-Centered Medical Home (PCMH) is a new model for comprehensive primary care that seeks to strengthen the physician-patient relationship. This exploratory study utilizes Pearson correlation coefficients to examine relationships between PPC-PCMH Survey results, which measure adoption of PCMH structures, and patient experience data. The results show an unexpected negative correlation between the PPC-PCMH structures of access and communication and the related patient experience measure.

■ WA27

C - Room 4B, Level 3

Linear Programming

Contributed Session

Chair: Holly Floyd, Texas State University-San Marcos, 250 S. Stagecoach Trl. #136, San Marcos, United States of America, hf1046@txstate.edu

1 - Explore the Higher-Order Rescaling Perceptron Algorithm

Dan Li, Department of Industrial and Systems Engineering, Lehigh University, 200 West Packer Ave, Bethlehem, PA, 18015, United States of America, dal207@lehigh.edu, Tamàs Terlaky

The rescaling perceptron algorithm solves LO problems with high probability in $O(n\ln(1/r))$ iterations, where r is the radius of the largest inscribed ball. It uses one vector to rescale the system at each iteration. We realize rescaling by using parallel processors and several vectors in one higher-order step. We explore how the number and quality of vectors affect the rescaling rate. With properly chosen vectors, we get better rescaling rates and improve the complexity.

2 - A New Method to Solve Linear Programming Problems

Oscar Buitrago, Professor, Universidad Libre de Colombia, oscary.buitragos@unilibrebog.edu.co, osyesu@gmail.com, Bogotà D.C, Colombia, oscary.buitragos@unilibrebog.edu.co, Andres Ramirez

Many methods have been developed for solving LP problems, including the famous Simplex and interior point algorithms. In this study a new procedure for solving LP problems is described, based on orthogonal projections that move through the polyhedron frontier which defines the feasible region until it reaches the optimal point.

3 - Optimal Deployment Plan of Emission Reduction Technologies

Muhammad Bari, Student, Texas A&M University, University Dr., College Station, TX, 77843, United States of America, ehsanulbarihome@yahoo.com, Josias Zietsman, Luca Quadrifoglio, Mohamadreza Farzaneh

The objective of this research was to develop methodologies for optimal deployment of emission reduction technologies for non-road equipment in a cost effective and optimal manner. The multi-objective problem consists of two weighted objectives, (i) maximizing NOx reduction and (ii) maximizing fuel savings. The models developed in this study serves as a tool to assist the decision makers to decide about the deployment preference of technologies.

4 - A Multi-Period Energy and CO2 Emission Optimization Toward Sustainable Automotive Manufacturing

Seog-Chan Oh, Senior Researcher, General Motors R&D, 30500 Mound Road, Warren, MI, 48090, United States of America, seog-chan.oh@gm.com, Stephan Biller

Fluctuating energy prices and enactment of climate change legislations add increasing uncertainty in costs associated with energy and CO2 emission for automotive companies. To combat the challenges, we propose a mixed-integer optimization model to maximize the reduction of energy and CO2 emission costs for the automotive manufacturing process. Given a multi-year budget, we analyze different scenarios, assuming different impacts of energy prices and environmental regulations.

■ WA28

C - Room 4C, Level 3

Health Management of Complex Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Qingyu Yang, Assistant Professor, Wayne Sate University, 4815 Fourth Street, Detroit, MI, 48202, United States of America, qyang@wayne.edu

Co-Chair: Jian Liu, Assistant Professor, University of Arizona, Rm 268, 1127 E. James E. Rogers Way, Tucson, AZ, 85741, United States of America, jianliu@email.arizona.edu

1 - Multi-level Multi-State Information Integration for System Performance Prediction

Jian Liu, Assistant Professor, University of Arizona, Rm 268, 1127 E. James E. Rogers Way, Tucson, AZ, 85741, United States of America, jianliu@email.arizona.edu

Heterogeneous data available at different levels of a complex system create great opportunity to more accurately predict the system level performance. This research provides a Bayesian approach that simultaneously combines multi-state event data of interdependent components and subsystems. A simulation example demonstrates the capability of the approach.

2 - Sensor Recovery in Multivariate Condition Monitoring Systems

Haitao Liao, Assistant Professor, The University of Tennessee, 211 Pasqua Building, Knoxville, TN, 37996, United States of America, hliao4@utk.edu, Jian Sun

Loss of sensor readings due to malfunction of connectors and/or sensors is crucial to fault diagnosis and prognosis in a multichannel condition monitoring system. To improve the operational reliability of the overall system, effective sensor recovery becomes an important, value added technique. This work addresses a statistical sensor recovery methodology to enhance multichannel condition monitoring.

3 - Power Reliability Management in Smart Grids via Virtual Energy Provisioning

Tongdan Jin, Texas State University, 601 University Drive, San Marcos, TX, 78666, United States of America, tj17@txstate.edu, Ying Yu, Mahmoud Mechehoul

We propose a novel demand side management concept called Online Purchase Electricity Now (OPEN) to minimize load variations and generation uncertainties caused by renewable energies. The OPEN system allows customers to order and request advanced electricity via the Internet as if performing online purchasing. It aims for customers to achieve "order exactly what they need, and consume exactly what they ordered". The new concept has great potentials and promises for smart grid technologies.

4 - Failure Profile Analysis of Repairable Systems

Qingyu Yang, Assistant Professor, Wayne Sate University, 4815 Fourth Street, Detroit, MI, 48202, United States of America, qyang@wayne.edu, Yong Chen, Yili Hong, Jianjun Shi

The relative failure frequency among major failure modes of a repairable system is referred to as failure profile. Identification of failure profile can provide valuable information for system design and maintenance management. In this research, a statistical model and two testing procedures are developed to study the statistical properties of the failure profile. The efficiency of the developed methods is verified by a case study of a high throughput screening (HTS) process.

■ WA29

C - Room 5A, Level 3

Renewable Energy Integration Into Power Systems for Smart Operations

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Eunshin Byon, PhD, Postdoctoral Research Associate, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77840, United States of America, esbyun@neo.tamu.edu

1 - Impact of Environmental Factors to the Degradation of Solar Photovoltaic Module

Rong Pan, Assistant Professor, Arizona State University, Sch Compt Infor & Dec Sys Engr, Tempe, AZ, 85287, United States of America, Rong.Pan@asu.edu

To make the solar energy economically competitive, PV manufacturers typically provide 20-30 year warranties to their customers. In this talk, we present a practical approach to weather modeling and its usage in PV module degradation analysis. We have analyzed the performance data of several PV modules collected over a long time of period (approximately 15 years). These data will be used to demonstrate the methodology to be developed in this study.

2 - Hierarchical Simulation Modeling Framework for Electrical Power Quality and Capacity

Esfandyar Mazhari, University of Arizona, 1127 East James E. Rogers Way, Tucson, AZ, 85721-0020, United States of America, emazhari@email.arizona.edu, Young-Jun Son

A two level hierarchical simulation modeling framework is proposed for an electric power network involving PV-based solar generators, various storage units, and grid, where the lower level model concerns power quality and the higher level model concerns capacity. The higher level is based on agent-based modeling while the lower level is based on circuit-level, continuous time modeling. An integration and coordination framework is developed, and it is demonstrated with a utility level scenario.

3 - Reliability Issues in Power System Planning and Operation with Renewable Energy Sources

Chanan Singh, Regents Professor, Texas A&M University, Department of Electrical & Computer Engi, College Station, TX, 77843, United States of America, singh@ece.tamu.edu

Renewable energy sources are fast penetrating the power grid. It is estimated that wind power alone may be close to 20 percent of the power scenario in America and many European nations have similar targets.Such significant penetrations of renewable energy pose considerable challenges for power system reliability in planning and operation. This presentation will review this problem and share some results to model and analyze the impact of their integration on reliability of the power grid.

4 - Virtual Models of Wind Turbines

Andrew Kusiak, Professor, The University of Iowa, Mechanical and Industrial Engineering, Iowa City, IA, 52242, United States of America, andrew-kusiak@uiowa.edu

Complex nature of the wind, makes modeling wind turbines is a major challenge. Data mining offers algorithms for modeling wind turbines. A methodology for the development of virtual models of wind turbines is presented. The virtual models are developed and tested with data collected at a wind farm. Several data-mining algorithms for parameter selection and model extraction are analyzed. The research results are illustrated with industrial case studies.

■ WA30

C - Room 5B, Level 3

Reliability III

Contributed Session

Chair: Elias Keedy, PhD Student, University of Houston, S350 Engineering Bldg 1, Houston, TX, 77204, United States of America, eliekeedy@yahoo.com

1 - Reliability Modeling in the Design of a New Energy Concept

Sarah Riddell Powers, Lawrence Livermore Natl Lab, 7000 East Avenue, L-153, Livermore, CA, United States of America, powers22@llnl.gov

Laser Inertial Fusion Energy (LIFE) is an advanced energy technology under development at LLNL. Achieving high system availability is a key project goal for the economic competitiveness of LIFE. A model is developed to simulate and study the reliability of various system designs, maintenance strategies and optimal spare component levels. Results show the advantage of design modularity in achieving high system availability without needing high component reliability thus expediting time to market.

2 - Optimal Maintenance for Linear Consecutively Connected Systems

Rui Peng, Department of Industrial and Systems Engineering, National University of Singapore, Singapore, ISE Department, BLK E1A, NUS, Singapore, Singapore, Singapore, g0700981@nus.edu.sg, Gregory Levitin, Szu Hui Ng, Min Xie

This paper considers a linear multi-state consecutively connected system (LMCCS) consisting of N+1 linear ordered elements. Each element can provide a connection between the position in which it is allocated and the next few positions. The system fails if the first element is not connected with the (N+1)th element. A framework is proposed to solve the cost optimal maintenance strategy of the system subject to reliability requirement.

3 - Comparative Study of Stochastic Models to Estimate Reliability of Infrastructure Systems

Raha Akhavan-Tabatabaei, Assistant Professor, Universidad de los Andes, Cra 1 Este # 19A-40, Bogotà, Colombia, r.akhavan@uniandes.edu.co, Edgar Mauricio Sànchez Silva, Juan Sebastian Borrero

We consider the problem of infrastructure reliability subject to progressive deterioration and shocks. We consider the deterioration mechanisms and compare the performance of various stochastic models in describing the remaining life of a component. Some conclusions are shown and stochastic models are classified according to their efficiency.

4 - Reliability and Maintenance of Stents Based on Probabilistic Analysis of Multiple Failure Processes

Elias Keedy, PhD Student, University of Houston, S350 Engineering Bldg 1, Houston, TX, 77204, United States of America, eliekeedy@yahoo.com, Qianmei Feng

The high demand in counteracting the effects of atherosclerosis and the ignorance of the probabilistic aspects in existing studies make the investigation of stents reliability a competitive concern. Based on fracture mechanisms, we analyze two processes: delayed and instantaneous failures. General reliability and maintenance models are developed to acquire an optimal replacement policy of stents. Our work provides new perspectives on approaching reliability concepts in medical devices evolution.

■ WA31

C - Room 5C, Level 3

Forecasting I

Contributed Session

Chair: Ozden Gur Ali, Koc University, Sariyer, Istanbul, Turkey, oali@ku.edu.tr

1 - Social Media Aided Event Forecasting

Mohammad Ali Abbasi, PhD Student, Arizona State University, 699 S. Mill Ave. #553, Attn: Mohammad Ali Abbasi, Tempe, AZ, 85281, United States of America, ali.abasi@asu.edu

We introduce a novel method to forecast social events and behaviors of communities in the society. We've crawled tweets and blog posts of specific groups for a period of 5 months and classify them using opinion mining methods to extract members' intention for specific events. Simultaneously we track the communities' real (on the ground) activities. Experiments showed that with enough number of online activities we can forecast the events related to the communities with high confidence.

2 - Time Series Forecasting in Oracle Crystal Ball

Samik Raychaudhuri, Oracle Americas Inc., 2033 N Fork Dr, Lafayette, CO, 80026, United States of America, samikr@gmail.com, Eric Wainwright

In this presentation we will have an overview of the functionality provided by Oracle Crystal Ball's (CB) Predictor engine. CB Predictor has an intuitive interface for selecting, managing and cleaning data, outlier detection and filling in missing values, running multiple seasonal and nonseasonal forecasting algorithms and regression on large datasets, and a coherent way of presenting and extracting results or generating reports. We will also have a sneak preview of forthcoming features.

3 - Using Conditional Kernel Density Estimation for Wind Power Density Forecasting

Jooyoung Jeon, University of Oxford, 2 Alan Bullock Close, St Clements, Oxford, United Kingdom, joo.jeon@smithschool.ox.ac.uk, James Taylor

Wind power is recognized as one of the most promising renewable energy resources. Despite great benefits from wind power density forecasting, most research has focused on point forecasting. We develop a novel approach to producing wind power density forecasts. The inherent uncertainty in wind speed and direction and the stochastic relationship of wind power to wind speed and direction are addressed using Monte Carlo simulation of a VARMA-GARCH model and conditional kernel density estimation.

4 - Driver Moderator Model - Mining with Domain Knowledge

Ozden Gur Ali, Koc University, Sariyer, Istanbul, Turkey, oali@ku.edu.tr

We devise an interpretable method that predicts SKU sales as a function of the pricing, promotion and product availability decisions by the retailers consistently across similar situations. The method results in interpretable models, leverages domain knowledge, does concurrent model estimation and feature selection and relies on data pooling for generalization capability. We evaluate our method with two multi-store large scale grocery databases from Turkey and the USA.

■ WA32

C - Room 6A, Level 3

Applications and Heuristics Methods in Integer Programming

Sponsor: Computing Society
Sponsored Session

Chair: Haibo Wang, Assistant Professor, Texas A&M International University, 5201 University Blvd, Laredo, TX, 78041, United States of America, hwang@tamiu.edu

1 - An Approach for Parallel Machine Job Scheduling Problem with Interrelated Processing Times

Bahram Alidaee, The University of Mississippi, School of Business, University, United States of America, balidaee@bus.olemiss.edu, Haibo Wang

This paper addresses the parallel machine job scheduling problem with interrelated processing times, which has applications in many areas such as storage allocation in computer design, organization restructuring, continuous project scheduling, and scheduling in political campaigns. we present a quadratic unconstrained binary optimization(QUBO) model and solve it with a neighborhood search heuristic. The computational time and the optimization gap reduction are reported.

2 - Solving Large Max Cut Problems using Tabu Search

Gary Kochenberger, Professor, University of Colorado at Denver, 1250 14th Street, Denver, 80217, United States of America, Gary.Kochenberger@ucdenver.edu, Haibo Wang, Fred Glover, Zhipeng Lu, Jin-Kao Hao

Large Max Cut Problems continue to pose a challenge for most approaches presented in the literature. In this paper we report our experience with a new Tabu Search approach for the general unconstrained binary quadratic program as it is applied to max cut test problems. Best known results on many instances with up to 10,000 vertices are reported.

3 - Warehouse Management - Cross Docking

Jun Huang, Texas A&M International University, United States of America, huangjundragon@sina.com, Haibo Wang

Warehouse management is a critical topic in logistic research field. The warehouse is divided into several functional areas such as reserve storage area, order picking area and cross docking. This study will combine the cross docking problem with storage area layout design and products allocation by using the graph partition method as finding a partition of the vertices of a given graph into subsets satisfying certain properties. Thus, the aforementioned problem can be solved more properly.

■ WA33

C - Room 6B, Level 3

Integrating Constraint Programming and OR

Sponsor: Computing Society
Sponsored Session

Chair: Tallys Yunes, Department of Management Science, University of Miami, Coral Gables, FL, 33124-8237, United States of America, tallys@miami.edu

1 - Relaxation Based on Multivalued Decision Diagrams

John Hooker, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, United States of America, john@hooker.tepper.cmu.edu, Sam Hoda, Willem-Jan van Hoeve

We solve scheduling problems with a branching method in which a multivalued decision diagram (MDD) plays the role of both the linear relaxation in mixed integer programming and the constraint store in constraint programming. We obtain order-of-magnitude speedups on problems with multiple "among" constraints, which are used in employee scheduling, assembly line sequencing, etc.

2 - A Logic-Based Benders' Decomposition Approach for Solving an Aircraft Maintenance Scheduling Problem

J. Christopher Beck, University of Toronto, 5 King's College Rd, Toronto, ON, M5S 3G8, Canada, jcb@mie.utoronto.ca, Maliheh Aramon Bajestani

We address a flight maintenance problem where the goal is to schedule maintenance jobs to maximize the expectation that an existing flying program will have a full complement of aircraft. The schedule must consider the aircraft failure probabilities and maintenance capacities. We present a logic-based Benders' decomposition that exhibits multiple orders-of-magnitude improvement over an existing mixed-integer programming model.

3 - Improving the Held and Karp Approach with Constraint Programming

Willem-Jan van Hoeve, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, vanhoeve@andrew.cmu.edu, Michel Rueher, Jean-Charles Régin, Louis-Martin Rousseau

We show that domain filtering algorithms developed for the weighted spanning tree constraint can be adapted to the Held and Karp procedure to solve the TSP. In addition, we introduce a special-purpose filtering rule based on the underlying mechanisms used in Prim's algorithm. Finally, we explore two different branching schemes to close the integrality gap.

■ WA34

C - Room 7, Level 3

Joint Session ICS/ Complex/ QSR: Sensing, Prediction and Prognostics in Complex Systems

Sponsor: Computing Society/ Complex Systems/ Quality, Statistics and Reliability
Sponsored Session

Chair: Satish Bukkapatnam, Professor, Oklahoma State University, 318, Enginnering North, School of Industrial Engineering, Stillwater, OK, 74075, United States of America, satish.t.bukkapatnam@okstate.edu

1 - Willingness-to-Pay Prediction using Empirical Mode Decomposition and Local Gaussian Process

Satish Bukkapatnam, Professor, Oklahoma State University, 318, Enginnering North, School of Industrial Engineering, Stillwater, OK, 74075, United States of America, satish.t.bukkapatnam@okstate.edu, Changqing Cheng, Akkarapol Sa-ngasoongsong

Prediction of customer preferences over time is important for effective design of a product portfolio. However, the preferences evolution follows a nonlinear and nonstationary dynamics. We present two new approaches, based a local gaussian process (LGP) and empirical mode decomposition (EMD) for accurate prediciton of customer willingness-to-pay (WTP).

2 - Identification of a Mixture of Hidden Markov Models using Metaheuristic Search

Dragan Djurdjanovic, Assistant Professor, The University of Texas at Austin, 1 University Station, C2200, ETC 5.122, Austin, TX, 78712, United States of America, dragand@me.utexas.edu, Michael Cholette

Mixture of Hidden Markov Models (HMMs) was recently proposed for modeling of degradation of systems working under variable operating conditions. We present a method for identification of a mixture of HMMs from a sequence of observations corresponding to a known sequence of operating conditions. The method utilizes a metaheuristic search to initialize the Baum-Welch algorithm and maximize the likelihood of observations.

3 - Weather Forecasts and Power Grid Operations

Victor Zavala, Argonne National Laboratory, Math and Comp. Science Div., Bdg 240, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, vzavala@mcs.anl.gov, Mihai Anitescu, Emil Constantinescu

We review motivations and challenges arising in the implementation of advanced numerical weather prediction models in power grid operations. In particular, we analyze trade-offs between computational bottlenecks, resolution, accuracy, and economic performance of power systems.

4 - Binary Code Provenance and Heredity Detection Modeling and Error Analysis

LiYing Cui, Reserach Assistant, Penn State University, 310 Leonhard Building, University Park, PA, 16802, United States of America, luc5@psu.edu, Soundar Kumara

Information in this digital era exists as binary code. Due to the information explosion in recent years there is a need to detect the lineage among information. In the cases of malware, it will be necessary identify the variants and to predict the functionality of future viruses. In this work, we propose a binary code provenance and heredity detection and prediction method based on CyGene (Gene equivalent in Cyber engineering) detection. The error analysis of this method is studied thoroughly based on the ideas of false positives and false negatives.

5 - On the Optimal Control of Large Scale Systems with Stochastic Interactions

Eugene Perevalov, Lehigh University, Department of Industrial & Systems Engineerin, Bethlehem, PA, 18017, eup2@lehigh.edu

We study the problem of efficient control of large-scale systems that can be modeled by a collection of homogeneous elements with stochastic interactions. For the general case, we formulate the efficient control problem as an inverse inference problem in Bayesian networks. For the case of systems with a high degree of uniformity in the element interactions, we propose to use the renormalization group (RG) approach for the purpose of characterizing the phase structure of the system and feasibility of efficient control. We give several examples and perform numerical experiments to check the validity of the proposed approach.

■ WA35

C - Room 8A, Level 3

Advances in Anomalous Diffusion I

Sponsor: Applied Probability
Sponsored Session

Chair: Iddo Eliazar, Professor, Holon Institute of Technology, P.O. Box 305, Holon, 58102, Israel, eliazar@post.tau.ac.il

1 - Universal Generation of Fractal Statistics

Iddo Eliazar, Professor, Holon Institute of Technology, P.O. Box 305, Holon, 58102, Israel, eliazar@post.tau.ac.il, Joseph Klafter

We present a stochastic superposition model which is capable of generating - in a universal fashion - various "fractal statistics". The stochastic superposition model is general and robust, and arises naturally in diverse fields of science and engineering. Universally-generated "fractal statistics" include: anomalous diffusion - power-law growth of temporal dispersion; Lévy flights - power-law amplitudinal fluctuations; 1/f noises - power-law temporal correlations.

2 - Detecting the Origins of Anomalous Siffusion: P-variation Test and its Applications

Marcin Magdziarz, Dr, Wroclaw University of Technology, Wyspianskiego 27, Wroclaw, 50-370, Poland, marcin.magdziarz@pwr.wroc.pl

Motivated by growing interest in single molecule spectroscopy, we propose a method to detect mechanisms leading to subdiffusion. We introduce the so-called p-variation test, which allows distinguishing between two models of subdiffusion on the basis of one realization of the unknown process. We apply our approach to experimental data (random motion of an individual molecule inside the E. coli cell).

3 - Aging, Ergodcity Breaking and Universal Fluctuations in Continuous Time Random Walks

Igor Sokolov, Prof., Humboldt University Berlin, Newtonstr. 15, Berlin, D-12489, Germany, igor.sokolov@physik.hu-berlin.de

We consider subdiffusive transport within the continuous time random walk (CTRW) model. The anomalous diffusion under CTRW is a process with non-stationary increments and shows explicit dependence of observables on the time elapsed from preparing the system in its present state. This corresponds to aging of the process, leading to death of linear response to an external stimulus and intrinsic ergodicity breaking. Different manifestations of these properties will be discussed.

■ WA36

C - Room 8B, Level 3

Panel Discussion: Research in Teaching Schools

Sponsor: INFORM-ED
Sponsored Session

Moderator: John Kros, Associate Professor of Marketing and Supply Chain Management, East Carolina University, 3121 Bate Building, Greenville, NC, 27858, United States of America, krosj@ecu.edu

1 - Panel Discussion: Doing Research at Balanced Model Schools

Panelists:John Kros, Associate Professor of Marketing and Supply Chain Management, East Carolina University, 3121 Bate Building, Greenville, NC, 27858, United States of America, krosj@ecu.edu, Marvin Brown,Assistant Professor of CIS, Grambling University, 403 Main Street, Grambling LA 71245, United States of America, brownm@gram.edu, Christopher Keller,Assistant Professor of Marketing and Supply Chain Management, East Carolina University, 3136 Bate Building, School of Business, Greenville NC 27858, United States of America, kellerc@ecu.edu, Scott Nadler, Assistant Professor, University of Central Arkansas, COB 312, Conway AR 72035, United States of America, SNadler@uca.edu

This is a session set up by the INFORM-ED forum it is a panel on the topic of "Doing Research at Balanced Model Schools."

■ WA37

C - Room 8C, Level 3

Stochastic Control, Dynamic Games and Their Applications

Sponsor: Applied Probability
Sponsored Session

Chair: Hector Jasso-Fuentes, Mathematics Department, CINVESTAV-IPN, Apartado Postal 14-740, 07000, Mexico DF, Mexico, Mexico, hjasso@math.cinvestav.mx

1 - Some New Results in Controlled Switching Diffusions
Ari Arapostathis, Professor, University of Texas at Austin, 1 University Station (C0803), Department Electrical and Computer Eng., Austin, TX, 78712, United States of America, ari@mail.utexas.edu

We study the stability and ergodic control problems of controlled switching diffusions, modeled by a coupled system of Ito stochastic differential equations, under no assumption of irreducibility. Stability is defined as positive recurrence relative to an open ball in the space of the continuous component. We show among others that if the model is stable, then the upper envelope of the class of invariant probability measures is a finite measure, and we study the implications of this property.

2 - Control of Inventories with Markov Demand
Alain Bensoussan, Research Professor, University of Texas at Dallas, School of Management, Office 3.211, Dallas, 830688, United States of America, axb046100@utdallas.edu

We consider inventory control problems in discrete time. The horizon is infinite, and we consider discounted payoffs as well non-discounted payoffs (ergodic control). We may have backlog or not. We may have set up costs or not. We show how the base stock policy and the s,S policy can be extended.

3 - Overtaking Equilibria for Zero-sum Markov Games
Onesimo Hernandez-Lerma, Prof., CINVESTAV-IPN, Math. Department, A.Postal 14-740, Mexico D.F. 07000, Mexico, ohernand@math.cinvestav.mx

We study overtaking (a.k.a. catching-up) optimality for a class of zero-sum Markov games that includes stochastic differential games, and games with a countable state space.

4 - Joint Optimization of Pricing Strategies and Inventory Control with Continuous Stochastic Demand
Yongqiang Wang, University of Maryland, College Park, 3182 AVW, College Park, MD, United States of America, yqwang@umd.edu, Michael Fu, Steven Marcus

We analyze the dynamic pricing problem for inventory systems with price-sensitive continuous stochastic demands. An analytical solution for a special demand is provided. For more general demand models, we propose a simulation-based method for solving the dynamic pricing problem, assuming a finite number of price changes over the time horizon of interest. In the framework of our simulation-based algorithm, we can also jointly optimize the price and the initial inventory level.

■ WA38

C - Room 9A, Level 3

Complementarity Problems

Sponsor: Optimization/Linear Programming and Complementarity (Joint Cluster ICS)
Sponsored Session

Chair: Hande Benson, Associate Professor, Drexel University, Department of Decision Sciences, LeBow College of Business, Philadelphia, PA, 19104, United States of America, hvb22@drexel.edu

1 - Single Timescale Regularization Schemes for Monotone Nash Games
Uday Shanbhag, Asst. Professor, University of Illinois at Urbana Champaign, Urbana, Il, United States of America, udaybag@illinois.edu, Aswin Kannan

We consider single-timescale schemes for the distributed computation of equilibria arising from montone Nash games, Specifically, we propose iterative regularization counterparts of Tikhonov and proximal-point schemes where regularization/centering parameters are updated after every projection step, rather than when an approximate solution of the regularized problem is available. Convergence theory, particularly in limited coordination settings, is presented along with numerical results.

2 - Controlling PHEV Recharging Through Effective Electricity Price Signals
Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50014, United States of America, lzwang@iastate.edu, Pan Xu

We use a bilevel optimization model to design effective electricity price signals to control PHEV recharging profile. Various studies have shown that uncontrolled PHEV recharging could have a significant impact on the capacity adequacy, cost efficiency, and reliability of power systems. Price signals could serve as a demand management tool to control the recharging activities. Our models will be able to compare the effectiveness of different price signals.

3 - A Branch-and-bound Algorithm for the Bilevel Mixed Integer Linear Programming Problem
Pan Xu, Iowa State University, 3038 Black Engineering, Ames, United States of America, panxu@iastate.edu, Lizhi Wang, Shan Jin, Sarah Ryan

We present a new algorithm for the bilevel mixed integer linear programming problem. This algorithm consists of two levels of branch-and-bound. At the upper level, we break the non-convex feasibility region into convex pieces. At the lower level, we solve a linear program with complementarity constraints, which is a simple case of mathematical program with equilibrium constraints.

4 - 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.

■ WA39

C - Room 9B, Level 3

Joint Session OPTIM/ ICS:

Sponsor: Optimization/ Computing Society
Sponsored Session

Chair: Jeff Linderoth, University of Wisconsin-Madison, 1513 University Av., Madison, WI, United States of America, linderoth@wisc.edu

1 - Disjunctive Cuts for Convex Mixed Integer Nonlinear Program (MINLP)
Mustafa Kilinc, Graduate Student, University of Wisconsin-Madison, 3226 Mechanical Engineering Building, 1513 University Avenue, Madison, WI, 53706, United States of America, kilinc@wisc.edu, Jeff Linderoth, James Luedtke

Stubbs and Mehrotra [1999] generalized the disjunctive cutting plane method of Balas et al. into a branch-and-cut method for convex MINLPs which generates cuts by solving a convex projection problem in a higher dimensional space. Thus, it is computationally expensive to be included in a MINLP solver in practice. Our new method achieves this by solving a cut generating linear program iteratively. Computational results shows significant improvements in root node gap closure and solution times.

2 - New Linear Relaxations for Quadratically Constrained Quadratic Programming Problems
Mahdi Namazifar, University of Wisconsin-Madison, 1513 University Ave, Madison, WI, United States of America, namazifar@wisc.edu, Jeff Linderoth, James Luedtke

We study a novel approach to build polyhedral relaxations for nonconvex quadratically constrained quadratic programming (QCQP) problems. This approach considers all of the constraints of the problem at once and tries to find tight relaxations for the problem which are reasonable in size. We present numerical comparisons in terms of lower bounds and relaxation size.

3 - Inequalities for a Nonseparable Quadratic Set
Hyemin Jeon, University of Wisconsin-Madison, Room 3227, Mechanical Engineering Bldg., 1513 University Avenue, Madison, United States of America, jeon5@wisc.edu, Jeff Linderoth

We consider a nonseparable quadratic set which appears in applications such as portfolio optimization, and investigate ways to obtain a good approximation of its convex hull. Our work starts from transforming the set using Cholesky factorization, and studying its linear outerapproximation to obtain strong valid inequalities. Lifting plays a vital role in generating these inequalities.

4 - Pooling Problems with Binary Variables
Jeff Linderoth, University of Wisconsin-Madison, 1513 University Av., Madison, WI, United States of America, linderoth@wisc.edu, James Luedtke, Claudia D'Ambrosio, Andrea Lodi, Andrew Miller

The pooling problem is a bilinear program that models linear blending in a network. Often, pooling problems contain binary variables that model network design issues. We study how to tighten relaxations of pooling problems with binary variables by studying the convex hull of simple sets associated with these problems.

■ WA40

C - Room 9C, Level 3

Solver APIs II

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited 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 COIN-OR Open Solver Interface: A Status Report
Matthew Saltzman, Clemson University, Department of Mathematical Sciences, Martin Hall, Box 340975, Clemson, SC, 29631, United States of America, mjs@clemson.edu

The Open Solver Interface (OSI) is the oldest multi-solver API in COIN-OR. We discuss its current status and plans for the future.

2 - A COIN OSI Solver Plugin for Microsoft Solver Foundation
Lou Hafer, Simon Fraser University, Burnaby, BC, V5A 1S6, Canada, lou@cs.sfu.ca

MsfOsi implements a solver plugin that allows Microsoft Solver Foundation to use COIN solvers through the OSI API. There are interesting differences in design philosophy. This talk will examine what it takes to bridge the gap.

3 - The Optimization Services Solver Interface
Kipp Martin, University of Chicago, 5807 South Woodlawn, Chicago, IL, 60637, United States of America, kmartin@chicagobooth.edu

In this talk we describe how to use the Optimization Services (OS) project to interface with COIN-OR solvers. The OS interface is quite flexible and allows the user to generate linear and nonlinear instances for solvers. In addition, there is an interface for solver options and solver results.

■ WA41

C - Room 10A, Level 3

Vehicle Routing I

Contributed Session

Chair: Ahmed El-Nashar, Doctoral Student, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, 32816, United States of America, aelnasha@mail.ucf.edu

1 - Efficient School Bus Routing for Special Needs Students
Behrooz Kamali, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, bkamali@uark.edu, Ed Pohl, Scott J. Mason

Special needs and medically fragile students ride specialized buses to and from school daily. Unfortunately, special needs service-to-school assignments are often made without any consideration of a student's geographical location. We present optimization models that seek to improve administration-based performance metrics via smarter network assignments and effective bus routing decisions.

2 - A New Capacitated Path Covering Problem
Macarena Donoso, PhD Student, Diego Portales University, Ejercito 441, Santiago, Chile, macarena.donosop@gmail.com, Ignacio Basulto

We formulated and solve a particular capacitated vehicle routing problem. A path is built between two points of the network, for every vehicle of the fleet. Every route exceeds neither the vehicle capacity nor the maximum time of the trip. The objective is minimize the travelling cost. The nodes that to be not covered, must be inside a distance coverage to the the network. We propose an integer programming formulation and, an heuristic algorithm of resolution based on ants colonies was developed.

3 - A Near Optimal Algorithm for Multivehicle Dispatching and Routing with Time Windows
Ahmed El-Nashar, Doctoral Student, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, 32816, United States of America, aelnasha@mail.ucf.edu, Dima Nazzal

We propose a metaheuristic for solving the VRPTW for a depot with limited number of docks. The metaheuristics clusters customers into groups based on their proximity to one another. A modified local improvement algorithm is applied to each cluster to find the best sequence for visiting customers with different dispatching times. Finally, an assignment problem formulation is used to determine the dispatching time and the visiting sequence for each vehicle to minimize the total traveled distance.

■ WA42

C - Room 10B, Level 3

Computational Optimization and Applications I

Sponsor: Optimization/Computational Optimization and Software (Joint Cluster ICS)
Sponsored Session

Chair: Michele Samorani, PhD Candidate, Leeds School of Business, University of Colorado at Boulder, UCB 419, Boulder, CO, 80309-0419, United States of America, Michael.Samorani@Colorado.EDU

1 - Solving Hard Combinatorial Optimization Problems as Implicit Hitting Set Problems
Erick Moreno-Centeno, Assistant Professor, Texas A&M University, Industrial and Systems Engineering, College Station, United States of America, e.moreno@tamu.edu, Richard Karp

The hitting set (HS) problem is: given a set U and a family S of subsets of U, find a minimum-cardinality set that intersects each set in S. In the implicit HS problem (IHS), S is given via an oracle which verifies that a given set is a HS or returns a not-intersected set from S. Many NP-hard problems can be solved as IHS. We solve IHS by combining efficient heuristics and exact methods. We present computational results for the minimum-feedback-vertex-set and the maximum-weight-trace problems.

2 - Envy Quotes and the Iterated Core-Selecting Combinatorial Auction
Abraham Othman, Graduate Student, Computer Science Department, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, aothman@cs.cmu.edu, Tuomas Sandholm

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 mechanism, agents act on hints that suggest the prices of the bundles they are interested in. Prior work has required agents to have perfect information about every agent's valuations to achieve a solution in the core. Here a core solution is reached even in the private value setting.

3 - Data Mining Driven Neighborhood Search
Michele Samorani, PhD Candidate, Leeds School of Business, University of Colorado at Boulder, UCB 419, Boulder, CO, 80309-0419, United States of America, Michael.Samorani@Colorado.edu, Manuel Laguna

Metaheuristic approaches based on neighborhood search escape local optimality by applying predefined rules and constraints. Our general approach learns (offline) the guiding constraints that, when applied online, will result in effective escape directions from local optima. The user must define the neighborhood and provide an attribute representation of a solution and of a pair of solutions. We show our results on a set of task allocation and matrix bandwidth minimization problems.

■ WA44

C - Room 2, Level 2- Mezzanine

Resource Allocation in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: David Hutton, Stanford University, Palo Alto, CA, United States of America, billdave@stanford.edu

1 - Cost-Effectiveness of Screening and Treating Acute HIV Infection in Men Who Have Sex with Men

Jessie Juusola, PhD Candidate, Stanford University, Dept of Management Science & Engineering, 499 Terman Engineering Center, Stanford, CA, 94305, United States of America, jjuusola@stanford.edu, Eran Bendavid, Doug Owens, Margaret Brandeau, Elisa Long

Given the highly infectious nature of acute HIV infection, identifying and treating acutely infected individuals could play a significant role in reducing HIV transmission. We develop a dynamic compartmental model of the HIV epidemic in the US to estimate the costs and health benefits of screening for acute infection and treating acutely infected men who have sex with men. We find such programs likely to be a cost-effectiveness method of reducing the burden of HIV in this high-risk group.

2 - Initiatives Management in Public Healthcare Administration

Zehra Bilginturk Yalcin, University of Texas, Austin, Operations Research and Industrial Eng, Graduate Program, Austin, TX, 78712, United States of America, zehra.yalcin@gravitant.com, Ilyas M. Iyoob

A Public Healthcare Administration agency in a large state in the US is constantly running multiple initiatives within the organization. The agency faces the issue of selecting, prioritizing and scheduling initiatives based on the objectives of interest at the time, while maintaining dependencies between initiatives as well as limited resources and Federal budget constraints. The problem is modeled as an MIP and serves as a useful decision support tool in Public Healthcare Administration.

3 - Modeling Cost-Effectiveness Data for Medical Decision Making: A Statistical Framework

Megan DeFauw, University of Michigan, mcdefauw@umich.edu, Vijayan Nair, Joseph Norman, Allison Rosen

The effect of treatment on cost and QALYs in CEA is determined through simulation or a clinical study. In either case, the mean cost-effectiveness ratio is a poor characterization of treatment effect. We develop a statistical framework exploiting the stochastic evolution of disease processes over time to characterize the effect of treatment and also exploit the concept of stochastic dominance to aid in decision-making when the utility function is unknown. Finally, we illustrate with an example.

■ WA45

C - Room 6, Level 2- Mezzanine

Pierskalla Finalists V

Sponsor: Health Applications
Sponsored Session

Chair: Mariel Lavieri, Assistant Professor, University of Michigan, 1205 Beal Avenue, Ann Arbor, MI, 48109-2117, United States of America, lavieri@umich.edu

1 - Real-time Differentiation of Nonconvulsive Status Epilepticus From Other Encephalopathies using Quantitative EEG Analysis: A Pilot Study

Jicong Zhang, PhD Candidate, University of Florida, 303 Weil Hall, ISE Department, Gainesville, FL, 32611, United States of America, jicong@ufl.edu, Panos Pardalos, Chang-Chia Liu, Petros Xanthopoulos, Scott Bearden, Basim M. Uthman

Generalized NonConvulsive Status Epilepticus (NCSE) and some non-epileptic encephalopathies have similar clinical symptoms and exhibit similar EEG waveforms. To distinguish NCSE from some non-epileptic encephalopathies is difficult and significant clinically. Nonlinear dynamics are extracted from EEG and classifiers are designed to differentiate NCSE and toxic/metabolic encephalopathy. The results showed strong evidence that nonlinear dynamic measures can be useful in clinical diagnosis of NCSE.

2 - A Bilevel Model for Designing Preventive Healthcare Facility Networks

Yue Zhang, Assistant Professor, The University of Toledo, 2801 West Bancroft Street, Toledo, OH, 43606, United States of America, Yue.Zhang@sauder.ubc.ca, Oded Berman, Vedat Verter, Patrice Marcotte

This paper presents a methodology for designing a network of preventive healthcare facilities to improve its accessibility to potential clients, so as to maximize participation to preventive healthcare programs. We formulate the problem as a mathematical program with equilibrium constraints. We use the model to analyze an illustrative case, the network of mammography centers in Montreal. A number of interesting results and managerial insights are discussed.

3 - Inferring Model Parameters in Network-based Disease Simulation

Eva Enns, Stanford University, 117 Encina Commons, Stanford, CA, 94035, United States of America, evaenns@stanford.edu, Margaret Brandeau

Many models of infectious disease ignore the underlying contact structure through which the disease spreads. However, in order to evaluate the efficacy of certain disease control interventions, it may be important to include this network structure. We present a network modeling framework of the spread of disease and a methodology for inferring important model parameters, such as those governing network structure and network dynamics, from readily available data sources.

4 - The Mayo Clinic Optimizes Patient Transport Staffing

Dustin Kuchera, MS, Business Analyst, Mayo Clinic, 626 8th St SW, Rochester, MN, 55902, United States of America, kuchera.dustin@mayo.edu, Thomas R. Rohleder, PhD

In this paper, we report on the implementation of simple integrated queuing and mathematical programming methods to optimize staffing for patient transport at the Mayo Clinic. A tool was developed and implemented in Microsoft Excel and Visual Basic for Applications and includes an easy-to-use interface. Results of the implementation include significant staff savings via more efficient scheduling.

5 - Prioritization of Medical Equipment for Maintenance Decisions

Sharareh Taghipour, PhD Candidate, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, sharareh@mie.utoronto.ca, Dragan Banjevic, Andrew K.S. Jardine

Clinical engineering departments in hospitals are responsible for establishing and regulating a Medical Equipment Management Program to ensure that medical devices are safe and reliable. To mitigate functional failures, significant and critical devices should be identified and prioritized. We present a multi-criteria decision-making model to prioritize medical devices according to their criticality.

■ WA47

C - Room 8, Level 2- Mezzanine

New Directions in Project Management

Cluster: Topics in Project Management
Invited Session

Chair: Willy Herroelen, Emeritus Professor, K.U.Leuven, Research Center for Operations Management, Department of Decision Sciences & Information Management, Naamsestraat 69, Leuven, B-3000, Belgium, willy.herroelen@econ.kuleuven.be

1 - A New Approach for Project Risk Analysis

Stefan Creemers, K.U.Leuven, Research Center for Operations Management, Department of Decision Sciences & Information Management, Naamsestraat 69, Leuven, B-3000, Belgium, stefan.creemers@econ.kuleuven.be, Erik Demeulemeester, Stijn Van de Vonder

Most quantitative project risk analysis techniques provide insight in the risk profile of the project and in the feasibility of certain project completion dates. Far fewer efforts exist that aim at identifying the underlying risk factors that cause the project schedule to slip. We introduce an approach to calculate the impact that each risk has on the project completion date. Such an approach allows to focus mitigation efforts on those risks whose mitigation would be most effective.

2 - On the Interaction Between Railway Scheduling and Resource Flow Networks

Erik Demeulemeester, Professor, KU Leuven, Naamsestraat 69, Leuven, B-3000, Belgium, erik.demeulemeester@econ.kuleuven.be, Wendi Tian

In previous research, we have shown that in realistic situations railway scheduling improves both the stability and the expected project length over roadrunner scheduling. In this research, we introduce the concept of resource flow networks and analyze what the impact is of the resulting combinations on average project length, its standard deviation, the timely project completion probability and the stability cost. Extensive computational results will be presented on small and larger projects.

3 - Proactive Execution Policies for the Stochastic RCPSP

Filip Deblaere, KU Leuven, Naamsestraat 69, Leuven, B-3000, Belgium, filip.deblaere@econ.kuleuven.be, Erik Demeulemeester, Willy Herroelen

We propose a methodology for the determination of a project execution policy for the stochastic RCPSP that attempts to minimize the project execution costs, defined as the sum of the expected costs due to activity starting time deviations and the expected penalties or bonuses associated with late or early project completion. We show that our approach significantly outperforms existing proactive scheduling procedures for resource-constrained projects with uncertain activity durations.

■ WA48

C - Room 9, Level 2- Mezzanine

Software Demonstrations

Cluster: Software Demonstrations
Invited Session

1 - FICO - Building Optimization Applications in Xpress

Oliver Bastert, Product Management, FICO, 901 Marquette Avenue, Suite 3200, Minneapolis, MN, 55402, United States of America

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. During this tutorial, 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 - Palisade Corporation - DecisionTools Suite Software Introduction

Thompson Terry, Senior Risk Analyst, Trainer, Consultant, Palisade Corporation, 798 Cascadilla Street, Ithaca, NY, 14850, United States of America, tterry@palisade.com

Palisade's DecisionTools Suite includes 7 software packages that can be used by a wide variety of departments and individuals within any organization to better assess risk and make well-informed decisions. This comprehensive example demonstrates how all the components of the Suite can be used together to assess the likelihood of success of a new product launch, determine critical variables to limit risk exposure, optimize the inclusion of the new product into existing manufacturing facilities, and plan for the expansion of both production and distribution networks.

■ WA49

C -Room 10, Level 2- Mezzanine

Machine Learning and Business Intelligence

Sponsor: Information Systems
Sponsored Session

Chair: Maytal Saar-Tsechansky, Assistant Professor, University of Texas at Austin, 1 University Station, Austin, 78712, United States of America

1 - Active Inference and Active Learning for Data Streams

Foster Provost, Professor, New York University, 44 West 4th Street #8-86, New York, NY, 10012, United States of America, fprovost@stern.nyu.edu, Josh Attenberg

We consider applications where predictive models are applied to a stream of instances that can repeat, such as web pages for ad impressions, and where there is a budget for applying human resources to acquire ground truth labels for carefully chosen instances—both for learning and for direct inference (in lieu of using the predictive model). We introduce strategies for allocating human resources, which consider: p(x), which may be highly skewed; error cost; and the value for (active) learning.

2 - Bias in Cross Validation

Claudia Perlich, Chief Scientist, Media 6 Degrees, 16 Oakrdige Rd, Mt Kisco, United States of America, claudia@media6degrees.com, Grzegorz Swirszcz

Evaluation of model performance has a long tradition in statistics and machine learning. Non-parametric estimations of model performance include bootstrapping, jackknife, random sub-sampling and cross-validation. We show that cross-validation to data with low signal can lead to 'holdout' predictions with perfectly opposite ranking. While such a 'model' would raise suspicion, great harm can be done if it is integrated in an automated process that includes stacking or ensemble selection methods.

3 - Collaborative Information Acquisition (Talk)

Danxia Kong, The University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, Danxia.Kong@PhD.mccombs.utexas.edu, Maytal Saar-Tsechansky

Most information acquisition policies aim to improve the predictive accuracy of a model. However, in practice, a predictive model is used with other models to inform arbitrarily complex decisions. This paper discusses a new kind of collaborative information acquisition (CIA) policies, where multiple predictive models collaboratively prioritize information acquisitions to promote the decisions they inform. We present a framework and a specific CIA policy that yields superior decision performance.

■ WA50

C -Room 11, Level 2- Mezzanine

Managing Workload Dependencies in the Cloud

Cluster: Cloud Computing
Invited Session

Chair: Hani Jamjoom, IBM Research, 19 Skyline Dr., Hawthorne, United States of America, jamjoom@us.ibm.com

1 - Uncovering Causal Factors in HPC Workloads

Anshul Sheopuri, Research Staff Member, IBM TJ Watson Research Center, 19 Skyline Drive, Hawthorne, United States of America, sheopuri@us.ibm.com, Zon-yin Shae, Eric Shiu, Hani Jamjoom

Scheduling and Pricing engines are critical components of a High Performance Computing (HPC) system. To deploy these engines in a HPC system, it is important to understand the causal factors of demand fluctuations - number of users, time of day, time of month, etc. The objective of our work is to bring scheduling and pricing models in HPC to market by validating or invalidating the assumptions used for developing these models by uncovering the causal factors of demand fluctuations.

2 - Using Application Dependencies for Workload Migration Decisions in Cloud Datacenter Environments

Petros Zerfos, Research Staff Member, IBM T.J. Watson Research Center, 19 Skyline Drive, Hawthorne, NY, 10532, United States of America, pzerfos@us.ibm.com, Hani Jamjoom, Yew Huey Liu, Kang-Won Lee, Vivek Shrivastava

Virtual machine (VM) migration can optimize the use of physical servers in cloud datacenters. Enterprise applications consist of multiple interdependent VMs. Current research optimizes for intra-server constraints (e.g., CPU); it ignores inter-server dependencies (e.g., network communication). Our work formulates the VM migration problem to also account for inter-VM dependencies, and proposes an online approximation. Using workloads from a datacenter, we explore the efficacy of our solution.

3 - Overdriver: Enabling High Data Center Utilization Through Aggressive Memory Oversubscription

Dan Williams, Cornell University, 4104 Upson Hall, Ithaca, NY, 14853, United States of America, djwill@cs.cornell.edu, Hani Jamjoom, Yew Huey Liu, Hakim Weatherspoon

With the intense competition between cloud providers, resource oversubscription is essential for achieving higher utilization and profits from the underlying infrastructure. Resource oversubscription, however, comes at a price: it increases the likelihood of overload due to insufficient physical resources. We present Overdriver, a system that aggressively oversubscribes memory and immediately reacts to mitigate the effects of all types of overload, including transient overload.

■ WA51

C -Room 12, Level 2- Mezzanine

Optimal Routing Through Military Networks

Sponsor: Military Applications
Sponsored Session

Chair: Chris Odom, ENS, US Navy, Colorado School of Mines, Engineering Hall 816 15th Street, Golden, CO, 80401, United States of America, codom@mines.edu

1 - Routing and Scheduling Supply Ships for the Combat Logistics Force

Gerald Brown, Operations Research Department, Naval Postgraduate School, Monterey, CA, 93943, United States of America, ggbrown@nps.navy.mil, Matthew Carlyle, Patrick Burson, Jeff Kline, Anton Rowe

We synchronously route a fleet of supply ships between ports and combatant customer ships throughout an area of operations, or worldwide. Key concerns include keeping combatant inventories above required operational safety stock levels, minimizing port visit and other supply ship costs, sourcing costs, and the cost of fuel consumed. We show how the system works and what we have learned in practice along with our Military Sealift Command sponsor.

2 - Interdicting Networks to Competitively Minimize Evasion with Synergy Between Applied Resources

Brian Lunday, Assistant Professor, Department of Mathematical Sciences, U.S. Military Academy, Department of Math. Sci. (Building 601), United States Military Academy, West Point, NY, 10996, United States of America, lunday@vt.edu, Hanif Sherali

We examine the problem of minimizing the maximum probability of evasion by an entity traversing a network from a given source-and-terminus, incorporating novel forms of superadditive synergy between resources applied to arcs in the network. We propose an alternative model for sequential overt and covert deployment of subsets of interdiction resources, and conduct comparative analyses between models for purely overt (with or without synergy) and composite overt-covert strategies.

3 - New Results on the Network Diversion Problem

Christopher Cullenbine, PhD Candidate, Colorado School of Mines, 1500 Illinois Street, Golden, CO, 80401, United States of America, ccullenb@mines.edu, Kevin Wood, Alexandra Newman

The network-diversion problem seeks a minimum-weight, minimal s-t cut in a graph that contains a pre-specified edge. The problem arises in intelligence-gathering and war-fighting scenarios. We use Lagrangian relaxation with a stronger integer linear-programming formulation to modify edge weights for near-minimum-weight cut enumeration. We also describe new NP-completeness results, polynomially solvable special cases, and provide computational results that show improvements over the original.

4 - Routing Military Vehicles in a Threat Environment Accounting for Arc-Dependent Risk Costs

Chris Odom, ENS, US Navy, Colorado School of Mines, Engineering Hall 816 15th Street, Golden, CO, 80401, United States of America, codom@mines.edu, Alexandra Newman, Kevin Wood

A directed graph with nodes representing waypoints and sets of arcs denoting paths for vehicle transit models the area of operations. We develop an integer program and modify an enumeration algorithm to determine a path that maximizes the probability of mission success subject to flow balance and side constraints. We account for arc-dependent risk costs for the case in which a threat contributes risk to two or more arcs, and we provide preliminary numerical results.

■ WA52

C -Room 13, Level 2- Mezzanine

Decision Support for Military Operations

Cluster: Homeland Security and Defense
Invited Session

Chair: Janet Spoonamore, Army Research Office, P.O. Box 1221, Research Triangle Park, NC, 27709, United States of America, janet.spoonamore@us.army.mil

1 - Solution Method for Large Scale Chance-constrained Problems - Application Potential to Defense and Homeland Security Problems

Miguel Lejeune, George Washington University, 2201 G Street, NW Funger 415, Washington, DC, 20052, United States of America, mlejeune@gwu.edu

We introduce a new method for the solution of chance-constrained problems. It is based on the extraction of patterns which define sufficient/minimal conditions for the chance constraint to hold and allows the exact reformulation of the stochastic problem as a linear problem. The method is computationally very efficient and allows the very fast solution of problems in which up to 50000 scenarios are used to characterize uncertainty. Applications to defense and homeland security problems will be discussed.

2 - Army Research Office Program - Decision and Neural Sciences

Janet Spoonamore, Army Research Office, P.O. Box 1221, Research Triangle Park, NC, 27709, United States of America, janet.spoonamore@us.army.mil

The Decision and Neuro Sciences program addresses development of new advanced modeling, simulation, optimization and other analysis methodologies to support command-level decision-making at the operational level. The program includes two thrusts - one addressing advanced numerical methods - especially addressing stochastic behaviors and second addressing modeling of cognitive and neural phenomenology of decision making.

3 - Tactical Behavior Composition

Evan Clark, Intelligent Automation, Inc., 15400 Calhoun Drive, Suite 400, Rockville, MD, 20855, United States of America, eclark@i-a-i.com, Jeffrey Smith

Behavior composition for computer generated forces is a technique that facilitates the creation and validation of agent behavior. It refers to the practice of creating reusable primitives that can be combined to construct new complex agent behaviors. Research in behavior composition has often focused on the use of procedural primitives. This paper discusses a framework for commander agent behavior composition that includes not only procedural primitives, but also those representing tactical concepts such as spatial relationships, subordinate coordination, terrain analysis, firepower and mobility. These primitives give the domain expert the ability to influence the manner in which tactical decisions are made. These primitives are elements of a tactics description language called Tesla Using the Tesla language, a tactical behavior expert composes tactic templates which can later be used by commander agents in course of action development and to solve tactical problems.

4 - Resource-constrained Project Scheduling Under Uncertainty: Models, Algorithms and Applications

Haitao Li, University of Missouri - St. Louis, 229 CCB, One University Blvd, St. Louis, MO, 63121, United States of America, lihait@umsl.edu

This research studies the stochastic resource-constrained project scheduling problem (SRCPSP), which has a wide range of applications in machine scheduling, supply chain design, project portfolio optimization and personnel/manpower optimization. The SRCPSP is modeled as a Markov decision process (MDP) to cope with both structural and non-structural randomness. Techniques from optimization, artificial intelligence, simulation and statistics are built into an approximate dynamic programming (ADP) framework to tackle the "curses of dimensionality". Preliminary computational results on the deterministic RCPSP are promising.

■ WA53

C -Room 14, Level 2- Mezzanine

Marketing

Contributed Session

Chair: Nancy Ryan, Associate Professor of Marketing, St. Edward's University, 3001 South Congress Avenue, Austin, TX, 78701, United States of America, nancym@stedwards.edu

1 - Differences Between Imagers and Verbalizers in Users' Preference-making

Sangwon Lee, The Pennsylvania State University, 343 Leonhard Building, University Park, PA, 16802, United States of America, sangwon.advance@gmail.com, Richard Koubek

Understanding target users is a crucial issue in establishing design and marketing strategies for computer-based applications. To contribute to the comprehension of target users, this study examines the effects of cognitive style (imagers vs. verbalizers) on user preference based on usability and aesthetics through an experiment using four simulated systems with different levels of usability and aesthetics.

2 - The Market Entry Decision Based on Time-series Country Efficiency

Gary Chao, Kutztown University, P.O. Box 730, Kutztown, PA, 19530, United States of America, chao@kutztown.edu, Maxwell Hsu

Companies may examine country ranking reports before they expand business operations abroad. Most reports focus on some socio-economic variables and compute the country ranking results using a weighted averaging method. This research picks up an attractive foreign market by taking advantage of the data envelopment window analysis (DEWA) in finding a relatively more efficient marketplace to invest. We apply to evaluate the efficiency of 22 countries based on the globalEDGE data from 2002 to 2008.

3 - Let Me Stack Them Up: An Analysis of Internet Marketing Service Contract
Ryan Choi, PhD Student, University of California, Irvine, 6454 Adobe Circle, Irvine, CA, United States of America, jihungc@uci.edu

We examine two service contracts which Amazon.com offers to its competing sellers; i.e., Selling on Amazon (SOA) and Fulfillment by Amazon (FBA). We analyze how Amazon is incentivized to offer one or both of these contracts. Compared to pure competition, either contract is more likely offered when consumers' valuation gap gets small. Assuming that this valuation gap disappears once a contract is signed up, Amazon's contracting decision varies depending on which seller has a cost advantage.

4 - Attracting Customers with Attractive Signage and Architecture
Nancy Ryan, Associate Professor of Marketing, St. Edward's University, 3001 South Congress Avenue, Austin, TX, 78701, United States of America, nancym@stedwards.edu, Helene Caudill

Retail establishments should not overlook the importance of signage and architecture. We conducted a laboratory study using over 125 students who reviewed the exterior signs and architecture of five different restaurants. Results reveal how important these two features are in terms of customers' intentions to eat there.

■ WA54

C -Room 15, Level 2- Mezzanine

Technology Assessment and Forecasting II

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Fred Phillips, Professor, Alliant International University, Avenue of Nations, San Diego, CA, 92131, United States of America, fphillips@alliant.edu

1 - How do Small Biotechnology Firms Innovate? The Cases From Taiwan
Yu-Shan Su, Associate Professor, National Taiwan Normal University, 162, HePing East Road, Section 1, Taipei, 106, Taiwan - ROC, bellesu222@yahoo.com.tw

How do small firms innovate? How do a small firm's internal capabilities and external alliances contribute to its innovativeness? The main purpose of this study is to adopt theoretical angle of open innovation to discuss small biotechnology firms in Taiwan. This study offers an integrated perspective of open innovation in the literature.

2 - Forecasting Timely Revolutions in Organizational Performance
Charles Weber, Associate Professor, Portland State University, P.O. Box 751, Engineering and Technology Management, Portland, OR, 97207, United States of America, charles.weber@etm.pdx.edu, Nitin Mayande

It has been shown that subsystem-level learning activities and firm-exogenous learning activities can induce delayed, timely revolutions in organizational performance. This paper develops a method for forecasting revolutions in organizational performance in an open innovation system. Firm-internal and firm-external factors are taken into consideration.

3 - Forecasting the Development of Clean Coal and Natural Gas Technologies
Christopher Ordowich, SRI International, 1100 Wilson Blvd, Arlington, VA, United States of America, christopher.ordowich@sri.com, John Chase

This study estimates the costs and efficiencies of several types of coal and natural gas power plants with and without carbon capture technologies through 2050. Improvements in plant efficiency and reductions in capital and O&M costs are modeled using technology learning curves established by a detailed analysis of historic performance data. Combined with demand and input cost forecasts, the learning curves were used to project the cost and adoption of each plant type over time.

4 - Exploring the Societal Dimensions of IT: A Look at the Future of Sustainable IT Services
Robert Harmon, Professor of Marketing & Technology Management, Portland State University, P.O. Box 751, Portland, OR, 97207, United States of America, harmonr@pdx.edu, Haluk Demirkan

Green IT, the first wave of sustainable IT, developed strategies for reducing energy costs and carbon footprints, primarily in data centers. Green IT has been product-oriented and internally focused within the IT function. The second wave of sustainable IT will be service-oriented and focused beyond the IT function to serve the organization's business ecosystem and society at large. This work explores the key dimensions driving the development and applications of sustainable IT services.

5 - Inter-institutional Relationships and Emergency Management
Fred Phillips, Professor, Alliant International University, and General Informatics LLC, 10622 Sunset Ridge Drive, San Diego, CA, 92131, United States of America, fp@generalinformatics.com

Public disasters from the Exxon Valdez spill to the US mortgage meltdown involve many agencies. In improved networks of institutions, the fox will not guard the henhouse, accountability is enhanced rather than clouded, and remediation is quick, with blame assigned later. This paper advocates a new field of High-Performance Inter-Organizational Interaction (HPII). It maps dimensions of HPII against an extended Multiple Perspectives schema. Recent disasters and research directions are discussed.

■ WA55

C -Room 16, Level 2- Mezzanine

New Product Innovation Strategy

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Sreekumar Bhaskaran, Assistant Professor, Southern Methodist University, 6212 Bishop Blvd, Dallas, TX, 75205, United States of America, sbhaskar@mail.cox.smu.edu

1 - Managing Delegated Search Over Design Spaces
Sanjiv Erat, University of California San Diego, San Diego, CA, United States of America, serat@ucsd.edu, Vish Krishnan

Organizations increasingly seek solutions to open-ended design problems by employing an approach where the search over a solution space is delegated to outside agents. We study this new class of problems, and through an analytical model, we examine the relationship between problem specification, award structure, and breadth of solution space searched by outside agents towards characterizing how a firm should effectively manage such open-ended design contests.

2 - Drivers of Value and Growth: An Examination of Innovation in the Solar Energy Supply Chain
Jane Davies, University of Cambridge, Judge Business School, Trumpington Street, Cambridge, CB2 1AG, United Kingdom, j.davies@jbs.cam.ac.uk, David Kirkwood

The introduction of government incentives has seen a plethora of firms enter the solar sector. These include both start-ups and firms diversifying from other industries. Along with incumbents, these firms face the dual pressures of reducing production costs while increasing the technology efficiency of solar power. We combine secondary data and case study analysis of 70 solar firms to show that process and technological innovation have differential effects on revenue growth and market value.

3 - Design and Introduction of Conspicuous Durable Products
Vishal Agrawal, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, GA, United States of America, Vishal.Agrawal@mgt.gatech.edu, Stylianos 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 draw upon the traditional market models of vertically differentiated durable products to incorporate exclusivity-seeking behavior, and show that firms should instead consider designing products that undergo slow value erosion in conjunction with a high-price, low-volume product introduction strategy.

4 - Product Introduction Timing for Start-ups
Sinan Erzurumlu, Assistant Professor, Babson College, Tomasso 123, Babson Park, MA, 02457, United States of America, serzurumlu@babson.edu, Sreekumar Bhaskaran, Karthik Ramachandran

We study how a start-up organization should structure its development process. While cash constraints pressure the firm to launch a product as soon as possible (to avoid or delay bankruptcy), it could affect the future products. We develop optimal policies for the start-up firm to determine whether and when to launch an existing product under technological uncertainty about future development of products.

■ WA56

C - Room 1, Level 1

Simulation Optimization and Global Optimization of Expensive Functions

Sponsor: Simulation Society
Sponsored Session

Chair: Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu

1 - Simulation-Optimization Methods for Resource Allocation to Achieve Equity

Muer Yang, University of Cincinnati, Dept of QAOM, College of Business, Cincinnati, OH, 45221, United States of America, yangmr@mail.uc.edu, Theodore Allen, Michael Fry, David Kelton

This paper uses simulation-optimization models to allocate limited resources under uncertainty to achieve equity. By equity, we mean that all jobs, customers, etc. should have approximately equivalent performance measures (e.g., time in queue). We can provide probabilistic guarantees of global optimality for these allocations. We present one possible application of this work in allocating voting machines to precincts for local and national elections.

2 - Global Optimization with Reponse Surfaces for Expensive Simulation Models

Christine Shoemaker, Professor, Cornell University, 210 Hollister Hall, Cornell University, Ithaca, NY, 14853, United States of America, cas12@cornell.edu

We will describe an effective algorithm for global optimization of simulation models that are computationally expensive and apply it to several problems, including an environmental simulation model involving systems of nonlinear partial differential equations. We will demonstrate applications of up to 30 decision variables.

3 - Noise-Tolerant Bayesian Bisection

Peter Frazier, Assistant Professor, Cornell University, 232 Rhodes Hall, Ithaca, NY, 14853, United States of America, pf98@cornell.edu, German Gutierrez, Shane Henderson

We consider the stochastic optimization problem where we observe noisy derivatives of the objective function. These derivatives observations are expensive to obtain, and so our goal is to optimize the function as accurately as possible with a bounded number of observations. We derive the optimal sequential sampling policy using dynamic programming for a simplified version of this problem, and then discuss the use of this policy in the original problem.

■ WA57

C - Room 2, Level 1

Recent Advances in Portfolio Optimization

Sponsor: Financial Services Section
Sponsored Session

Chair: Chaithanya Bandi, Massachusetts Institute of Technology, 77 Mass Ave, Cambridge, MA, 02139, United States of America, cbandi@mit.edu

1 - Fairness in Multi-account Optimization with Transaction Costs

Dan Iancu, Stanford University, Stanford GSB, Stanford, CA, United States of America, Iancu_dan@gsb.stanford.edu, Dimitris Bertsimas, Nikolaos Trichakis

In this work, we focus on the problem faced by fund managers when executing rebalancing trades for multiple accounts simultaneously. We formulate a model that addresses two key issues, namely how to split the trading costs across the accounts, and how to incorporate all the information in a scheme for rebalancing the accounts in a fair way.

2 - Estimating the NIH Efficient Frontier

Dimitrios Bisias, PhD Student, MIT, 70 Pacific Street Apt.327, Cambridge, MA, 02139, United States of America, dbisias@mit.edu, Andrew Lo, James Watkins

The National Institutes of Health (NIH) is the preeminent source of funding for biomedical research, hence its funding allocation decisions have enormous impact on public health and social welfare. Modern financial portfolio theory is used to estimate the risk/reward trade-offs of NIH allocation decisions by treating appropriation as an investment and the decrease in years of life lost as the investment return.

3 - Optimal Portfolio Strategy with Liquidity Capacity

Wei Chen, Analytical Solutions Manager, SAS Institute Inc., SAS Campus Dr., Cary, NC, 27513, United States of America, Wei.Chen@sas.com

Liquidity is essential for banks to maintain long-term viability. An optimal portfolio strategy should not only manage the cash flow gaps but also provide adequate low cost contingent funding sources in distressed events. This paper proposes a model of finding minimal cost portfolio with a chance constrained level of positive excess cash flow and self-sustaining liquidity capacity. The model results in a tractable linear programming problem using the scenario based approach.

■ WA58

C - Room 3, Level 1

Finance-Risk Management

Contributed Session

Chair: D.J. Alexander-Houle, Adjunct; Program Manager, University of Phoenix, HP, 14207 Torrey Vista Dr, Houston, TX, 77014, United States of America, dahoule@sbcglobal.net

1 - A Coherent Valuation Approach for Valuing Risky Projects

S. Reza Seyedshohadaie, Texas A&M University, 3131 TAMU, College Station, United States of America, sreza@tamu.edu, Sergiy Butenko, Ivan Damnjanovic

We present a coherent valuation approch for valuing risky projects in partially complete markets. The model is based on the exposure to risk and the trade-off between risk and reward. We demonstrate the application of the model on a larg-scale engineering project.

2 - Estimation Error Reduction in Portfolio Optimization with Conditional Value-at-Risk

Gah-Yi Vahn, PhD Student, UC Berkeley, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, CA, 94704, United States of America, gyvahn@berkeley.edu, Andrew Lim

We introduce a novel method of obtaining robust solutions to data-driven portfolio optimization with Conditional Value-at-Risk (Expected Shortfall). This method can be interpreted as penalizing model uncertainty in the optimization problem. We present some analysis of the method and empirical results that show the superior performance of this method when the underlying log-return data is both well-behaved (multivariate Gaussian) and heavy-tailed (multivariate t).

3 - Dynamic Models for Consumer Default Risk

Jonathan Crook, Professor, University of Edinburgh, Credit Research Centre, Business School, 50 George Square, Edinburgh, EH10 4SW, United Kingdom, j.crook@ed.ac.uk, Tony Bellotti

This talk explains the use of survival analysis for the prediction of default for consumer loans. The talk will explain how macroeconomic variables can be incorporated into the model and show results from the parameterisation of such a model and the predictive performance of it using a data set relating to credit cards. The model is used to stress test the portfolio of loans using Monte Carlo simulation to estimate the Value at Risk and Expected Shortfall of the portfolio.

4 - Risk Tolerance Tempered with Optimal Time Increments

D.J. Alexander-Houle, Adjunct; Program Manager, University of Phoenix, HP, 14207 Torrey Vista Dr, Houston, TX, 77014, United States of America, dahoule@sbcglobal.net, G. R. Houle

How people reason about economic choices is risk tolerance.Of social concern is the risk shift from pooled to personal responsibility. Using the fractal nature of people creates the framework for risk complexities Grable indicates as, "underlying factor within Ö decision frameworks" and the aggressiveness of decisions will reflect risk tolerance levels (2008, p. 4). Research results identifying worst case performance illustrates a foundation for creating systemic risk tolerance.

■ WA61

H - Room 400, 4th Floor

Operations Management V

Contributed Session

Chair: Heping Liu, North Dakota State University, Department of Industrial & Manufacturing, Fargo, ND, 58108, United States of America, hepingliu@yahoo.com

1 - Constraint and Flight Rule Management for Space Mission Operations

John Chachere, Senior Computer Scientist, Stinger Ghaffarian Technologies, 1060 Arbor Road, Menlo Park, CA, 94025, United States of America, john.m.chachere@nasa.gov, Jeremy Frank, Javier Barreiro

NASA's Mission Operations Directorate (MOD) has formalized thousands of operational constraints to help govern human spaceflight missions. MOD collects, develops, documents and applies these constraints to ensure the safety of the crew, as well as proper operation of the spacecraft systems and payloads. These constraints are stored in human-readable documents and also used to configure tools used by the flight controllers who plan and fly missions. We have begun developing a novel capability for authoring and maintaining such constraints called the Constraint and Flight Rule Management system (ConFRM). ConFRM provides history tracking and commenting features that allow authors to trace the history of constraints throughout their lifecycle. ConFRM maintains links between related constraints, and between constraints and source information used to create the constraints. ConFRM uses these links to ensure consistency between constraints throughout their lifecycle, and provides authors and reviewers the ability to navigate between constraints and related data. Finally, ConFRM enables export of constraints into many different forms, including human readable documents and tool configurations, thereby eliminating manual labor and reducing transcription errors.

2 - Reverse Ranking and Overshooting in Supply Chains with Private Inventory Information

Alexandre Belloni, Assistant Professor, Duke University, 1 Towerview Drive, Durham, NC, 27708, United States of America, abn5@duke.edu, Giuseppe Lopomo, Shouqiang Wang

We study contracts for a single supplier with fixed capacity selling to multiple retailers who are privately informed on their inventory levels. In symmetric environments, instead of a balancing policy, it is optimal for the supplier to make retailers with lower initial inventory levels end up with a larger final positions (reverse ranking). We characterize when it is optimal to "overshoot" to provide a larger quantity to a retailer than it would get in the corresponding centralized system.

3 - Backup Agreements in Multiple Component Procurements with Demand Updates

Mingchang Wu, PhD Student, University of Connecticut, 2100 Hillside Road, Storrs Mansfield, Storrs Mansfield, CT, 06269, United States of America, mingchang.wu@business.uconn.edu, Suresh Nair, Lakshman Thakur

We study a supply chain where a manufacturer buys two different components from two suppliers to produce one product for the selling season.This is an extension of Eppen and Iyer's work,where we now look at components rather than end product.With each supplier,the manufacturer has a particular backup agreement.Our objective is to derive an optimal purchase policy which describes the optimal commitments to each supplier and a reaction plan to the demand updates at the later stage.

4 - The Optimum Policies to the Distribution/Inventory System Problem in the Medical Center

Jimmy Alexander Carvajal Beltran, Student, Universidad de los Andes, Carrera 1 N° 18A - 12, Bogotà, Colombia, ja.carvajal911@uniandes.edu.co, Ciro Alberto Amaya Guio, Fabiàn Andrés Castaño Giraldo, Nubia Milena Velasco Rodriguez

This paper describes a new approach for solving the budget constrained distribution and inventory problem for one warehouse and n retailers. This is a typical situation in medical supply networks where a single warehouse supplies a set of pharmacies with the main objective of minimizing total costs. To solve the problem, we propose an iterative algorithm which uses mathematical programming methods. We present the principal ideas of this approach and results using random instances.

5 - Simulation Modeling for Clinic Telephone Systems

Heping Liu, North Dakota State University, Department of Industrial & Manufacturing, Fargo, ND, 58108, United States of America, hepingliu@yahoo.com, Jing Shi

Clinic telephone systems can guide patients to obtain optimal healthcare delivery services. In our research, simulation modeling is used to optimize clinic telephone systems with the functions of leaving messages and call-back services. Centralization and decentralization are two considered telephone system frames. According to operator utilization and patient satisfaction level, various scenarios are designed and simulated. The obtained results can benefit the telephone system configuration.

■ WA62

H - Room 402, 4th Floor

Aviation Applications III

Contributed Session

Chair: Akira Kondo, Federal Aviation Administration, 800 Independence Ave., SW, Washington, DC, 20591, United States of America, akira.kondo@faa.gov

1 - Customer Profitability Analysis for Marketing Initiatives in a Fractional Airline

Jintao Ouyang, CitationAir, 5 American Lane, Greenwich, CT, 06831, United States of America, jouyang@citationair.com, Aang Daniel, Roger Zhan, Haiyuan Wang

Due to the operation nature of fractional airlines, operation costs such as charter premium and position do not directly link to specific customers. A regression based statistical method is presented to associate these costs to each customer. We also identify the factors that affect the profitability of customers. These factors can be used for marketing initiatives such as contract renewal, customer retention, and devising new pricing schemes.

2 - Optimized Airport Security Study

Shannon Harris, Technomics, Inc, 201 12th Street South, Suite 612, Arlington, VA, 22202, United States of America, sharris@technomics.net, Joon Kim, Jaime Gonzalez, Elizabeth Wilson

The current security measures implemented at airports produce "soft targets" in the form of lengthy queues that heighten the risk of a terrorist attack. This study examines Washington Dulles and designs a model to improve the allocation and usage of security resources. Two alternative designs make use of layered, defense-in-depth security measures and the concept of unpredictability. The best alternative is selected by analyzing simulation outputs based on a value function.

3 - A Value-based Time-Phased Bayesian Network (VTBN) for Augmented Safety Risk Assessment

James Luxhoj, Professor, Rutgers University, 96 Frelinghuysen Road, Dept. of ISE, Piscataway NJ 08854, United States of America, jluxhoj@rci.rutgers.edu, Michael Morton

The use of Unmanned Aircraft Systems (UAS) for civil applications is increasing in the United States. There is a need to develop advanced risk models that capture the complexities of integrating aviation regulations, functions, hazards and causal factors into a probabilistic model for augmented safety assurance. This presentation introduces a Bayesian Network that integrates the use of value functions and time phasing for modeling safety risk analysis of small UAS applications.

4 - Departure Demand, Efficiency, Taxi-out Delay, and Unimpeded Taxi-out Time

Akira Kondo, Federal Aviation Administration, 800 Independence Ave., SW, Washington, DC, 20591, United States of America, akira.kondo@faa.gov

Taxi-out delays play an important role in the computation of key airport performance metrics. In this system, departure demand and resulting airport departure efficiency significantly impact crucial parts in System Airport Efficiency Rate (SAER). This study provides a new definition of taxi-out times and how estimation of unimpeded taxi-out time affects computation of taxi-out delays.

■ WA63

H - Room 404, 4th Floor

Decision Analysis For Public Health

Sponsor: Decision Analysis

Sponsored Session

Chair: Ozgur Araz, Postdoctoral Fellow, University of Texas at Austin, Patterson Lab 628, Austin, TX, 78712, United States of America, oaraz@mail.utexas.edu

1 - Comparing Cost-effectiveness of Physical Activity Interventions

Shinyi Wu, Assistant Professor, University of Southern California, 3715 McClintock Ave., GER 240C, Los Angeles, CA, 90089, United States of America, shinyiwu@usc.edu

We conducted a systematic review and developed a method to compare cost-effectiveness (CE) across a wide variety of physical activity (PA) intervention strategies. Study quality was variable. Decision prompts were most cost-effective but had tiny effects. School-based and other wide-reach interventions ranked well. High intensity programs were least cost-effective but had the largest effect sizes. The CE, effect size, and study quality should all be considered when choosing PA interventions.

2 - A Decision Analytic Approach for Modeling School Closures During an Influenza Pandemic

Ozgur Araz, Postdoctoral Fellow, University of Texas at Austin, Patterson Lab 628, Austin, TX, 78712, United States of America, oaraz@mail.utexas.edu, Sean Burke, Paul Damien, Lauren Meyers, Bryce van de Geijn, Alison Galvani

In this presentation, we present a decision analytic approach for making school closure decisions during an influenza pandemic. We build a mass action model and assume the severity of the disease is uncertain for the decision makers. A decision tree is used to evaluate several closure and reopening decisions simultaneously based on their cost effectiveness. Lastly, we perform several sensitivity analyses on decision making parameters and present our results.

3 - Dynamics of a Pharmaceutical Risk Sharing Agreement

Reza Mahjoub, PhD Student, Ivey Business School, 1151 Richmond St., London, ON, Canada, rmahjoub@ivey.uwo.ca, Fredrik Odegaard, Greg Zaric

Some new drugs such as cancer drugs could be very costly to develop and manufacture while their effectiveness and efficiency in real life 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 develop a model to examine the dynamics of a risk sharing contract for a drug manufacturer.

■ WA64

H - Room 406, 4th Floor

Health Care, Modeling and Optimization V

Contributed Session

Chair: Ilgin Acar, Anadolu University, Department Of Industrial Engineering, Iki Eylul Campus, Eskisehir, 26555, Turkey, ipoyraz@anadolu.edu.tr

1 - Consensus by Averaging Phylogenetic Trees

Scott Provan, University North Carolina, Department Statistics and Operations Research, Chapel Hill, NC, 27599, United States of America, Scott_Provan@UNC.edu, Ezra Miller, Megan Owen

We introduce a new notion of the consensus tree for a set of phylogenetic trees, by representing them as points in the phylogenetic tree space of Billera, Holmes, and Vogtmann. The property of non-positive curvature of this space ensures that the consensus tree captures the correct notion of an "average" tree, and that there is an algorithm for computing this tree. We give as applications reconstructing species trees from gene trees and comparing the structure of blood vessels in the brain.

2 - A Probabilistic Optimization Approach to Analyze Large Scale Emergency Medical System on Highways

Ana Iannoni, Ecole Centrale Paris - Laboratoire Genie Industriel, Grande Voie des Vignes, Chatenay Malabry, 92295, France, iannoni93@hotmail.com, Reinaldo Morabito, Cem Saydam

In this study we present optimization methods based on greedy heuristics embedding an approximate hypercube queuing model. The proposed approach can support two decisions in the operation of emergency systems on highways: the location and districting of the ambulances. We applied these methods to a case study and to instances of up to 100 ambulances. The present approach is an alternative for the analysis of large scale systems, which provides reasonable accuracy and affordable running times.

3 - A Multi-class Open Queuing Network with Priority Discipline Applied to the Emergency Department

Sumi Kim, Yonsei University, Shinchon-dong, Seodaemun-gu, Seoul, Korea, Republic of, sumi_kim@yonsei.ac.kr, Seongmoon Kim

We formulate the patient flows in the emergency department using a multi-class open queueing network. The unique aspect of this paper is that it incorporates the priority discipline with the queueing network, in order to control the waiting time of more urgent patients. A case study based on actual data from an emergency department demonstrates how effective the introduced model and the policy with the priority discipline are in controlling the waiting time and improving the quality of service.

4 - Optimal Clinical Scheduling with No-shows

Ji Lin, PhD Candidate, Purdue University, Weldon School of Biomedical Engineering, 206 S. Martin Jischke Drive, West Lafayette, IN, 47907, United States of America, lin35@purdue.edu, Mark Lawley, Kumar Muthuraman

The accessibility and efficiency of outpatient care are largely affected by the appointment schedules. Patient no-show causes waste of physician time and revenue loss. Random booking results in long waiting time and overtime. Patients usually have different no-show rates. Thus, we propose MDP model and optimal scheduling policies for heterogeneous no-show patients. Approximate Dynamic Programming methods are developed to solve the curse of dimensionality.

5 - Workload Scoring of Nurse to Patient Assignments

Ilgin Acar, Anadolu University, Department Of Industrial Engineering, Iki Eylul Campus, Eskisehir, 26555, Turkey, ipoyraz@anadolu.edu.tr, Steven Butt

This work is the first to explicitly consider incorporating travel distances into the construction of a nurse's patient assignments through the construction of a workload score based on nurse travel distances and patient acuity measures. The workload scores were developed through consultation with charge nurses using AHP. The resulting tool displays a nurse's assigned rooms and associated workload score in an accessible spreadsheet format.

■ WA65

H - Room 408, 4th Floor

Inventory Management V

Contributed Session

Chair: Ayse Gönül Karaarslan, PhD Candidate, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, a.g.karaarslan@tue.nl

1 - A Simulation-optimization Approach to the Inventory Mangement of Perishable and Substitutable Items

Bret Myers, Villanova University, 442 Hartford Square, West Chester, PA, 19380, United States of America, bret.myers@villanova.edu

A simulation-optimization approach is used to analyze inventory policy for two perishable and substitutable items. A set of perishable items is considered under a periodic system of inventory control where demand for a preferred item can be satisfied by a substitute item with in the event of a stockout of the preferred item. The retailer is faced with the decision of determining the order-up-to levels which maximize expected total profit.

2 - Policy Parameter Adjustments to Meet Desired Service Level Requirements for (r, NQ) Inventory Models

Yasin Unlu, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, yunlu@uark.edu, Manuel D Rossetti

This study introduces a simulation optimization based procedure for setting policy parameters of continuous review (r, NQ) inventory models in the face of complex demand cases. The experiments done with various demand scenarios show that the procedure yields promising results in terms of attaining specified target service levels.

3 - A Multiple-level Supply Chain Coordination Model by (Q, r) Policies in a Fuzzy Environment

Xinmin Wu, OR Specialist, SAS, Sas Campus Drive, Cary, 27513, United States of America, xinmin.wu@sas.com, Don Warsing

we present a serial multiple-level supply chain coordination model by (Q,r) policies in a fuzzy risk environment. Sources of risk and uncertainty in our model include demand, lead time, supplier yield, which are modeled by fuzzy sets. Heuristics are presented to determine local optimal policies on the basis of techniques identified in the literature on fuzzy sets. A coordination process with an external coordinator is implemented to improve supply chain performance based on global view.

4 - A Modified Base Stock Policy for an Assemble to Order System with Different Review Periods

Ayse Gönül Karaarslan, PhD Candidate, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, a.g.karaarslan@tue.nl, Ton de Kok, Gudrun P. Kiesmüller

We have a single item assembled from two components. The inventory levels are reviewed periodically and customer demand is stochastic. One of the components has a longer lead time, higher holding cost and shorter review period compared to the other one. We analyze a modified base stock policy such that one stockpoint is controlled by an order-up to policy. The orders for the other stockpoint are synchronized depending on its order-up-to level and the inventory level of the other component.

■ WA66

H - Room 410, 4th Floor

Transportation, Other

Contributed Session

Chair: Gokhan Memisoglu, PhD Student, Texas A&M University, Department of Industrial and Systems Eng, Texas A&M University, College Station, TX, 77843-3131, United States of America, gmemis@tamu.edu

1 - A Net Present Value Model for Investment in Airport Assets

Alexandre de Carvalho, Instituto de Pesquisa EconÙmica Aplicada - IPEA, Diretoria de Estudos Regionais e Urbanos, SBS Quadra 1, Edificio BNDES, sala 718, Brasilia, DF, 70076-900, Brazil, alexandre.ywata@ipea.gov.br, Alessandro VM de Oliveira, Reinaldo C. Garcia

Improvement and expansion in infrastructure transport assets are among the main concerns facing the transport specialists due to the high investments involved. The timing and the combination of new transport investments is key to analyze their long-term effects. This paper proposes an investment model based on Net Present Value (NPV) analysis. In particular, the model is applied to: (i) the building of a new airport; and (ii) the expansion of already existing "major" and "minor" airports.

2 - Network Connectivity Analysis for Port Competitiveness Study

Ek Peng Chew, Associate Professor, National University of Singapore, 10 Kent Ridge Crescent, Singapore, 669606, Singapore, isecep@nus.edu.sg, Loo Hay Lee, Jianlin Jiang, Chee Chun Gan

Port connectivity is an important factor that deserves much attention in the study of port competitiveness. Determining how well one port connects to others is hardly easy, as it being an abstract concept might bring about different interpretations and definitions in different cases. In this paper, we will propose a measure using network anaylsis to measure port connectivity.

3 - Student Assignment Models for a School System

Trivikram Rao, PhD Student, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, Louisville, KY, 40292, United States of America, trivikram.rao@louisville.edu, Arsalan Paleshi, Bulent Erenay

This research proposes a mathematical programming approach for student assignment to schools while incorporating quantitative, qualitative constraints such as travel cost, parental preferences, and socio-economic constraints. The model's sensitivity in cost, parental satisfaction terms to certain constraints is tested. Also, extension of this approach to other assignment problems is discussed.

4 - Optimal Deployment of Emissions Reduction Technologies for Large Fleets

Gokhan Memisoglu, PhD Student, Texas A&M University, Department of Industrial and Systems Eng, Texas A&M University, College Station, TX, 77843-3131, United States of America, gmemis@tamu.edu, Mohamadreza Farzaneh, Kiavash Kianfar

In states that have serious air quality problems, such as Texas and California, public fleet managers are under pressure to reduce emissions from their fleet. In order to help them with this problem, this research study will create an optimization model capable of determining the most efficient assignment of emission reduction strategies among vehicles and equipment in a large fleet. To achieve the goal, this study will focus on Texas Department of Transportation's (TxDOT's) fleet.

■ WA67

H - Room 412, 4th Floor

Simulation I

Contributed Session

Chair: Ahmet Ozkul, Assistant Professor of Management, University of New Haven, 300 Boston Post Rd., Maxcy Hall, West Haven, CT, 06516, United States of America, aozkul@newhaven.edu

1 - Incorporating Analytic Hierarchy Process with Simulation to Assess Health Service Quality

Yan Li, The University of Texas-Pan American, 508 E Redbud Ave, Mcallen, TX, 78504, United States of America, tongjijacky@hotmail.com, Jianzhi Li

While improving quality in health care is currently at the forefront of professional, political, and managerial attention, it has yet to fully understand the key dimensions constituting health-care quality and develop valid approaches to their measurement. The methodology proposed in this paper, AHP based simulation, will provide great insights in tackling this problem and open up a world of possibilities for future research.

2 - Modeling Parameter Uncertainty in Stochastic Simulations

Canan Gunes, PhD Student, Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA, 15213, United States of America, cgunes@andrew.cmu.edu, Bahar Biller

We consider a stochastic simulation and demonstrate how to account for stochastic uncertainty and parameter uncertainty in the output analysis. We further decompose the variance of the output data into terms associated with each type of uncertainty and use this decomposition to develop a data-collection schema for reducing parameter uncertainty. We illustrate our approach with inventory system simulations.

3 - A Discrete Simulation Approach to the Design of a Warehouse for Air Cargo Operations

Carlos Osorio, Politecnico Grancolombiano, Calle 57 3-00 Este Fac Ingenieria, Bogota, Colombia, caosorio@poli.edu.co, Oscar Javier Parra Ortega

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 - Simulation to Identify Errors in Generalized Tournaments

Christopher Keller, Assistant Professor of Marketing and Supply Chain Management, East Carolina University, 3136 Bate Building, School of Business, Greenville, NC, 27858, United States of America, kellerc@ecu.edu

This paper presents a Monte Carlo simulation of ranking participants in a generalized tournament, including variations in: number of participants; completeness of the tournament; and paired comparison errors. Some paired comparison errors are not reliably identifiable and a complete and accurate ordering of participants is unlikely. Using a partial ordering topological rank, jackknife estimates of the average rank do admit the identification of some of the paired comparison errors.

5 - Simulating Social Networks in Understanding Dynamics of Customer Purchase Behavior: Case of Cult Brands

Ahmet Ozkul, Assistant Professor of Management, University of New Haven, 300 Boston Post Rd., Maxcy Hall, West Haven, CT, 06516, United States of America, aozkul@newhaven.edu, Aqin Hu

When we consider customers as actors in a purchasing relationship of products, Social Network Analysis may be used to reveal unknown patterns and explain customer behavior. Using a simulation analysis, we create a market of M customers and N products. Customers create a relationship when they buy a given product. The number of links and frequency of the purchase determine the nature of the relationship. We calculate social network measures in each cycle to observe the dynamics.

■ WA68

H - Room 415, 4th Floor

Innovation/Entrepreneurship I

Contributed Session

Chair: Arash Dadvand, CGN and Associates, 415 SW Washington St, Peoria, IL, 61602, United States of America, adadvand@cgn.net

1 - Diffusion of Innovation Products: Network Effects and Bandwagon Effects

Shuzhen Sun, School of Industrial Engineering & Management, Oklahoma State University, School of Industrial Engineering & Mgt., Oklahoma State University, Stillwater, Ok, 74078, United States of America, zhener18@gmail.com, Di Xu

Bandwagon effects and network effects play important roles in consumers' purchase decisions. This paper uses the small-world network model to study the two effects on the diffusion of innovation products. Simulations are conducted to examine the diffusion process and adoption rate under different levels of bandwagon pressures, different strength of network effects,and different network configurations, on the assumption that bandwagon effects exist in all conditions.

2 - A System Dynamics Model to Understand Innovation in the Design Process

Nur Ozge Ozaltin, University of Pittsburgh, 1048 Benedum Hall, Pittsburgh, PA, 15261, United States of America, noo7@pitt.edu, Mary Besterfield-Sacre, Larry Shuman

To improve innovation, it should be better understood how the teams navigate the design process from initial conception to prototype. We examine the bioengineering design process to investigate associations between design patterns and the quality of the resulting artifact. We identify the critical patterns and factors that lead to innovation.

3 - Entrepreneurship and Community Development: A Fallacy From Central Mexico

Eliseo Vilalta-Perdomo, Head Dept Industrial and Systems Engineering, Tecnológico de Monterrey, Av Gral Ramón Corona 2514, Col. Nuevo México, Zapopan, 45201, Mexico, eliseo.vilalta@itesm.mx, Cynthia Montaudon-Tomas

To consider entrepreneurship as a dynamo for economic development is challenged throughout this work done in central Mexico. Two programs from different rural communities in Guanajuato are studied. Probably the most promising finding is to recognize that individual economic development and community social development are not linked. A proposal to increase quality of life in rural communities is presented. It is centered on creating and maintaining self-organized web-based networks.

4 - Efficient Targeted Concept Development Method

Arash Dadvand, CGN and Associates, 415 SW Washington St, Peoria, IL, 61602, United States of America, adadvand@cgn.net

Breakthrough competitive advantage are accomplished by competitive concepts. Concept development is costly, hard to manage and may not result in a viable solution. This is a method to formulate a problem, effectively and efficiently create concepts based on generic cross-industry patented solutions, and prioritize concepts to meet predefined goals. Final set of concepts could be optimized and improved.

■ WA69

H - Salon F, 6th Floor

Transportation, Rail

Contributed Session

Chair: Katharina Beygang, University of Kaiserslautern, Department of Mathematics, OR Group, Postfach 3049, Kaiserslautern, 67653, Germany, beygang@mathematik.uni-kl.de

1 - Extensions to the Online Delay Management Problem on a Single Train Line

Christiane Zeck, University of Kaiserslautern, Department of Mathematics, OR Group, Postfach 3049, Kaiserslautern, 67653, Germany, zeck@mathematik.uni-kl.de, Sven O. Krumke, Clemens Thielen

The online delay management problem consists in deciding when to wait for delayed passengers in order to minimize the total passenger delay. Viewing this problem in the context of game theory, we determine an optimal online strategy. We also introduce a new objective function modeling a refund system for delayed passengers with the aim of maximizing the profit. For this problem, there cannot be a competitive deterministic online algorithm, but we present a 2-competitive randomized algorithm.

2 - Railway Routing Algorithms for Hazardous Materials

Marc Meketon, Oliver Wyman, 212 Carnegie Center, Princeton, NJ, 08540, United States of America, Marc.Meketon@oliverwyman.com, Paul Stephens

New Federal Railroad Administration guidelines require examining various hazardous material routing alternatives. The shortest path may traverse large population centers or other non-desirable areas. Finding a set of acceptable paths is challenging for large railroads where the "K-shortest" paths differ insignificantly. This research discusses solutions to the important, but difficult, task of identifying different paths with acceptable distance and cost that also represent real alternatives.

3 - Efficient Usage of Railway Infrastructure Through Pricing Mechanisms

Arnt-Gunnar Lium, Research Scientist, SINTEF Technology and Society, P.O. Box 4760 Sluppen, Trondheim, N 7465, Norway, arnt-gunnar.lium@sintef.no, Adrian Werner

Railroad infrastructure is very costly to develop; hence, increased utilization will have a significant positive impact on society. One way of increasing utilization over the day is to implement tariffs such that railroad operators adapt their schedules in a socio-economical optimal way. We look into how bi-level programming can be combined with stochastic service network design to determine socio-economical optimal tariffs.

4 - Extensions to the Train Marshalling Problem

Katharina Beygang, University of Kaiserslautern, Department of Mathematics, OR Group, Postfach 3049, Kaiserslautern, 67653, Germany, beygang@mathematik.uni-kl.de, Sven O. Krumke

Shunting yards, consisting of a hump and a set of parallel classification tracks, play an important role in railroad life. They are used for the rearrangement of cars according to their destinations. The Train Marshalling Problem consists of minimizing the number of classification tracks needed for the rearrangement of a given car sequence. It is well known to be NP-complete. We give competitive polynomial time algorithms for the online variant as well as lower bounds on the competitiveness.

■ WA70

H - Salon G, 6th Floor

Planning and Strategies for Airline Operations

Sponsor: Aviation Applications
Sponsored Session

Chair: Sergey Shebalov, Principal Research Analyst, Sabre Holdings, Dallas/Fort Worth, TX, United States of America, Sergey.Shebalov@sabre-holdings.com

1 - Baggage Capacity and Demand Management Becomes Even More Sophisticated

Desmond Di Wang, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, diwang2007@u.northwestern.edu, Diego Klabjan

While sophisticated forecasting management systems exist for the passengers and cargo load of an aircraft, this is not the case for baggage despite significant costs associate with baggage mishandling. It is thus desirable to detect excessive baggage load early during the booking process to avoid dire consequences for both passengers and the airline. We present methodologies behind a system for baggage load forecasting any number of days before the day of operations.

2 - Short-term Maintenance Allocation

Sergey Shebalov, Principal Research Analyst, Sabre Holdings, Dallas/Fort Worth, TX, United States of America, Sergey.Shebalov@sabre-holdings.com

Short-term maintenance allocation involves building and supporting maintenance schedule for each tail to ensure its operationability. We present a model that creates an optimal set of maintenance blocks for a given tail assignment and allocates maintenance events to them. We optimize aircraft utilization and maintenance cost while maintenance capacity is constrained. We extend our formulation to allow overnight aircraft swaps and thus integrate maintenance allocation and tail assignment.

3 - Planeside Manpower Planning at United Airlines

Feryal Kuran, United Airlines, 1200 E. Algonquin Rd., Elk Grove Village, IL, United States of America, Feryal.Kuran@united.com, Kumar Satyam

Planeside Tool is a major component of the Ramp Operations automation strategy at United Airlines. Initial phase enables manual assignment of resources to cover arrival and departure packages. Model, developed by Enterprise Optimization, suggests best assignment of resources to packages and lunches over multiple hours considering various factors. Weighting of factors can be adjusted depending on needs of operations. Model enables improved coverage of flights and better utilization of resources.

4 - Structured Deplaning: A Simulation and Optimization of Implementable Strategies

Andrew Wald, Northwestern University, 2145 Sheridan Road, Evanston, IL, 60208, United States of America, andrewwald@gmx.com, Diego Klabjan

Deplaning naturally occurs row by row down the length of an aircraft. Using simulation and optimization, we design deplaning strategies (e.g., deplane by group) that significantly reduce the overall deplaning time. These evaluations are established through field observations and simulation, and have been tested across several equipment types.

■ WA71

H - Salon H, 6th Floor

Resource Efficiency and Distribution Models in DEA

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Subhash Ray, University of Connecticut, CT, United States of America, subhash.ray@uconn.edu

1 - Using DEA to Help the Regulator Set Promulgated Insurance Rates

Patrick Brockett, University of Texas, TX, United States of America, brockett@mail.utexas.edu, William Cooper, Jing Ai, Charles Yang, Linda Golden, Utai Pitaktong

We offer a methodology for setting efficient promulgated insurance rates illustrated through an application to title insurance rate setting. In title insurance, losses constitute a tiny percentage of the premium, and expenses dominate the rates. Rates are set (in Texas) by the regulator relying upon average expenses and loss ratios. This inflates rates and rewards inefficiency, since inefficient agents with higher expenses drive up the average expense resulting in higher promulgated rates. We use DEA to: identify those title agents that efficiently utilize their resources to produce policies, and show how rates can be promulgated based upon the expenses of only these efficient agents, thus encouraging efficient management and reasonable rates.

2 - A DEA Approach to Simulation Output Analysis of an Agent-based Model of a Distribution Network

William Sawaya, Assistant Professor, Texas A&M University, Eng. Tech. and Industrial Distribution, College Station, TX, 77845, United States of America, sawaya@tamu.edu, Andrew Johnson, Sri Nagendra Jayanty

Simulation output analysis for comparing different systems configurations can be complicated by the fact that there are often multiple performance variables of interest. This complexity can be further compounded in agent-based system because it is conceivable that there are multiple agents that each have their own performance information. This research presents a DEA approach analyzing simulation output of different system configurations for multiple organizations in a distribution network.

3 - Cost Efficiency in a Model of Production and Distribution

Subhash Ray, University of Connecticut, CT, United States of America, subhash.ray@uconn.edu

This paper develops a measure of overall cost efficiency in an integrated model of production and distribution. The DEA model introduced by Ray et al (2008) for multi-location cost minimization in the presence of input price variation across locations is combined with the standard transportation model. The principal innovation is that optimal quantities produced at different locations and the quantities shipped to different destinations are determined simultaneously in a unified DEA model that minimizes total production and distribution cost.

■ WA72

H - Salon J, 6th Floor

Joint Session TSL/ SPPSN: Aiding Disaster Relief Through Optimization

Sponsor: Transportation Science and Logistics Society/ Public Programs, Service and Needs
Sponsored Session

Chair: Irina Dolinskaya, Assistant Professor, Northwestern University, 2145 Sheridan Road, M235, Evanston, IL, 60208, United States of America, dolira@northwestern.edu

1 - Continuous Approximations for Relief Routing

Michael Huang, Northwestern University, 2145 Sheridan Rd, Evanston, IL, 60208, United States of America, Michael-Huang@u.northwestern.edu, Karen Smilowitz

In relief routing, solutions must be found quickly and should be easy to implement. We describe a simple policy and develop analytic approximations to measure its effectiveness. We demonstrate the accuracy of the approximations' by comparing the predicted values against simulations of the policy. Finally, we test the solutions from the policy against more sophisticated polices generated with a Tabu search.

2 - A Review on Recent OR Research in Disaster Operations Management

Rajan Batta, Professor and Associate Dean, University at Buffalo (SUNY), Department of Industrial & Systems Engg, 438 Bell Hall, Buffalo, NY, 14260, United States of America, batta@buffalo.edu, Gina Galindo

Disasters have attracted the attention of OR researches who are interested on applying scientific techniques to improve DOM effectiveness, and reduce the consequences of disasters on the economy and human lives. In this talk a review on recent OR research in DOM is offered and some future research directions are proposed.

3 - Modeling Disaster Relief Networks

Luis de la Torre, PhD Candidate, Northwestern University, 2145 Sheridan Road, IEMS, Tech C210, Evanston, IL, 60201, United States of America, ledelatorre@u.northwestern.edu, Irina Dolinskaya, Karen Smilowitz

This talk presents our research in last mile operations of disaster relief distribution. In particular, we focus on how distribution problems are represented in operations research models and characteristics of distribution in practice. We discuss implications of problem assumptions in both modeling and implementation.

■ WA73

H - Salon K, 6th Floor

Supply Chain: Reverse Logistics, Cost of Quality

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Theresa Barker, PhD, University of Washington, Box 352650, Seattle, WA, 98115, United States of America, barkertj@u.washington.edu

1 - Cost Sharing for Economic Lot-Sizing Problems with Remanufacturing Options

Mohan Gopaladesikan, School of Industrial Engineering, Purdue University, 315 N. Grant Street, Grissom Hall 308, West Lafayette, IN, 47907, United States of America, mohang@purdue.edu, Nelson Uhan

We consider a class of cooperative games that model the cost sharing issues that arise from the economic lot-sizing problem with remanufacturing options. By investigating the properties of various mathematical programming formulations and relaxations for the underlying lot-sizing problem, we obtain some insights into the existence of cost allocations in the core and the approximate core of these games, as well as the algorithmic aspects of computing such cost allocations.

2 - Robust Design of Computer Remanufacturing and Recycling Facilities

Suzanne Marcotte, Professor, Universite du Quebec a Montreal, 315 rue Ste-Catherine Est, Montreal, QC, H2X 3X2, Canada, Suzanne.Marcotte@cirrelt.ca, Benoit Montreuil

This presentation will describe the capacity planning of resources required in a computer remanufacturing and recycling facility. It will describe the generic process and the operations and decisions to be taken. Each operation of this process is characterized by sources of uncertainty and variability. It will then present results on the capacity required given various level of uncertainty.

3 - Integrating Cost of Quality in Supply Chain Modeling: A Preliminary Study

Krystel K. Castillo-Villar, Texas Tech University-Tecnologico de Monterrey, Box 43061, Lubbock, TX, 79409-3061, United States of America, krystel.castillo@ttu.edu, Neale R. Smith, James L. Simonton

This work presents a preliminary methodology to compute the cost incurred by various actors within the supply chain due to the cost of poor quality or cost of quality (CoQ). We consider a generic consumer goods supply chain, consisting of three tiers, namely suppliers, manufacturers, and retailers. The purpose of this work is to provide a guide to translate defect rates at supplier, manufacturing plant, and retailer to quality costs. The study recommends ways quality engineers can use the methodology to make decisions regarding investment in prevention activities, rework process, inspection, among others. The practical implications of this research are a better selection of suppliers and manufacturing plants based on quality and cost considerations and a better understanding of CoQ not just as an internal, but also as an external performance measure. The study offers insights based on the findings and provides guidelines for future research.

■ WA74

H - Room 602, 6th Floor

Optimal Sensor Location and Deployment

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Yi-Chang Chiu, University of Arizona, Tucson, AZ, United States of America, chiu@email.arizona.edu

1 - Permanent Traffic Counter Location Problem on Transportation Network

Fatemeh Sayyady, Research Assistant, North Carolina State University, 2501 Stinson Drive, 208 Mann Hall, Raleigh, NC, 27695, United States of America, fsayyad@ncsu.edu, George List, Yahya Fathi, John Stone

We consider the problem of determining an optimal placement for the traffic counters on a large-scale highway network, subject to a budget constraint. We formulate the problem as a mixed integer linear programming problem, and show that it has structural similarities with the p-median problem as well as the knapsack problem. A reasonably fast Lagrangian-heuristic approach is presented to solve large size instances of the problem where CPLEX fails to report optimal values.

2 - Traffic Sensor Deployment Under Probabilistic Disruptions and Generalized Surveillance Effectiveness Measures

Xiaopeng Li, University of Illinois at Urbana-Champaign, B156 Newmark Civil Engineering Laborator, 205 N. Mathews Ave, Urbana, IL, 61821, United States of America, li28@illinois.edu, Yanfeng Ouyang

We propose a reliable sensor location model to optimize surveillance effectiveness when sensors are subject to site-dependent probabilistic failures, and a general effectiveness measure is proposed to encompass most existing measures needed for engineering practice. We formulate a compact mixed-integer program and develop a variety of solution algorithms. We also propose alternative formulations in the form of reliable fixed-charge sensor location models.

3 - A Continuum Approximation Approach to Reliable Traffic Sensor Deployment on Highway Corridors

Xiaopeng Li, University of Illinois at Urbana-Champaign, B156 Newmark Civil Engineering Laborator, 205 N. Mathews Ave, Urbana, IL, 61821, United States of America, li28@illinois.edu, Yanfeng Ouyang

We propose a continuum approximation framework for the reliable deployment of traffic sensors to optimize surveillance effectiveness when sensors are subject to site-dependent probabilistic failures.

4 - Optimal Advance Detector Location for Green Termination Systems on High Speed Isolated Intersections

Lili Du, NEXTRANS Center, Purdue University, 2700 Kent Avenue, West Lafayette, IN, 47906, United States of America, ldu@purdue.edu, Anuj Sharma, Srinivas Peeta

This model finds near-optimum solutions very efficiently, and results from the approximation method are shown to be very close to those from the discrete methods.

Wednesday, 11:00am - 12:30pm

■ WB01

C - Ballroom D1, Level 4

Planning for Uncertainty in Energy Systems

Sponsor: Energy, Natural Resources and the Environment/ Energy Sponsored Session

Chair: Sarah Ryan, Professor, Iowa State University, 3004 Black Engineering Bldg., Ames, IA, 50011-2164, United States of America, smryan@iastate.edu

1 - Electric Power System Generation Expansion Planning Problems Considering Risk

David Coit, Associate Professor, Rutgers University, Industrial & Systems Engineering, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States of America, coit@rutgers.edu, Hatice Tekiner, Frank Felder

GEP problems are solved to determine generation options to add and where/when to be constructed considering risk. In studies, decision makers are risk neutral; but often they are risk averse. We solve a multiobjective optimization problem to minimize cost and risk. We define a subset of scenarios to represent the stochastic nature. Multiobjective optimization problem is solved to find a Pareto Front.

2 - Generation Expansion Portfolio Optimization with Stochastic Production Tax Credit for Wind Power

Jo Min, Iowa State University, IMSE Department, 3004 Black, Ames, IA, 50011, United States of America, jomin@iastate.edu, Jin Lee, Chenlu Lou, Chung-Hsiao Wang

We construct and analyze a generation expansion portfolio model consisting of conventional power plants and windmills. Specifically, a mean - variance utility function is optimized under the assumption that the fuel price, electricity price, and production tax credit for wind power are random variables. Via parametric quadratic programming, we analytically derive various managerial insights with respect to the degrees of risk aversion, renewable portfolio standards, and production capacities.

3 - Computational Issues in Solving Large-Scale Stochastic Grid Expansion Problems

Jean-Paul Watson, Sandia National Laboratories, jwatson@sandia.gov, David Woodruff

Grid generation and transmission expansion problems are frequently expressed as stochastic mixed-integer programs, commonly multi-stage due to long-term planning horizons. However, these models are very difficult to solve, due to multiple exogenous uncertainty sources and scenario tree depth. We investigate the issue of decomposition solver performance on such problems, focusing on Progressive Hedging. Computational results and solution strategies are reported for several test problems.

4 - Scenario Reduction Methods for Rolling Stochastic.Energy Planning Programs

Yan Wang, PhD Student, Iowa State University, 3004 Black Engineering, Ames, IA, 50010, United States of America, yanwang@iastate.edu, Sarah Ryan

A medium-term fuel procurement and electricity generation planning problem is naturally solved as a rolling horizon series of stochastic programs with evolving fuel price forecasts. We examine the accuracy and computational efficiency of a scenario reduction heuristic that emphasizes the initial decision rather than the distribution of scenarios.

■ WB02

C - Ballroom D2, Level 4

Risk Management & Stochastic Programming in Gas and Power Systems

Cluster: Energy: Modeling the Interface Between Markets and Operations

Invited Session

Chair: Qipeng Phil Zheng, Assistant Professor, West Virginia University, Industrial & Management Systems Eng, P.O. Box 6070, Morgantown, WV, 26505, United States of America, Qipeng.Zheng@mail.wvu.edu

1 - Forecasting PHEV Sales and Recharging Activities

Lizhi Wang, Iowa State University, 3016 Black Engineering, Ames, IA, 50014, United States of America, lzwang@iastate.edu, Zhaoyang Duan, Brittni Gutierr

Sales of plug-in hybrid electric vehicles (PHEVs) and PHEV users recharging behavior are two critical factors for studying the potential impact of PHEVs on electric power systems. We present novel approaches to making more accurate and revealing forecasts of these factors. We will forecast the sales of PHEVs as a function of several interacting sub-factors, and forecast PHEV users' recharging behavior as a function of available recharging infrastructures.

2 - Identification and Prevention for Blackout on Large-scale Power Grid

Hongsheng Xu, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, xuhongsh@ufl.edu

A blackout is the situation where there is a total loss of power to a relatively wide area, and how to quickly identify it in the power grid is key to preventing it from cascading. In this paper, we are focusing on detecting the possible blackout using our proposed evaluation criteria and algorithms. The results above could lead to some strategy guidance for designing and operation power grid. A computational study is presented in which we apply our model to the simulated data sets.

3 - Midterm Coordination of Natural Gas Storage and Power Generation

Cong Liu, Postdoctor, Argonne national Laboratory, 9700 S. Cass Ave., Bldg 221, Argonne, IL, 60439, United States of America, liuc@anl.gov, Jianhui Wang, Mohammad Shahidehpour, Zuyi Li

In this talk, we will investigate the midterm coordination of natural gas resources and power generation. The objective is to minimize the integrated social cost including cost of power and natural gas systems while satisfying their complex coupled network constraints. The original problem will be decomposed into sub-problems for each week. Lagrangian relaxation will be used to relax weekly coupling constrains of gas storage reservoirs.

4 - Expansion Planning Models for Combined Electricity and Natural Gas Systems

Alexey Sorokin, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 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, especially for electricity generation. We consider transmission expansion problem for gas and electricity networks, as well as for LNG terminal location planning. The multiple stage expansion model is proposed.

■ WB03

C - Ballroom D3, Level 4

Environmental Legislation, Carbon Trading and Supply Chain Management

Sponsor: Energy, Natural Resources and the Environment//Forestry Sponsored Session

Chair: Eda Kemahlioglu-Ziya, University of North Carolina-Chapel Hill, CB#3490, Chapel Hill, NC, United States of America, Eda_KemahliogluZiya@unc.edu

1 - Strategic Carbon Footprint Labeling in a Supply Chain

Rob Zuidwijk, Rotterdam School of Management, P.O. Box 1738, Rotterdam, Netherlands, RZuidwijk@rsm.nl, Charles Corbett, Chien-Ming Chen

When firms plan to put carbon footprint labels on their products, it is often not unambiguous how those carbon footprints should be determined. Current standards for carbon footprint reporting also leave room for ambiguity. This gives firms some flexibility in how to allocate carbon emissions to different products. In this paper, we examine conditions under which that flexibility in fact helps to reduce the firm's total carbon footprint without compromising profits.

2 - How Does Product Recovery Affect Quality Choice?

Gilvan Souza, Associate Professor, Indiana University, Kelley School of Business, 1309 E 10th St, Bloomington, IN, 47401, United States of America, gsouza@indiana.edu, Atalay Atasu

We study the impact of product recovery (remanufacturing or recycling) on product quality, where quality increases market valuation for the product. We find that the recovery cost structure and the presence of take-back legislation significantly impact quality. Product recovery can be welfare improving, underscoring benefits of environmental legislation.

3 - The Effect of Remanufacturing on New Products

Vishal Agrawal, Georgia Institute of Technology, 800 W Peachtree St NW, Atlanta, GA, United States of America, Vishal.Agrawal@mgt.gatech.edu, Atalay Atasu, Koert Van Ittersum

In this paper, we experimentally investigate the effect of remanufactured products on the perceived value of new products. We incorporate this effect to analytically investigate an OEM's strategy in the presence of competition from third-party remanufacturers. Our research shows that an OEM may not always benefit from preempting third-party remanufacturers. Instead, an OEM may find it more profitable to allow third-party competitors to remanufacture its products.

4 - Complying with Take-Back Legislation: A Cost Comparison and Benefit Analysis of Compliance Schemes

Gokce Esenduran, The Ohio State University, 2100 Neil Avenue, Columbus, OH, United States of America, esenduran_1@fisher.osu.edu, Eda Kemahlioglu-Ziya

We compare three compliance schemes (i.e. individual, collective and collective with individual financial responsibility) that firms follow to comply with take-back legislations. We model each scheme as a two-stage Nash game and find the key market/operating conditions that make one preferable to the others. As the most cost effective scheme may fall short on environmental benefits, i.e. collection rate\treatability level, we identify how environmental benefits compare between the three schemes.

■ WB04

C - Ballroom D4, Level 4

Decision Analysis III

Contributed Session

Chair: Rebeca Díaz, Full Time Teacher, Technological Institute of Superior Studies of Coacalco, Av. 16 de septiempre No. 54, Cabecera, Municipal, Coacalco, Edo, de México, México D.F., 55700, Mexico, rbkdiazt@hotmail.com

1 - Integrated Multi-Time-Scale and Multi-Organizational-Scale Decision Making Model

Christian Wernz, Assistant Professor, Virginia Tech, Industrial and Systems Engineering, 250 Durham Hall (0118), Blacksburg, VA, 24061, United States of America, cwernz@vt.edu, Abhijit Deshmukh

In organizations, hierarchically interacting agents make decisions at different time scales. Typically, higher level agents make decisions about strategic variables with lower frequency compared to lower level agents, which make decisions about operational variables more often. We develop a multiscale decision model for hierarchical agents, and present an analysis of three-level agent interactions.

2 - Selection of Talents Based on Decision Making Theory

Shaikh Akhlaque-E-Rasul, Concordia University, 1515 St. Catherine West, Montreal, Canada, akhlaque1045@hotmail.com, Sudhir P. Mudur

It is always a difficult task to select the best candidate from many. Sometimes, biased opinions may skew the selection process. To overcome any bias and to rank the candidates, we show how decision makers can apply the decision-making theory of material science, which was developed by D. H. Jee. In the present work, several case studies from our daily life that benefit from the use of this theory are presented.

3 - Inclusion of Preference-Dependence in Multi-attribute Utility Theory (MAUT)

Johannes Siebert, Akademischer Rat, University of Bayreuth, Lehrstuhl Prof. Schluechtermann, Universitaetsstr. 30, Bayreuth, 95440, Germany, Johannes.Siebert@uni-bayreuth.de

Decision makers express preferences -here considered as factors- as ratios to averages of the alternative. A Taylor expansion of the product of these factors yields first and higher order terms. The former depend on each one preference only whereas the later depend on two or more preferences and are used to model dependencies. The new model is termed aggregate utility factor model (AUFM). In a computer-based experiment practicability and consistence in decision making are confirmed.

4 - CUT: A New Multi-criteria Approach for Non-additive Concavifiable Preferences

Nikolaos Argyris, London School of Economics and Political Science, Houghton Street, London, N1 0HP, United Kingdom, n.argyris@lse.ac.uk, Jose Figueira, Alec Morton

We propose a new multi-criteria approach for concavifiable preferences: Concave UTility (CUT). CUT defines a space of value functions consistent with a DM's expressed preferences. CUT has analogies with existing aggregation-dissagregation approaches, e.g. the UTA procedure, however CUT is more general as it does not require that preferences are additive. We describe how CUT can be used in an interactive setting: pre-ordering a finite set of discrete alternatives and multi-criteria optimization.

5 - Studying the Effect of Improved Individual Skills in Negotiation and Collective Decision Making

Rebeca Díaz, Full Time Teacher, Technological Institute of Superior Studies of Coacalco, Av. 16 de septiempre No. 54, Cabecera, Municipal, Coacalco, Edo, de México, México D.F., 55700, Mexico, rbkdiazt@hotmail.com, Leopoldo Viveros, Mario Chew

Some questions about group decision making relate to the skills of the members, for instance: Does the group make better decisions than those of its most skilled member? If the members do not share objectives, how the skills at decision making and negotiation influence the decision? To study these issues we developed an environment in which the skills of each member can be controlled, using a simulated job-sequencing problem as a benchmark and final year engineering students as subjects.

■ WB05

C - Ballroom D5, Level 4

Stochastic Optimization

Contributed Session

Chair: Asad Ata, Southern Methodist University, P.O. Box: 750123, Dallas, TX, 75275-0122, United States of America, ata.asad@gmail.com

1 - Equity Valuation and Debt Selection via Stochastic Programming

Davi Valladao, PhD Student, Pontifical Catholic University of Rio de Janeiro, Rua Marqu's de São Vicente, 225, Rio de Janeiro, RJ, 22451-041, Brazil, davimichel@gmail.com, Geraldo Veiga, Alvaro Veiga

We develop a multistage stochastic programming model for equity valuation and debt selection for a firm with a predetermined project portfolio. We consider fixed and floating interest rate debt with different maturities. Moreover, the price of each corporate bond is given by a risk free valuation multiplied by a discount factor. We assume this factor to be a concave piecewise linear function of the new debt issued, with each segment based on different leverage rate levels.

2 - On a Class of Stochastic Programs with Endogenous Uncertainty: Algorithm and Applications

Bruno Flach, PSR, Praia de Botafogo 228/1701, Rio de Janeiro, 22260020, Brazil, bruno@psr-inc.com

We study a class of stochastic programming problems in which the probability distribution of the random parameters is decision-dependent. We propose a convexification technique coupled with a cut-generation algorithm for the MINLP formulation and the incorporation of importance sampling concepts into the stochastic programming framework so as to allow the solution of large instances. The applicability of our methodology is illustrated by an example in the area of power systems' reliability.

3 - A Stochastic Programming Model for Seasonal View Selection Problem in Database Management Systems

Rong Huang, Research Assistant, North Carolina State University, 484 Daniels Hall, Campus Box 7913, Raleigh, NC, 27695-7913, United States of America, rhuang@ncsu.edu, Rada Chirkova, Yahya Fathi

We introduce the stochastic seasonal view selection problem with random query sets, and model it as a two-stage stochastic integer programming problem. We propose exact and inexact methods for solving the problem and present the results of a computational experiment.

4 - A New Hybrid Method for Solving Multistage Stochastic Programming Problems

Nezir Aydin, Research Assistant, Wayne State University, 4815 Fourth Street, Room: 1067, Detroit, MI, 48202, United States of America, aydin@wayne.edu, Alper Murat, Leslie Monplaisir

In this study, we propose a creative way of combining the Progressive Hedging Algorithm (PHA) and Sampling Average Approximation (SAA) methods for solving multi-stage Stochastic Programming (SP) problems such that the exactness and speed of attaining a solution can be traded-off. Through extensive experimental results, we demonstrate the effectiveness of this hybrid approach over the pure strategies (SAA or PHA only) under specific circumstances using multi-product lot-sizing problem.

5 - An LP Based State Space Approach to Stochastic Dynamic Programming Problem

Asad Ata, Southern Methodist University, P.O. Box: 750123, Dallas, TX, 75275-0122, United States of America, ata.asad@gmail.com, Eli Olinick, Chester Chambers, Eli Snir

A linear programming (LP) approach is discussed to solve a stochastic dynamic programming (SDP) problem. An attempt is made to alleviate the curse of dimensionality by formulating the problem as a discrete time, infinite horizon, stochastic dynamic programming model with a finite state space. The model results as an instance of Unichain Markov Decision Process. The LP produces a profit maximizing policy and states the likelihood the resulting markov system is in any particular state.

■ WB06

C - Ballroom E, Level 4

Tutorial: Robust Vehicle Routing

Cluster: Tutorials
Invited Session

Chair: Fernando Ordonez, Associate Professor, University of Southern California, Department of Industrial and Systems Eng, 3715 McClintock Ave, Los Angeles, CA, 90007, United States of America, fordon@usc.edu

1 - Robust Vehicle Routing

Fernando Ordonez, Associate Professor, University of Southern California, Department of Industrial and Systems Eng, 3715 McClintock Ave, Los Angeles, CA, 90007, United States of America, fordon@usc.edu

Vehicle routing problems in many industrial applications must take into account uncertain demand, traffic conditions and/or service times. In this tutorial we present recent work on the use of robust optimization for vehicle routing problems (VRP) under uncertainty. We outline different robust VRP models, depending on the formulation, source of the uncertainty, and correlation in the uncertainty. Furthermore, we discuss previous computational results that illustrate when such a robust model is convenient and when it is not. We show with results in two different applications that robust optimization is useful to find a routing plan when routes will be adapted to the outcome of the uncertainty.

■ WB07

C - Ballroom F & G, Level 4

Supply Chain, Closed-loop I

Contributed Session

Chair: Sameer Kumar, Professor of Operations and Supply Chain Management, Opus College of Business, University of St. Thomas, Mail # TMH 343, 1000 LaSalle Avenue, Minneapolis, MN, 55403-2005, United States of America, skumar@stthomas.edu

1 - Analysis of Bullwhip Effect Under Retailer and Customer Forecasting with Price-sensitive Demand Function

Yungao Ma, School of Management, Xi'an Jiaotong University, Shaanxi, China, 710049, Xi'an, 710049, China, ma.gao@stu.xjtu.edu.cn, Zhiping Yuan, Yufei Huang

In a single two-stage supply chain with one supplier and one retailer, we analyze the impact of demand forecast by retailer and price forecast by customers on Bullwhip Effect (BWE) under moving average (MA) and exponential smoothing (ES) forecasting methods. Results show that: first, demand forecast can reduce BWE under price-sensitive demand function; second, price forecast can reduce BWE under certain conditions when customers consider price fluctuation; besides, BWE under ES is not always significant compared to that under MA.

2 - Product Recoveries in China: Remanufacturing vs. Refurbishing

Yao Chen, Shanghai Jiaotong University, No.535 Fahua Road, Shanghai, Shanghai, China, yaochen514@msn.com, Fangruo Chen

The markets for recovered products in China consist of both remanufactured and refurbished products, where the former must match the quality limit. Relative to new products, the two type of recovered products enjoy a cost advantage, but suffer from a lower willingness-to-pay by the consumers. We characterize the equilibrium market structure when all the three products compete with each other with a emphasis on the conditions under which the remanufacturing products can survive the competition.

3 - Variable-level Disassembly Planning for Facilitating Remanufacturing Between Different Products

Yoo S. Hong, Associate Professor, Seoul National University, 599 Kwanakro, Kwanakgu, Seoul, Korea, Republic of, yhong@snu.ac.kr, Changmuk Kang

In order to resolve the mismatch between return supply of end-of-life (EOL) products and demand of a new product, an EOL product has to be disassembled and remanufactured at a part level, and used for producing a different product. This study solves a problem of planning disassembly of different kinds of products of which return and demand change over time. Each product is disassembled into variable levels according to its return and demand of serviceable parts.

4 - 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 # TMH 343, 1000 LaSalle Avenue, Minneapolis, MN, 55403-2005, 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.

■ WB08

C - Room 11A, Level 4

Location Modeling Applications

Sponsor: Location Analysis
Sponsored Session

Chair: Rajan Batta, Professor and Associate Dean, University at Buffalo (SUNY), Department of Industrial & Systems Engg, 438 Bell Hall, Buffalo, NY, 14260, United States of America, batta@buffalo.edu

1 - Ambulance Location, Relocation and Relocation with Uncertainty Models

Bo Zeng, Assistant Professor, University of South Florida, Department of IMSE, Tampa, FL, 33620, United States of America, bzeng@usf.edu, Shengyong Wang

Various location models for ambulances have been extensively studied. In this talk, we first present a dynamic relocation model that could be combined with any existing location models. Then, a stochastic relocation model that includes request uncertainties will be presented. Finally, numerical study will be given to show the effectiveness of those models on response times in difference situations.

2 - Centralized Dispatch Approximation for the Transshipment Problem

Dmitry Krass, Professor, University of Toronto, Rotman School of Management, 105 St. George Street, Toronto, ON, M5S 3E6, Canada, Krass@Rotman.Utoronto.Ca, Alex Shlakhter

In the transshipment problem a number of retailers facing stochastic demand must place orders before the demand is known, but can transship inventory once the demand is realized. We show that by assuming a central depot through which all transshipments must flow, the computations of the (approximately) optimal ordering policy are greatly simplified. Moreover, the performance of the approximate policy is excellent. We also analyze and obtain analytical results for the monotone policy case.

3 - Facility Location Problem with Network Oligopoly

Paul Berglund, University at Buffalo, 786 West Ferry Street, Buffalo, NY, 14222, United States of America, berglund@buffalo.edu, Changhyun Kwon

We formulate an equilibrium facility location problem on a discrete network, where the locating firm acts as the leader in a Stackelberg-Nash-Cournot competitive equilibrium problem. To maximize expected profits the locating firm must solve a problem with equilibrium constraints. Finding an optimal solution is hard for large problems. Therefore a heuristic solution procedure based on simulated annealing is presented.

4 - Locating Temporary Depots to Facilitate a Post-Disaster Relief Operation: A Case Study

Yen-Hung Lin, PhD Candidate, University at Buffalo (SUNY), 438 Bell Hall, Buffalo, NY, 14260, United States of America, yl48@buffalo.edu, Peter Rogerson, Alan Blatt, Marie Flanigan, Rajan Batta

A case study through HAZUS simulation software of a historical earthquake scenario is used to evaluate the performance of a disaster relief operation with a distributed supply strategy. The distributed supply strategy locates several temporary depots in the area impacted by a recent earthquake event so that demand can be fulfilled by either temporary depots or the central depot. The items being supplied are of three categories (water, food and medicine) and have different priorities.

■ WB09

C - Room 11B, Level 4

Behavioral Issues

Sponsor: Manufacturing and Service Operations Management Sponsored Session

Chair: Mirko Kremer, Pennsylvania State University, 460 Business Building, State College, PA, 16802, United States of America, Mirko.Kremer@psu.edu

1 - Explanations of Newsvendor Biases Do Not Square

Neil Bearden, Assistant Professor, INSEAD, 1 Ayer Rajah Ave, Singapore, 138636, Singapore, Neil.BEARDEN@insead.edu, Sameer Hasija

We show that now-conventional explanations of biases in newsvendor experiments do not hold up to close scrutiny. The accounts implicitly assume that decision behaviour is invariant with respect to problem framing, but we show that order quantities are strongly contingent on the way the problem is presented. Finally, we argue for an eliminitavist stance on explanation in behavioural operations: the attempt to give simple accounts of decision behaviour in complex problems should be abandoned.

2 - On the Ability to Identify Pareto-improving Supply Contracts

Mirko Kremer, Pennsylvania State University, 460 Business Building, State College, PA, 16802, United States of America, Mirko.Kremer@psu.edu, Tony Haitao Cui

Formal analyses of risk-sharing supply contracts typically focus on identifying contracts that induce maximal channel efficiency, while allowing for a flexible allocation of channel profits. As a first step toward a better understanding of the bargaining process toward such Pareto contracts, we investigate empirically how sellers and buyers choose from sets of contracts. We further explore how the ability to identify Pareto-improvements is sensitive to the framing of the contract.

3 - Revenue Sharing versus Buyback Contracts: Influence of Supplier Preferences

Karen Donohue, Associate Professor, University of Minnesota, Carlson School of Management, Minneapolis, MN, United States of America, donoh008@umn.edu, Yinghao Zhang, Tony Haitao Cui

Prior analytical research shows that buyback and revenue sharing contracts achieve equivalent channel-coordinating solutions when applied in a single supplier-buyer setting. More recently, behavioral research suggests that the two contracts do not always perform equivalently. We examine how supplier preferences, such as loss aversion and time discounting, can lead suppliers to prefer one contract type over the other depending on the ratio of overage and underage costs.

4 - Product Quality Choice and Inventory Risk Under Strategic Consumer Behavior

Robert Swinney, Assistant Professor, Stanford University, 518 Memorial Way, Stanford, CA, 94305-5015, United States of America, Swinney_Robert@GSB.Stanford.Edu, Sang-Hyun Kim

We analyze a model in which a firm selling a single, seasonal product sets both product quality and quantity before selling to a population of forward-looking customers. The size of the market is uncertain to the firm, and customers anticipate the price path of the product and may strategically delay a purchase to pay a lower price. We consider the impact of both demand uncertainty and customer behavior on the optimal quality and quantity of the product.

■ WB10

C - Room 12A, Level 4

Managing the Distribution Channel with Competing Products and Supply Risk

Sponsor: Manufacturing and Service Operations Management Sponsored Session

Chair: Yunzeng Wang, University of California-Riverside, A. Gary Anderson Graduate School of Mgmt, Riverside, United States of America

1 - Split Award Auctions for Supplier Retention

Aadhaar Chaturvedi, IESE Business School, Av. Pearson 21, Barcelona, Spain, achaturvedi@iese.edu, Damian Beil, Victor Martinez de Albeniz

Traditionally, buyers use auctions select the lowest-cost supplier. By doing so, they might alienate the losing suppliers. This involves a future cost of supplier qualification if they defect from the supply base. This paper considers the trade-off between the purchasing cost and the qualifying cost paid to maintain the supply base. We find the optimal split award that minimizes long-run costs and the optimal supply base size that the buyer should maintain.

2 - Nature of Coordination Contracts for Supply Chain Management: Classifications and Structural Results

Meng Lu, The Chinese University of HK, Shatin, N.T., Hong Kong, China, mlu@se.cuhk.edu.hk, Houmin Yan, Suresh Sethi

In this paper, based on the group decision-making and game theory, we define a framework for supply chain contracts and classify into groups. With precise mathematical definitions, and subsequently developed structural properties and sufficient conditions, we are not only able to measure the goodness of supply contracts but also to reveal the nature of the supply coordination. We develop indexes to measure coordination contracts in terms of coordination strength and decision sequence dependency.

3 - Heterogeneous and Nonlinear Frontier Analysis: Supply-Chain Transaction Cost Perspective

John Liu, Chair Professor, Hong Kong PolyU, CD 401b, Kowloon, Hong Kong - PRC, lgtjliu@polyu.edu.hk, Jason Jianfeng Mao

Inspired by the works of Williamson (2008), transaction cost economics of supply chain management is emerging as a challenging research area, due to heterogeneity and non-linearity of transaction costs as incurred in outsourcing operations of SCM. We herein develop a degenerative frontier model which incorporates both heterogeneity and nonlinearity. We obtain convexity properties, and develop a solution method which converts a DF problem into a sequence of convex problems.

■ WB11

C - Room 12B, Level 4

Empirical Research in Operations Management

Sponsor: Manufacturing and Service Operations Management Sponsored Session

Chair: Vishal Gaur, Associate Professor, Johnson School, Cornell University, 321 Sage Hall, Ithaca, NY, 14850, United States of America, vg77@cornell.edu

1 - The impact of New Product Introduction on Plant Productivity in the NA Automotive Industry

Serguei Netessine, Professor, INSEAD, Boulevard de Constance, Fontainebleau, 77305, France, serguei.netessine@insead.edu, Manu Goyal, Anand Gopal, Matthew Reindorp

We empirically estimate productivity losses during new product introductions in the automotive industry. We show that productivity losses can be mitigated through manufacturing flexibility and different forms of organizational learning.

2 - An Empirical Study of Pricing in the U.S. Automobile Industry

Antonio Moreno, The Wharton School, 3730 Walnut St, Philadelphia, United States of America, amore@wharton.upenn.edu, Gerard Cachon, Christian Terwiesch

Despite the abundant theoretical literature on dynamic pricing, price postponement and operational flexibility, there is limited empirical evidence on how firms actually adjust their prices, and how operational practices play a role in their pricing decisions. Using a detailed transactional dataset of the US auto industry, we study the impact of operational strategic decisions on pricing.

3 - Improving Retail Store Performance by Incorporating Traffic Characteristics in Labor Planning

Vidya Mani, The University of North Carolina at Chapel Hill, The Kenan-Flagler Business School, Chapel Hill, NC, 27599, United States of America, vidya_mani@unc.edu, Saravanan Kesavan, Jayashankar Swaminathan

Managing store labor is critical to improving customer service as well as controlling costs for retailers. Using data from a large retailer, we show how labor planning can be improved by incorporating store traffic characteristics in managerial staffing decisions.

4 - An Empirical Estimation of the Impact of Airline Flight Schedules on Flight Delays

Vinayak Deshpande, Purdue University, 100 S. Grant St, West Lafayette, IN, 47907, United States of America, vinayak@purdue.edu, Mazhar Arikan

Airline flight delays have come under increased scrutiny lately, with FAA data revealing that airline on-time performance was at its worst level in 13 years in 2007. Our goal is to examine the impact of the scheduled time block allocated for a flight on on-time arrival performance. We combine empirical flight data published by BTS, with the Newsvendor framework from the Operations literature to conduct this analysis. Our results show that airlines systematically under-schedule flights.

■ WB12

C - Room 13A, Level 4

Emerging Topics in Supply Chain Management

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Tingting Cui, University of California-Berkeley, Berkeley, CA, United States of America, tingting@ieor.berkeley.edu

1 - Modeling and Mitigating the Effects of Supply Chain Disruption on Wargames

Shilan Jin, SUNY at Buffalo, 435 Bell, SUNY at Buffalo, North Campus, Amherst, NY, 14260, United States of America, sjin6@buffalo.edu, Zigeng Liu, Jun Zhuang

We integrate supply chain risk management with a government-terrorist game in war zones. The equilibrium outcomes of wargames depend on the government's resources delivered through military supply chains, which are subject to disruptions. We study the government's optimal pre-disruption strategies, including inventory protection, capacity backup protection and the combination.

2 - Asymmetries of the Pull-to-Center Effect in the Newsvendor Experiments

Tianhu Deng, PH. D student, UC, Berkeley, IEOR Department, 4141 Etcheverry Hall, Mail Code 1777, Berkeley, United States of America, tianhu_deng@berkeley.edu

It has been frequently observed in newsvendor games, the subjects' average order quantity lies in between the optimal order quantity and the mid-point of the demand, in both high profit and low profit settings. This phenomenon is called pull-to-center effect. Some researchers found that the pull-to-center effect is stronger in the high-profit setting than the low profit setting while others found the opposite result. We present explanations for this discrepancy.

3 - Impact of Social Contagion in Make-to-Stock and Make-to-Order Supply Chains

Shan Li, Operations Research Scientist, Amazon.com, 605 5th Avenue South, Seattle, WA, 98104, United States of America, lisapine@berkeley.edu, Teck Ho, Z. Max Shen

We first analyze the impact of social contagion in a make-to-stock supply chain. We show that an out-of-stock phenomenon that occurs earlier in a product's life cycle always leads to a greater loss in a firm's customer assets. We then analyze the impact of social contagion in a make-to-order spply chain. We demonstrate that a lengthy lead time can slow down social contagion, decelerate customer purchases, and thus significantly decrease a firm's total customer assets.

4 - Flexible Nonhomogeneous Supply Chain Design Under Supply Chain Disruptions

Ye Xu, University of California-Berkeley, Berkeley, CA, United States of America, yex207@berkeley.edu, Z. Max Shen

We look at the flexibility design problem of a general supply chain with unbalanced structure, and nonhomogeneous demands and suppliers. Besides demand uncertainty, supply disruption is also considered in our model. We discuss solution algorithms for a series of models, and show that the marginal value of flexibility does not diminish as capacity increases. Rather, more flexibility is encouraged when more capacity is available.

■ WB13

C - Room 13B, Level 4

Dynamically Managing Customer Loyalty and Learning

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Dan Adelman, Professor, University of Chicago, 5807 South Woodlawn Ave., Chicago, IL, 60637, United States of America, dan.adelman@chicagobooth.edu

1 - 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 of a supplier dynamically allocating limited capacity among a portfolio of customers, where each customer's orders depend positively on the fill rates provided to her in the past. Customers differ from one another in their contribution margins, their demand volatilities, and the length of their memories. We develop an approximate dynamic programming algorithm that rationalizes the fill rates the supplier should target for each customer.

2 - Optimal Hiring and Retention Policies for Heterogeneous Workers with Learning

Alessandro Arlotto, University of Pennsylvania, 3730 Walnut Street, 500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, alear@wharton.upenn.edu, Stephen E. 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. We present numerical examples that show, among other things, that the active screening and monitoring of employees leads to substantial gains.

3 - Signaling Service Quality in Queues

Senthil Veeraraghavan, Assistant Professor, Wharton School of Business, University of Pennsylvania, 3730 Walnut Street, Jon M. Huntsman Hall, Suite 500, Philadelphia, PA, 19104, United States of America, Senthilv@wharton.upenn.edu

We study how a high quality service firm signals quality to differentiate from a low quality firm through expensive signaling efforts. Rational consumers try to learn quality through these imperfectly advertised signals. Their decisions are based on signaling efforts of the firms, congestion in the market, and the service value. We show that it is likely that a high quality firms may incur lower revenues due to signaling efforts.

■ WB14

C - Room 14, Level 4

Supply Chain Management IX

Contributed Session

Chair: Nomesh Bolia, Dr, IIT Delhi, #276 Block III, IIT Delhi, New Delhi, DL, 110016, India, nomesh@mech.iitd.ac.in

1 - Measurement and Optimization of Supply Chain Responsiveness

Sin-Hoon Hum, National University of Singapore, NUS Business School, 15 Kent Ridge Drive, Singapore, 119245, Singapore, bizhumsh@nus.edu.sg, Mahmut Parlar

We consider make-to-order supply chains with multiple stages where each stage is completed in a random length of time. We define the responsiveness of such a supply chain as the probability that an order placed now will be fulfilled within t time units. We optimize the responsiveness of the supply chain by maximizing the probability that the order will be fulfilled within some promised time interval subject to a budget constraint.

2 - Behavior of a Remanufacturing System in Presence of Varying Suppliers Reliability for New Product

Suman Niranjan, Assistant Professor, Savannah State University, College of Business Administration, 3219 College Street, Savannah, GA, 31404, United States of America, suman1130@gmail.com

In this paper we study a two-echelon remanufacturing system, which focuses on what should be the right mix of new and remanufactured components used in the manufacturing of a new product, and why should we care about the mix?. Moreover we study this problem in the presence of unreliable suppliers for new component. We analyze the performance of the system initially by developing a set of dynamic equations used in simulation based optimization framework.

3 - The Analysis of Performance in One Single and Dual Channels
Zhaoqiong Qin, Associate Professor, North Carolina A&T State University, 1601 E. Market Street, Greensboro, NC, 27411, United States of America, zqin@ncat.edu

Suppliers routinely decide whether to distribute their products through one single channel or dual channels. Conventional wisdom says that dual distribution channels outperform one single channel based on the whole supply chain's performance in the capacity and the supplier's profit. However, this paper finds that the channel structure including centralized and/or decentralized in the distribution plays an important role in these performances.

4 - Fuzzy Logic Based Methods to Quantify Supply Chain Performance
Nomesh Bolia, Dr, IIT Delhi, #276 Block III, IIT Delhi, New Delhi, DL, 110016, India, nomesh@mech.iitd.ac.in, Pranav Saxena, Jalaj Bhandari

Globalization and dynamic market conditions have forced companies to focus on methods to evaluate the performance of their supply chains and improvise where needed. Hence there is an increasing interest in quantifying performance. However there are a lot of uncertainties in supply chain parameters (hence performance measures), and relative importance of these performance measures. We apply fuzzy logic to address these issues and develop an appropriate performance index for supply chains.

■ WB15

C - Room 15, Level 4

Convex Optimization

Contributed Session

Chair: David Papp, Rutgers Center for Operations Research, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States of America, dpapp@rutcor.rutgers.edu

1 - Convex Relaxation for the Planted k-disjoint-clique Problem
Brendan Ames, PhD Candidate, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, bpames@math.uwaterloo.ca, Stephen Vavasis

We consider the k-disjoint-clique problem. For a given graph G, the problem is to find within the graph k disjoint cliques that cover the maximum number of nodes of G. The k-disjoint-clique problem is NP-hard, but we show that a convex relaxation can solve it in polynomial time for certain input instances. The input instances for which our algorithm finds the optimal solution consist of k disjoint large cliques that are then obscured by noise edges and noise nodes.

2 - A Convexity Result for an (S-1,S) Inventory Model Under Time Limits on Backorders
Emre Tokgoz, Emre.Tokgoz-1@ou.edu, Hillel Kumin

The (S-1,S) inventory model with time limits on backorders has previously been solved by minimizing a function of two variables, one of which is integer. We investigate the convexity of the objective function and develop new convexity results for functions with m integer and n continuous variables.

3 - A Holloway-Inspired Enhancement for the Frank-Wolfe Approach to the Convex Hull Problem
Xinyu Wang, PhD Student, Southern Methodist University, P.O. Box 750123, Dallas, TX, 75275-0122, United States of America, xwang@smu.edu, Richard Helgason

The extreme points of a convex hull can be found by using the Frank-Wolfe quadratic programming method. We investigate a novel Holloway-Inspired enhancement to the Frank-Wolfe method. The enhancement tries to avoid zigzag in the later stage of the projection point computation and gives us faster convergence. Experimental results indicate the enhancement leads to a significant speedup.

4 - A Polyhedral Projection Method for Solving Variational Inequalities
Sudhanshu Singh, PhD Student, UNC Chapel hill, UNC Department of STOR, B 44, hanes hall, CB# 3260, UNC Chapel Hill, Chapel hill, NC, 27599-3260, United States of America, sssingh@email.unc.edu, Shu Lu

Most projection based methods for solving variational inequalities suffer from the drawback that the projection on a general convex set is not easy to find. This talk presents a projection method which replaces the feasible set by a polyhedral convex set in each iteration. The proposed algorithm uses (sub)gradient information to generate the polyhedron. It is easy to implement and its convergence is analyzed under some mild assumptions.

5 - Generalized Sum-of-squares Cones and Their Applications
David Papp, Rutgers Center for Operations Research, 640 Bartholomew Rd, Piscataway, NJ, 08854, United States of America, dpapp@rutcor.rutgers.edu, Farid Alizadeh, Ricardo Collado

We consider the cone of sum-of-squares vectors with respect to an arbitrary bilinear multiplication in a finite dimensional space. We show that these cones are feasible sets of semidefinite optimization problems, extending Nesterov's results on real valued sum-of-squares functions. Different choices of spaces and multiplications give rise to a diverse set of applications; we show a few in combinatorial optimization, geometric optimization, and shape-constrained statistical estimation.

■ WB16

C - Room 16A, Level 4

Remanufacturing

Contributed Session

Chair: Pei-Fang Tsai, Assistant Professor, National Taipei University of Technology, 1, Sec. 3, Chung-hsiao E. Rd., Taipei, 10608, Taiwan - ROC, ptsai@ntut.edu.tw

1 - Inventory Management in Closed-loop Supply Chains Under Non-stationary Demand
Ibrahim Dogan, Wayne State University, Industrial & Manufacturing Engineering, 4815 Third Street, Detroit, MI, 48202, United States of America, aq9742@wayne.edu, Ratna Babu Chinnam

This study aims to analyze remanufacturer's inventory control policy under non-stationary demand. The objective is to decide on virgin product replenishment quantities under used product returns. The exact solution to this inventory control problem in our setting is complex and time demanding. We offer and analyze a number of different sub-optimal policies.

2 - Used Product Returns Policy Under Demand and Return Uncertainty
Samar Mukhopadhyay, Professor, SungKyunKwan University-GSB, 53 Myungryun dong 3-ga, Jongno gu, Seoul, 110745, Korea, Republic of, samar@skku.edu, Robert Setaputra

Reusing still usable components from a used up product makes sound environmental and economic sense. Uncertainty in the quantity of returns and demand complicates the operation. Our decision variable is the return policy, characterized by the amount refunded to the consumer. The trade-off is between increased revenue due to reduced input cost and increased cost due to higher return amount. Optimal return policy and managerial insights on sensitivity analyses will be presented.

3 - Remanufacturing Planning with Variable Quality Returns
Xiaoning Jin, PhD Student, University of Michigan, 2300 Hayward Street, Ann Arbor, MI, 48109, United States of America, xnjin@umich.edu, S. Jack Hu, Jun Ni

There is a need for remanufacturers to grade quality of the returns prior to recovery processes because of the quality uncertainty of returns.Since some returns require more capacity and cost to bring the unit up to a required quality standard than others,quality variability information will have great impacts on remanufacturing decisions.We'll develop a quality-dependent remanufacturing model to obtain the optimal control of the remanufacturing quantity that minimize the expected total cost.

4 - Best Partial Disassembly Strategy for Retrievable End-of-Life Products
Pei-Fang Tsai, Assistant Professor, National Taipei University of Technology, 1, Sec. 3, Chung-hsiao E. Rd., Taipei, 10608, Taiwan - ROC, ptsai@ntut.edu.tw

A product reaches its end of life when it is malfunctioned or undesirable to the users. This research focuses on returned products in two categories: those are qualified to be repaired or remanufactured, and those can be retrieved for useable parts. The best partial disassembly strategy is proposed and formulated as a multicommodity flow problem with applicability established. The objective is to obtain maximum potential benefits inherent in the end-of-life production planning.

■ WB17

C - Room 16B, Level 4

Decision Making in Interdependent Systems

Contributed Session

Chair: Kash Barker, Lecturer, University of Oklahoma, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, kashbarker@ou.edu

1 - Decision Analysis Tool for Assessing Hurricane Impact on Regional Workforce Productivity

Joost Santos, Assistant Professor, Engineering Management and Systems Engineering, The George Washington University, 1776 G Street NW, Rm 164, Washington, DC, 20052, United States of America, joost@gwu.edu

This research develops a workforce recovery model based on input-output analysis to estimate sector inoperability and economic losses. Based on our simulated hurricane scenarios, service sectors in Virginia suffer the largest workforce productivity impact-accounting for nearly 40% of the total economic losses. Sensitivity analysis of inoperability and loss reduction objectives can provide insights on identification and prioritization of critical workforce sectors to expedite disaster recovery.

2 - Resilience Assessment and Improvement of Urban Infrastructure Systems

Leonardo Dueñas-Osorio, Assistant Professor, Rice University, 6100 Main Street, MS-318, Houston, TX, 77005, United States of America, leonardo.duenas-osorio@rice.edu, Min Ouyang

This paper proposes an annual resilience metric, which reflects the capacity of infrastructure systems to resist, absorb and recover from all possible disruptive events. Taking the transmission power grid and gas transmission system of in Harris County, Texas, as an example, the effectiveness of different resilience improvement measures are analyzed and discussed. This study can provide insight and direction to design and retrofit resilient interdependent infrastructure systems.

3 - Interdependency Models to Compare Industry Preparedness and Reactive Strategies to Disruptive Events

Cameron MacKenzie, Graduate Student, Industrial Engineering, University of Oklahoma, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, cmackenzie@ou.edu, Kash Barker

We use a risk-based interdependency model to quantify the effect of preparedness strategies such as maintaining inventory and the effect of reactive strategies such as choosing alternate transportation routes or different suppliers if a disruptive event occurs. We examine the conditions that incentivize industries to prepare for a disruptive event and how those decisions impact their reactions to a supply chain disruption. We deploy the model with a case study using actual commodity data.

4 - Dynamic Analysis of Interdependent Inoperability in Multi-modal Transportation Networks

Raghav Pant, Graduate Student, Industrial Engineering, University of Oklahoma, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, Raghav.Pant-1@ou.edu, Kash Barker

We study time-dependent production losses to regions due to disruptions in important transportation facilities (e.g., ports), by integrating the Dynamic Inoperability Input-Output Model (DIIM) with a network queuing model. Network model-driven initial inoperability and recovery time estimates strengthen our ability to evaluate supply chain risk management options and enhance risk management decisionmaking. Examples using commodity flow data for inland port disruptions are illustrated.

5 - Impact of Disasters on National Freight Flows

Saniye Gizem Aydin, Graduate Student, Industrial Engineering, University of Oklahoma, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, gizemaydin@ou.edu, P. Simin Pulat, Guoqiang Shen, Manjunath Kamath, Ricki Ingalls

Transportation systems are vulnerable to disasters and absolutely vital for the economy. There are relatively few studies concerning the regional freight flow impact of the disaster, even fewer on national impact. Northridge Earthquake, Hurricane Katrina and I-40 Bridge collapse cases are studied. A spatial input-output model, distance and traffic volume based changes are used for measuring the importance, and the influence on decision making within the interdependent freight flow environment.

■ WB18

C - Room 17A, Level 4

OR in Practice II

Sponsor: CPMS, The Practice Section

Sponsored Session

Chair: Brian Lewis, Vice President, Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

Co-Chair: Bjarni Kristjansson, President, Maximal Software, Inc., 933 N. Kenmore St., Suite 218, Arlington, VA, 22201, United States of America, bjarni@maximalsoftware.com

1 - An Integrated Framework of Service Quality for Global Delivery of Contact Center Services

Nanda Kambhatla, Senior Manager, Human Language Technologies, IBM India - Research, 'D' Block, Embassy Golf Links, Koramangala Inner Ring Road, Bangalore, 560071, India, kambhatla@in.ibm.com, Mayuri Duggirala, Ramana Polavarupu, Dinesh Garg

We present a framework of provider-perceived service quality for contact center services, incorporating key dimensions of service quality based on interviews with service providers in contact center services. Our findings indicate that benchmarking and error management are significant provider-perceived dimensions of service quality in contact center services which predict business performance outcomes. Avenues for further research, as well as insights for research and practice are suggested.

2 - Decision Support System for Continuous Production

Krystsina Bakhrankova, Researcher, Institute of Technology and Society - Applied Economics, S. P. Andersens Veg 5, Box 4760 Sluppen, Trondheim, 7465, Norway, Krystsina.Bakhrankova@sintef.no

The paper develops a model-based decision support system (DSS) for a European chemical plant with a multi-stage continuous production process. The system comprises two modules - energy cost minimization and output maximization, where a gist of the two underlying formulations is presented. The planning tool is tested on real data instances - it reflects the essence of the researched production process, provides substantial energy cost savings and improved production capacity utilization.

3 - Optimizing Long-range Plans at Novartis

Brian Lewis, Vice President, Professional Services, Vanguard Software, 1100 Crescent Green, Cary, NC, 27518, United States of America, brian.lewis@vanguardsw.com

Long-range strategic planning decisions are not easily modeled with classic optimization techniques. Using Monte Carlo simulation-based forecasting, simulation optimization, and grid computing, Vanguard Software built a drug development pipeline model for Novartis which forecasts long-range R&D performance and optimizes strategic decisions such as investments in new drugs. In our presentation, we discuss the underlying model, lessons learned, and other practical issues.

■ WB19

C - Room 17B, Level 4

Revenue Management of Opaque and Non-traditional Channels

Sponsor: Revenue Management and Pricing Section

Sponsored Session

Chair: Benjamin Marcus, Suffolk University, 8 Ashburton Place, Boston, MA, United States of America, bmarcus@suffolk.edu

1 - Valuation of Opaque Products

Leo MacDonald, Assistant Professor, Coles College of Business, KSU, Kennesaw, GA, United States of America, lmacdon4@kennesaw.edu, Benjamin Marcus

Service providers (airlines, hotels, etc) often use opaque sales channels (Hotwire, Priceline) to increase revenues. A fundamental challenge for these providers is setting appropriate rates. Set rates too high and no purchase occurs; set rates too low and forgo the additional revenue. The focus of this research is to determine customer valuation of opaque versus non-opaque services through a choice experiment and develop a discrete-choice model to support the decision making process.

2 - Pricing Opaque and Traditional Channels Jointly
Benjamin Marcus, Suffolk University, 8 Ashburton Place, Boston, MA, United States of America, bmarcus@suffolk.edu

Despite the benefits to both firms and consumers, there are distinct challenges to selling products through opaque channels. We develop a model of a service provider selling inventory across a traditional channel and an opaque channel in order to identify optimal pricing policies in this setting. In addition, we use this model to explore the effects that different characterizations of customer behavior and product commoditization on the opaque channel can have on these policies.

■ WB20

C - Room 18A, Level 4

Pricing and Revenue Management I

Contributed Session

Chair: Craig Sorochuk, Assistant Professor of Decision Science, University of Wyoming, 1000. East University Avenue, Department of MGMT and MKT (#3275), Laramie, WY, 82071, United States of America, csorochu@uwyo.edu

1 - HOT Lane Pricing for Revenue Generation and Congestion Management: An Analysis of Demand Responses
Lin Qiu, Wilbur Smith Associates, 317 Center St. N, Vienna, 22180, United States of America, lin.w.qiu@gmail.com, Lei Zhang

High Occupancy Toll Lane has attracted significant interests as a means for congestion management and revenue generation. Using combined stated-preference and revealed-preference data for the I-394 corridor, this study develops models to capture the inter-relationships between pricing schemes, travelers' mode choices and dynamic attitudes towards HOT lanes. The estimated attitude and behavior changes form a reliable basis for projecting revenues and assessing congestion mitigation effects.

2 - Market Share Characterization Through Scenario Analysis
Amit Shinde, Research Associate, Arizona State University, 699 S. Mill Avenue, Tempe, AZ, 85281, United States of America, amit.shinde@asu.edu, Mani Janakiram, George Runger

The supply chain interactions within the high-technology industry are very complex. Multiple products with moderate differences in performance and price compete within the same market segment. We present data mining models for characterizing elements of such supply chains. These models are capable of assimilating knowledge from a variety of business scenarios, expert judgment and historical trends.

3 - Designing Public Storage Warehouses with Customer Choice
Yeming Gong, EM Lyon Business School, 23 Avenue Guy de Collongue, Ecully, France, gong@em-lyon.com

Public storage is a booming industry. A major question is how to design public storage facilities to fit market segments to maximize revenue. This paper propose a method to design public storage warehouses with considering the choice behavior of customers. We solve the problem by column generation.

4 - Computing Regulated Bertrand-Nash Equilibrium Prices Under Mixed Logit Demand
William Morrow, Assistant Professor, Iowa State University, 2014 Black Engineering Building, Ames, 50011, United States of America, wrmorrow@iastate.edu

Bertrand-Nash equilibrium prices have been used to analyze mergers, new product introductions, and regulatory policy in large differentiated product markets. We present a framework with regulatory costs that may not be differentiable, as with the Corporate Average Fuel Economy Standards. Two nonsmooth fixed-point formulations of the first-order conditions are shown to provide reliable and efficient methods for computing equilibrium prices in a large-scale example from the automotive industry.

5 - The Newsvendor Problem with Pricing and Secondary Revenues
Craig Sorochuk, Assistant Professor of Decision Science, University of Wyoming, 1000. East University Avenue, Department of MGMT and MKT (#3275), Laramie, WY, 82071, United States of America, csorochu@uwyo.edu, John Wilson

We present an expected profit model for a newsvendor who receives revenues from selling primary items as well as from selling secondary items that are only available if a primary item has already been purchased. Numerical examples are provided for a newsvendor whose primary items for sale are tickets to a performance event and whose secondary items for sale are concessions items, parking, etc.

■ WB21

C - Room 18B, Level 4

Green Supply Chain Management

Sponsor: Service Science
Sponsored Session

Chair: Vipul Jain, Assistant Professor, Indian Institute of Technology Delhi, Department of Mechanical Engineering, Indian Institute of Technology Delhi, New Delhi, 110016, India, vjain@mech.iitd.ac.in

1 - A Green Approach to Supplier Selection
Amit Kumar, Research Scholar, Indian Institute of Technology, Department of Mechanical Engineering, Delhi, New Delhi, India, akumar@icfi.com, Vipul Jain

As the climate change movement gathers momentum, there's a pressing need to assess suppliers based on their environmental performance along with other criteria. This paper proposes a comprehensive approach based on Data Envelopment Analysis with Carbon Footprint monitoring. The approach applies to heterogeneous suppliers and incorporates region specific emission compliance standards as well. Overall, it encourages suppliers to go green and cut down their emissions to survive the competition.

2 - Carbon Footprint, Information Disclosure, and Shareholder Pressure
Chien-Ming Chen, UCLA Institute of the Environment, La Kretz Hall, Suite 300, Box 951496, Los Angeles, CA, 90095, United States of America, cmchen@ioe.ucla.edu, Charles Corbett, Magali Delmas

This study examines the causal relationship between corporate carbon efficiency, voluntary information disclosure, and shareholder's pressure for greener business practices. Our analysis draws on the newly compiled direct and supply chain emission inventories of over 1000 public companies in North America. In the presentation we will present our preliminary findings.

3 - Evaluation and Management on Logistics Carbon Emission
Xiao Qing Wang, IBM Research, Building 19 Zhongguancun Software Park, Beijing, China, xqwangxq@cn.ibm.com, Jin Dong, Hongwei Ding, Minmin Qiu, Wei Wang

Logistics carbon emission management is addressed and carbon emissions from several key operational stages in logistics industry are studied and evaluated. A general logistics carbon emission evaluation framework considering different transportation modes, different warehouses and different carry modes is proposed. Carbon emission evaluation methods on transportation, storage and carry operational stages are presented.

4 - Measuring Carbon Emissions From Intermodal Freight Operations
Anthony Craig, PhD Candidate, MIT, 77 Massachusetts Ave, E40-222, Cambridge, MA, 02139, United States of America, tcraig@mit.edu, Edgar Blanco, Yossi Sheffi

Estimating the carbon emissions from intermodal shipments is difficult for shippers due to limited information and the complexity of intermodal operations. The structure of the rail network, terminal locations, and relative efficiency of rail and drayage operations all impact the actual emissions. Using data from an intermodal freight operator we compare the calculated carbon emissions for a set of shipments with the results obtained from popular carbon estimation methods.

■ WB22

C - Room 18C, Level 4

Workforce Management

Sponsor: Service Science
Sponsored Session

Chair: Foaad Iravani, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, firavani@anderson.ucla.edu

1 - Skill Mix and Cross-Training in Professional Service Firms
Vincent Hargaden, PhD Student, Rensselaer Polytechnic Institute, Industrial & Systems Engineering Dept, 110 8th Street, Troy, NY, 12180, United States of America, hargav@rpi.edu, Jennifer Ryan

A comprehensive mixed integer programming model has been developed for the workforce planning process in professional service firms. We will present results from the model which show the impact of skill mix, skill capability levels and cross-training on key performance metrics such as project completion rates, staff utilization and profit.

2 - A Hiring Plan Model for Call Center Management
Tao Huang, Progressive Insurance, 6300 Wilson Mills Rd, Mayfield Village, OH, 44143, United States of America, Tao_Huang@progressive.com, Janet Dolohanty, Steve Callitsis

We have developed a hiring plan model for call center management. The model identifies locations and schedules for the hiring need defined by the capacity planning and staff-on-hand while taking into account site specific monetary variables and nonmonetary constraints. The model outputs the optimal combination of schedules that minimizes hiring cost and specifies the agents required to improve the peak-hour service level performance.

3 - The Soft Resource Allocation Problem
Foaad Iravani, University of California-Los Angeles, Anderson School of Management, 110 Westwood Plaza, Los Angeles, CA, 90095, United States of America, firavani@anderson.ucla.edu, Sriram Dasu, Reza Ahmadi

We propose optimization models for workforce allocation in a leading software company that produces tax software. Every year, the firm struggles with a high workload imposed by changes in tax forms announced by the IRS. In this competitive market, any delay in the release of the product leads to significant losses. We develop models for organizing and staffing the development activities to meet the deadline at the lowest cost.

■ WB23

C - Room 18D, Level 4

Municipal Waste Management, Analytics and Optimization

Sponsor: Service Science
Sponsored Session

Chair: Heng Cao, CTO for Business Analytics & Optimization, IBM China Research Center, A2/F, Diamond, Zhong Guang Cun Software, Haidian District, Beijing, 100193, China, hengcao@us.ibm.com

1 - Decision Support System for Municipal Solid Waste Collection using Forecasting and Optimization
Tianzhi Zhao, IBM Research - China, Diamond Building A, ZGC Software Park, 8 Dongbeiwang West Road, Beijing, 100193, China, zhaotzhi@cn.ibm.com, Jun Zhang, Jin Dong, Heng Cao, Wenjun Yin

Municipal solid waste management (MSWM) is becoming a major issue facing cities around the world due to rapid urbanization and growth of population. In this paper, an analytics based decision support system is proposed for MSWM. The system model is composed of two components, one for waste generation prediction, another one for collection vehicle routing optimization. A GIS application is integrated into the system to provide route information to as well as map out the outputs from the model.

2 - Disturbance Analysis Model for the Maintenance Plan of Power Grid
Feng Jin, Dr., IBM Reaserch - China, Bulding 10, 399 Keyuan Road, Pudong, Shanghai, 201203, China, jinfsh@cn.ibm.com, Hairong Lv, Jun Luo, Wenjun Yin, Jin Dong, Qiming Tian

To keep the maintenance plan of power gird stable, especially to avoid chain-reaction, a probability model is proposed to analyze the effected plans once a plan is disturbed by various factors. In this model, we consider not only the traditional variation of start time, but also the variation of process time and workload under the complex grid topology. A case in a typical Chinese power company is studied to validate the model. The result shows the plan change rate is greatly reduced.

3 - An Effort Estimation Model in Project Delivery using Hidden Setup Cost
Saeed Bagheri, IBM T J Watson Research Center, 1101 Kitchawan Road, Yorktown Heights, NY, 10598, United States of America, sbagher@us.ibm.com, Nianjun Zhou, Krishna Ratakonda

We discuss the relationship between delivered projects and required effort. In particular, we analyze the logarithmic model and its shortcomings in required effort estimation for large projects. We introduce the hidden setup cost and its related linear model and explain how its existent leads to the above behavior in logarithmic models. Our proposed model facilitates effort estimation for project delivery in services and manufacturing. We illustrate this, using projects in software development.

■ WB24

C - Room 19A, Level 4

Joint Session SPPSN/ HAS: Emergency Medical Services: New Directions

Sponsor: Public Programs, Service and Needs/ Health Applications
Sponsored Session

Chair: Laura McLay, Assistant Professor, Virginia Commonwealth University, 1015 Floyd Ave, Box 843083, Richmond, VA, 23284, United States of America, lamclay@vcu.edu

1 - A Markov Chain Model for an EMS System with Repositioning
Armann Ingolfsson, University of Alberta, Edmonton, AB, Canada, armann.ingolfsson@ualberta.ca, Ramon Alanis, Bora Kolfal

We propose and analyze a Markov chain model of an Emergency Medical Services system that repositions ambulances using a compliance table policy, which is commonly used in practice. We validate the model against a detailed simulation model. We demonstrate that the model provides accurate approximations to such performance measures as the response time distribution and the distribution of the number of busy ambulances, and that it can be used to identify near-optimal compliance tables.

2 - An Equitable EMS Location Model: Minimizing Envy Toward Neighbors' Chance of Access to Service
Sunarin Chanta, PhD Student, Clemson University, 203 Freeman Hall, Department of Industrial Engineering, Clemson, SC, 29634, United States of America, schanta@clemson.edu, Maria Mayorga, Laura McLay

The model is developed for finding optimal locations in order to balance disparity in service between zones. The objective is to minimize the sum of "envy" among all zones with respect to an ordered set of p operating EMS stations weighted by the proportion of demand in each zone. Tabu search is provided to solve the problem. The performance of the proposed model is tested and compared to other location models such as the p-center and maximal-covering-location (MCLP) problems.

3 - Estimating Travel Speeds in Road Networks From GPS Data
Shane Henderson, Professor, Cornell University, School of ORIE, Rhodes Hall, Cornell University, Ithaca, NY, 14853, United States of America, sgh9@cornell.edu, Dawn Woodard, Brad Westgate, David Matteson

We estimate the speeds vehicles travel on road networks from widely spaced GPS readings as recorded by ambulances. We use a Bayesian formulation and estimate the posterior distribution of road travel speeds and other quantities using Markov chain Monte Carlo (MCMC). In this talk I will sketch the problem and data, describe the MCMC algorithm, and present some sample results.

4 - Fire Department and Other Emergency Medical Service
John Hall, National Fire Protection Association, Norwood, MA, United States of America, jhall@NFPA.org

People with emergency medical conditions may call an ambulance, possibly fire department based, and may seek medical assistance at any of several locations. This paper will discuss concepts and data sources and uses for a comprehensive system to track the flow of people in and out of emergency medical service.

■ WB25

C - Room 19B, Level 4

Transportation, Planning I

Contributed Session

Chair: David Novak, Assistant Professor, University of Vermont, 55 Colchester Ave., Kalkin 310, Burlington, VT, 05405-0157, United States of America, dnovak@bsad.uvm.edu

1 - Exploring Theoretical Properties of Bounded Rational User Equilibrium Flow Distributions
Yingyan Lou, Assistant Professor, The University of Alabama, A127K Bevill Building, Box 870205, Tuscaloosa, AL, 35405, United States of America, ylou@eng.ua.edu

This paper investigates theoretical properties of the boundedly rational user equilibrium (BRUE) flow set for transportation networks. Probabilistic methods are explored to address the uncertainty in link flows characterized by the non-convex BRUE flow set. Entropy maximization is used to identify the most likely link flow pattern. Finite sampling approaches are also investigated to derive various measures from assumptions on the continuous link flow probability space over the BRUE flow set.

2 - Toolkit for Anticipating and Evaluating Roadway Expansion and Tolling Impacts
Daniel Fagnant, Graduate Research Assistant, The University of Texas at Austin, ECJ Suite 6.9, MailCode C1761, Austin, TX, 78712, United States of America, annette.perrone@engr.utexas.edu, Kara Kockelman, Chi Xie

We present a new toolkit for forecasting the traffic volumes, travel times, network reliability, emissions, and safety impacts of roadway expansion and tolling projects. Trip tables are estimated using constrained maximum entropy methods, based on link-level traffic counts. Incremental logit models anticipate mode and time of day splits. All impacts are monetized and compared over project lifetimes, to generate benefit-cost ratios and other success indicators for Austin case studies.

3 - Simulation of Vessel Traffic and Dredging Impact Analysis in Delaware River
Ozhan Alper Almaz, PhD Student, Rutgers University, Industrial & Systems Engineering Departm, 100 Brett Road, Piscataway, NJ, 08854, United States of America, alperalmaz@gmail.com, Tayfur Altiok

We considered modeling of vessel traffic in the Delaware River Main Channel. A high fidelity simulation model was developed to investigate effects of deepening and dredging in the River on the navigational efficiency based on several assumptions. In this regard, vessel calls to terminals, lightering and barge operations, tidal and navigational rules in the River, terminal and anchorage properties and vessel profiles were considered.

4 - Evaluating the Effects of Trip Importance on System-Wide Performance in Transportation Networks
David Novak, Assistant Professor, University of Vermont, 55 Colchester Ave., Kalkin 310, Burlington, VT, 05405-0157, United States of America, dnovak@bsad.uvm.edu

We introduce measures for evaluating network robustness and identifying and ranking the most critical or important links in a transportation network called the Network Robustness Index, and comparing disparate networks using a scalable, system-wide performance over all links in the network called the Network Trip Robustness. We show that the relationships between network robustness, the capacity-disruption level, and network connectivity are non-linear and are not necessarily intuitive.

■ WB26

C - Room 4A, Level 3

Joint Session DM/ ICS: Bayesian Computational Issues in Data Mining

Sponsor: Data Mining/ Computing Society
Sponsored Session

Chair: Tevfik Aktekin, Assistant Professor of Decision Sciences, University Of New Hampshire, 15 Academic Way, Department of Decision Sciences, Durham, NH, 03824, United States of America, tevfik.aktekin@unh.edu

1 - Modeling Brazilian Swap Curve in a Hidden Markov Framework with Macroeconomic Variables
Richard Munclinger, Economist, IMF, 1301 20th Street, NW, Apt. 107, Washignton, DC, 20036, United States of America, richardmunch@gmail.com

We apply a hidden Markov model of the term structure to modeling Brazilian swap rates. We find that multiple regimes are identified in the data and that macroeconomic variables improve time series fit without destroying regime dependency. This work has two main contributions. Firstly, we include macroeconomic variables in conjunction with a hidden Markov framework. Secondly, we propose and apply a Bayesian MCMC algorithm to estimate hidden Markov models of the term structure.

2 - Explaining HIV Mortality, Bayesian Spatial Models Applied with MCMC Methods
Rasim Muzaffer Musal, Assistant Professor, Texas State University, 404 Rio Grande apt 209, Austin, TX, 78701, United States of America, rm84@txstate.edu, Tevfik Aktekin

We propose Bayesian Zero Inflated Poisson models to investigate the effects of poverty and inequality on the number of HIV related deaths in NY counties. In doing so, we quantify inequality via the Theil Index and Poverty via the ratios of the two Census 2000 variables. MCMC methods are utilized in eliciting posteriors. We present the computational complexities that are present in these methods and emphasize the methods for spatial effects.

3 - Bayesian Analysis of Discrete Time Queueing Networks with a Gridlock Prediction Application
Toros Caglar, George Washington University, 2201 G St., NW, Funger Hall, Suite 415, Washington, DC, 20052, United States of America, toros@gwu.edu, Refik Soyer

Analysis of discrete time queues and their networks have been mostly prevalent in the context of computer and communication systems. In this study, we aim to utilize a Bayesian approach for the analysis of these queues with an application in emergency room (ER) gridlock prediction, which requires transient analysis. We will also address the challenges presented by the large state space formed by the ER-hospital network and the MCMC simulation necessitated by the Bayesian analysis.

4 - Bayesian State Space Modeling of Mortgage Default Risk
Tevfik Aktekin, Assistant Professor of Decision Sciences, University of New Hampshire, 15 Academic Way, Department of Decision Sciences, Durham, NH, 03824, United States of America, tevfik.aktekin@unh.edu, Refik Soyer, Feng Xu

We consider discrete time Bayesian state space models with Poisson measurements to model the mortgage default risk at the aggregate level with a stochastic default rate and macroeconomic covariates. We discuss parameter updating and estimation using Markov chain Monte Carlo methods where the use of the efficient forward filtering backward sampling algorithm within a Gibbs sampler is developed. We use actual U.S. residential mortgage data and discuss insights gained from Bayesian analysis.

■ WB27

C - Room 4B, Level 3

Network Optimization I

Contributed Session

Chair: Chase Rainwater, University of Arkansas, INEG Department, Fayetteville, AR, 72701, United States of America, cer@uark.edu

1 - Integrated Dynamic Single Facility Location and Inventory Planning Problems
Jiaming Qiu, Student, Rensselaer Polytechnic Institute, 110 8th St., Troy, NY, 12180, United States of America, qiuj@rpi.edu, Thomas Sharkey

We analyze a class of problems which determines the relocation and inventory plan of a single facility over a finite horizon in order to meet dynamic customer demands. Dynamic programming algorithms are presented to solve the problem under different objective functions and construct the efficient frontier for bi-objective problems, most of which run in polynomial time.

2 - Hybrid Wired-cum-wireless Sensor Network Location-allocation Problem in Industrial Environment
Sima Maleki, Graduate Research Assistant, University of Tennessee/Industrial and Information Engineering Department, Knoxville, Knoxville, TN, 37996, United States of America, smaleki@utk.edu, Mohammad Mehdi Sepehri, Hamid Farvaresh, Rapinder Sawhney

A hybrid wired-cum-wireless sensor network consists of a wireless network and a wired backbone. The proposed designs consider limitations of wireless communication and constraints in industrial applications to minimize the network cost over a life of a network. The joint problem of configuring the hybrid network, locating the nodes and sensor clustering is formulated as a Mixed Integer Nonlinear Programming model. Results illustrate the cost effectiveness and longevity of hybrid configuration.

3 - Social Optimality and Pricing in Shared Computing Centers
Ishai Menache, postdoc, MIT, 77 Massachusetts avenue, 32-D632, Cambridge, MA, 02139, United States of America, ishai@mit.edu, Nahum Shimkin, Asuman Ozdaglar

Motivated by the recent advent of cloud computing facilities that offer online computing power on demand, we consider a large service facility that offers simultaneous service to a large number of heterogeneous users. Our main concern here is in maximizing the social utility, which comprises of the users' service utility minus their delay cost. We show that the social optimum may be achieved by simple per-unit pricing, which charges a fixed amount per unit time and resource from all users.

4 - Methodologies for Solving Dynamic Fortification Problems
Chase Rainwater, University of Arkansas, INEG Department, Fayetteville, AR, 72701, United States of America, cer@uark.edu, Huy-Nhiem Nguyen, Ed Pohl, Scott J. Mason

The fortification of critical infrastructure elements is an issue of notable importance. However, research in this area has studied the problem of fortification from purely a static perspective. This work presents a dynamic model that considers the temporal impacts of resource allocation decisions in a potentially changing infrastructure. Specifically, we propose decomposition-based solution approaches to solve this general class of problems.

■ WB28

C - Room 4C, Level 3

Prognostics and Health Management (PHM / Sensors / RFID)

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Sagar Kamarthi, Associate Professor, Northeastern University, 360 Huntington Ave, Boston, MA, 02115, United States of America, sagar@coe.neu.edu

Co-Chair: Abe Zeid, Northeastern University, 360 Huntington Ave, Boston, 02115, United States of America, zeid@coe.neu.edu

1 - A Bayesian Inventory Model using Real-time Condition Monitoring Information

Jennifer Ryan, Associate Professor, RPI, Industrial and Systems Engineering, 110 8th Street, Troy, NY, 12180, United States of America, ryanj6@rpi.edu, Rong Li, Zhi Zeng

We consider a manufacturer who periodically replenishes inventory for a machine part which is used simultaneously on a large set of geographically dispersed machines. This part is subject to deterioration, which can be captured by condition monitoring. We model the associated degradation signal using a Wiener process. In such a setting, we show how real-time sensor data can be used to improve the inventory management of spare parts.

2 - Application of Fuzzy Graph on Sensor Deployment Strategy for Fault Diagnosis

Zhenhua Wu, Research Assistant, TAMU, 3902 College Main Street, Apt.806, Bryan, TX, 77801, United States of America, wuzhenhua34@tamu.edu, Sheng-jen Hsieh, Jianzhi Li

I am sorry It only allows 500 characters, I can not submit my abstract. Is there any way we can solve it? My email is: wuzhenhua34@tamu.edu Thank you!

3 - Short Term Performance of Condition Monitored Degrading Manufacturing Systems

Saumil Ambani, University of Michigan, 1210 HH Dow, Ann Arbor, MI, 48105, United States of America, sambani@umich.edu, Lin Li, Jun Ni

Steady state performance of manufacturing systems has been studied for over 50 years, but its short term behavior remains relatively unexplored. In this presentation, we focus on the development of an analytical model for predicting the short term performance of a condition monitored degrading system. This approach allows us to incorporate real time information from the plant floor, such as buffer contents and condition of the machines, to make effective short term decisions.

■ WB29

C - Room 5A, Level 3

Joint Session QSR/ DM: Data Mining for Process Monitoring

Sponsor: Quality, Statistics and Reliability/ Data Mining
Sponsored Session

Chair: Myong Jeong, Rutgers University, 640 Bartholomew Road, Piscataway, NJ, United States of America, mjeong@rci.rutgers.edu

1 - Hybrid Novelty Score-Based Control Charts for Multivariate Process Monitoring

Gulanbaier Tuerhong, Korea University, Anam-dong, Seongbuk-gu, Seoul, Korea, Republic of, gulambar@korea.ac.kr, Seoung Bum Kim

We propose a new nonparametric multivariate control chart that can effectively handle large amounts of complex data through integration of one of the one-class classification algorithm with control chart techniques. Control limits of the proposed chart are established based on a bootstrap method. Experimental results with simulated data showed that the proposed control chart outperformed Hotelling's T2 control charts.

2 - An Economic Design of the Integrated Process Control

Minjae Park, Rutgers University, 126 Montgomery St. Apt 2F, Highland Park, NJ 08904, United States of America, pminj88@gmail.com

The economic cost model is developed for the integration of statistical process control (SPC) and automatic process control (APC). SPC is used to detect special causes by monitoring process performance. On the other hand, APC is used to improve the process by an adjustment controller. Both are needed to effectively keep processes close to target. The long run expected cost is also suggested as the criteria to evaluate the performance of economic cost model.

3 - Detection of Potential Failure Wafers Based on Fail Bit Counts Data

Seung Hoon Tong, Principal Engineer, Samsung Electronics Co., Ltd., San#16 Banwol-Dong, Gyeonggi-Do, Hwasung-City, 445-701, Korea, Republic of, shtong@samsung.com, In Kap Chang, Jeong Hee Hwang, Kun Han Kim, Seung Sik Jung

We present a method for detection of potential failure wafers based on fail bit counts data from wafer electrical test stage in semiconductor manufacturing. The number of fail bit each wafer has superior capability for classifying potential failure wafers than wafer yield itself. We developed two quality measures considering the magnitude and clustering level of fail bit patterns and showed real applied examples.

4 - Logistic Regression-Based Control Charts for Fault Identification

Jihoon Kang, Korea University, Anam-dong, Seongbuk-gu, Seoul, Korea, Republic of, joker404@hanmail.net, Seoung Bum Kim

Identification of process variables that contribute to out-of-control signal has been one of important problems in statistical process control. In the present study we integrated a logistic regression algorithm with control chart techniques for fault identification in multivariate process control. Simulation studies demonstrated the accuracy and efficiency of the proposed fault identification method.

■ WB30

C - Room 5B, Level 3

Statistics/Quality Control I

Contributed Session

Chair: Michael Wood, Principal Lecturer, University of Portsmouth, Strategy and Business Systems, Richmond Building, Portland St, Portsmouth, PO1 3DE, United Kingdom, michael.wood@port.ac.uk

1 - A New Monitoring Scheme for Various Types of Mean Shifts

Chang-Ho Chin, Assistant Professor, Kyung Hee University, 1 Seocheon-dong, Yongin-si, 446-701, Korea, Republic of, chin@khu.ac.kr, Taek-Jin Jeong

The EWMA control chart is more sensitive to small mean shifts than to large ones as opposed to the Shewhart control chart. The right selection of control charts to the underlying process is directly linked with the timely detection of mean shifts. For processes possibly with various types of mean shifts, we propose a control charting scheme of selecting and applying a right control chart to the process. Simulation results show the proposed scheme outperforms conventional ones.

2 - An Adaptive Sequential Methodology for n-Dimensional Quadratic Response Surface Optimization

Adel Alaeddini, Wayne State University, Department of Industrial Engineering, Detroit, MI, 48202, United States of America, dz3027@wayne.edu, Kai Yang, Alper Murat

Despite their ability in modeling a wide range of process and product design, RSM techniques are not the most effective methodologies for applications with limited resources. In this paper, we develop an adaptive methodology for response surface optimization (ASRSM) for expensive experiments with noisy data requiring high design performance. We also show that in terms of both design optimality and experimentation efficiency it compares favorably with optimal designs.

3 - Modeling Data using Kalman Filtering: A Proposal for SPC

Andre Korzenowski, Prof. Ms., PPGEP/UFRGS, Av. Osvaldo Aranha, 99 - 5° andar, Porto Alegre, RS, 90.035-190, Brazil, andre@korzenowski.com, Marcelo Portugal, Carla ten Caten

The aim of this paper is to compare forecasting in univariate time series models applied in Statistical Process Control (SPC). A structural model in state space via Kalman's filtering and an ARIMA model with exogenous variables were fitted. The modeling was applied in real data series of five different products in a plastic production. The results obtained indicate that structural model had better performance than ARIMA model when compared by RMSE.

4 - Problems with Statistical Methods in Management Research - and a Few Solutions

Michael Wood, Principal Lecturer, University of Portsmouth, Strategy and Business Systems, Richmond Building, Portland St, Portsmouth, PO1 3DE, United Kingdom, michael.wood@port.ac.uk

A case study of a typical journal paper leads to three conclusions. (1) The value of a statistical approach is seriously limited by various factors: e.g. difficulties of generalizing to contexts other than the sample studied. (2) The conventional hypothesis testing format makes results almost meaningless: instead, I suggest using confidence levels for hypotheses - and suggest two ways of doing this (one a bootstrap method on a spreadsheet). (3) The analysis should be far more user-friendly.

■ WB31

C - Room 5C, Level 3

Forecasting II

Contributed Session

Chair: Nitin Shenoy, Teaching Assistant, Texas Tech University, Texas Tech Industrial Engineering Department, Lubbock, Tx, 79409-3061, United States of America, nitin.shenoy@ttu.edu

1 - Wrong Response Functions: Their Detection and Implications
Steven Shugan, Professor, University of Florida, 2030 NW 24th Avenue, Gainesville, FL, 32605, United States of America, sms@ufl.edu

This paper first explains why simple tests are unable to detect wrong response functions. Next, the paper shows that wrong response functions use dampening and inflated parameters to filter error variance to obtain better predictions. This dampening is problematic when decisions require the correct response. Fortunately, it is possible to detect dampening with specific tests for dampening. This paper shows how to do that and demonstrates the effectives of those tests.

2 - Role of Forecast Effort on Supply Chain Profitability Under Various Information Sharing Scenarios
Linda (Xiaowei) Zhu, West Chester University of PA, 312A Anderson, West Chester, United States of America, xzhu@wcupa.edu, Xuemei Su, Samar Mukhopadhyay, Xiaohang Yue

We analyze several forecast systems and their impact on forecast accuracy, forecast costs and profit. Specifically, we consider a supplier who sells a product to a buyer in a single selling season. Three different forecast systems, namely, Non-Information Sharing, Information Sharing, and Supplier Forecasting were studied. We derive optimal price and forecast accuracy level and discuss forecast variance and the related forecast costs.

3 - Unpacking the Future: A Nudge Towards Wider Interval Forecasts
Kriti Jain, Doctoral Student, INSEAD, 1, Ayer Rajah Avenue, Singapore, Singapore, kriti.jain@insead.edu, Kanchan Mukherjee, Neil Bearden, Anil Gaba

With few exceptions, forecasters tend to underestimate uncertainty, for example, a typical analyst's 90% confidence intervals for future quantities will likely capture only 50-60% of the actual realizations. Using a series of lab and field experiments, we show that unpacking the distal future into intermediate more proximal futures has a substantial effect on subjective forecasts. We refer to this phenomenon as the time unpacking effect and show that it persists with expert judgments as well.

4 - The Welfare Implications of Carbon Taxes and Carbon Caps: A Look at U.S. Households
Kara Kockelman, The University of Texas in Austin, ECJ Suite 6.9, Austin, TX, United States of America, kkockelm@mail.utexas.edu, Binny Paul, Sumala Tirumalachetty

Household expenditure and vehicle choice data are used here to anticipate the economic impacts of energy taxes versus household-level carbon-emissions caps (with trading) across different income classes. Translog utility models were estimated and then maximized subject to money and carbon budget constraints. U.S. trade accounts were used to infer the carbon footprints of 9 goods' sectors, with vehicle choice and fuel economy modeled in detail. Cap and trade was found less regressive.

5 - Propane Demand Modeling for Residential Sectors - A Regression Analysis
Nitin Shenoy, Teaching Assistant, Texas Tech University, Texas Tech Industrial Engineering Department, Lubbock, Tx, 79409-3061, United States of America, nitin.shenoy@ttu.edu, Milton Smith

When winter space heating contributes significantly to the propane demand system; it is useful, for forecasting purposes, to separate total demand system in to two components: Large houses and Small houses. Examination of historical data indicates that the propane demand depends largely on weather conditions. Regression analysis techniques were used to show the combined effect of these weather conditions on propane demand.

■ WB32

C - Room 6A, Level 3

Computing Economic Equilibria

Sponsor: Computing Society
Sponsored Session

Chair: James Orlin, Professor, Massachusetts Institute of Technology, E53-363, Cambridge, MA, 02139, United States of America, jorlin@mit.edu

1 - A New Convex Program for Fisher Markets and Convergence of Proportional Response Dynamics
Nikhil Devanur, Microsoft Research, 1 Microsoft Way, Redmond, WA, United States of America, nikdev@microsoft.com

We give a new convex program that captures the equilibrium of spending constraint utilities, thus resolving an open problem. The new program also demystifies the convergence properties of "proportional response" dynamics: a simple, distributed way to converge to market equilibria. We show that the proportional response dynamics is equivalent to gradient descent on the new convex program, with KL-divergence instead of Euclidean distance.

2 - Equilibrium Computation for Low Dimensional Markets
Amin Saberi, Stanford University, Terman Engineering Building, Room 317, Stanford, CA, 94305, United States of America, saberi@stanford.edu

I will describe a model of markets in which every good has a value or desirability in each of the k dimensions. The utility of every agent in a bundle is a function of the values of the goods in that bundle in each dimension. In this model, I will present polynomial-time approximation schemes for computing the equilibria when k is bounded. Joint work with Costis Daskalakis

3 - Improved Algorithms for Computing Fisher's Market Prices
James Orlin, Professor, Massachusetts Institute of Technology, E53-363, Cambridge, MA, 02139, United States of America, jorlin@mit.edu

Irving Fisher developed a simple model of a market economy. Nevertheless, it is still non-trivial to develop efficient algorithms for determining the market clearing prices. We develop a combinatorial algorithm for computing the market equilibrium that runs in O(n^4 log n) time, improving the previous best bound of O(n^8 log U).

■ WB33

C - Room 6B, Level 3

Business Analytics and Optimization Practices

Sponsor: Computing Society
Sponsored Session

Chair: Jin Dong, IBM Research - China, Building 19 ZGC Software Park, 8 Dongbeiwang West Road, Beijing, 100193, China, dongjin@cn.ibm.com

1 - Supply Risk Management using Approximate Dynamic Programming
Lei Zhao, Tsinghua University, Department of Industrial Engineering, Tsinghua University, Beijing, 100084, China, lzhao@tsinghua.edu.cn, Xiaobo Zhao, Weijun Ding, Jiarui Fang, Jan Fransoo

We consider a production system that is subject to failures at part suppliers. Mitigation planning and emergent capacity can be used to hedge against the risk at a higher cost. We model and solve the problem using finite-horizon approximate dynamic programming.

2 - Mail Performance Measurement Study Process Improvements via Business Analytics & Optimization at IBM
Hua Ni, IBM, 8000 Grainger Ct, Springfield, VA, 22153, United States of America, huani@us.ibm.com, Christine Friesz

IBM conducts an ongoing measurement study of single-piece First-Class Mail service performance for the United States Postal Service. In this talk, we will present recent process improvement initiatives designed to strengthen the quality and operational efficiency of the measurement study, which leveraged Business Analytics and Optimization (BAO) methodologies such as optimization, simulation, and predicative analytics. We will also share the challenges and lessons learned from these efforts.

3 - Using Simulation in Global Supply Network Rationalization
Changrui Ren, IBM, Building 19 ZGC Software Park, 8 Dongbeiwang WestRoad, Haidian District, Beijing, China, rencr@cn.ibm.com, Xu Yang, Jin Dong, Qinhua Wang, Bing Shao, Miao He

This presentation will introduce a real case showing how simulation could be the key enablement for a supply chain network rationalization project in the pharmaceutical industry. An IBM tool - Supply Chain Process Modeler (SCPM) has been applied in this project. Five major simulation scenarios are designed based on the pain points the client has, and numerical results show that simulation has addressed the key issues and provided the client accountable evaluation results for decision-making.

4 - WISE-BPM: Accelerating Blueprint for Rollout Project in SAP System Implementation

Qinhua Wang, IBM Research - China, Building19, Zhongguancun Software Park, Beijing, 100193, China, wangqinh@cn.ibm.com, Bing Shao, Miao He, Changrui Ren, Jin Dong

In SAP system implementation, business process model of a rollout project should be conducted through localizing the global template. Simultaneously, global template changes should be synchronized to all rollout projects, which causes conflicts, information loss and duplication easily. WISE-BPM addresses this problem through an additional version control system to rollout global template changes, a localization flag and a mapping system to avoid information duplication and loss respectively.

■ WB34

C - Room 7, Level 3

Stochastic Optimization and Equilibrium Problems: Analysis and Stochastic Approximation Algorithms

Sponsor: Computing Society
Sponsored Session

Chair: Uday Shanbhag, Asst. Professor, University of Illinois at Urbana Champaign, Urbana, Il, United States of America, udaybag@illinois.edu

1 - Simulation-based Optimization in the Presence of Convexity

Eunji Lim, Assistant Professor, University of Miami, University of Miami, Coral Gables, United States of America, lim@miami.edu

We consider the problem of computing a response surface when the underlying function is known to be convex. We introduce a methodology that incorporates the convexity into the function estimator. The proposed response surface estimator is formulated as a quadratic program and exhibits convergence properties as a global approximation to the true function. Numerical results will illustrate the convergence behavior of the proposed estimator and its potential application to simulation optimization.

2 - Single Timescale Regularized Stochastic Approximation Schemes for Monotone Stochastic Nash Games

Jayash Koshal, Department of Industrial & Enterprise Systems Engineering, UIUC, 117 Transportation Building, 104 S. Mathews, Urbana, 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 develop single timescale projection-based stochastic approximation schemes for computing equilibria when the associated gradient map is merely monotone and establish its global convergence. In an extension where players choose their steplengths independently we claim the convergence of the scheme if the deviation across their choices is suitably constrained.

3 - On the Characterization of Solution Sets of Smooth and Nonsmooth Stochastic Nash Games

Uma Ravat, Graduate Student, University Of Illinois, Urbana, IL, 61801, United States of America, ravat1@illinois.edu, Uday Shanbhag

Solution sets of deterministic Nash games over continuous strategy sets can be characterized using variational analysis. A direct application of such results to stochastic regimes is challenging as the expectation yields a far less tractable nonlinear function. We develop an analytical framework to examine existence of stochastic Nash equilibrium under general probability measures in possibly nonsmooth regimes. We apply it to classes of Nash-Cournot games with risk and stochastic constraints.

4 - Optimal Coverage of Rectangular Request Areas using Multiple Rectangular Targets

Manish Bansal, PhD Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, bans1571@neo.tamu.edu, Kiavash Kianfar

We consider positioning k target rectangles on 2-dimensional plane to partially cover a set of existing rectangular areas (requests) to maximize total coverage reward. Applications include camera surveillance and imaging. We show this problem is NP-hard and present a novel branch-and-bound algorithm over a reduced solution space to solve the problem exactly. To our knowledge no algorithm has been proposed before for this problem and our algorithm is memory and performance efficient.

■ WB35

C - Room 8A, Level 3

Advances in Anomalous Diffusion II

Sponsor: Applied Probability
Sponsored Session

Chair: Iddo Eliazar, Professor, Holon Institute of Technology, P.O. Box 305, Holon, 58102, Israel, eliazar@post.tau.ac.il

1 - Anomalous Mixing and Reaction Induced by Spatially Fractional Dispersion

David Benson, Colorado School of Mines, 1500 Illinois St., Golden, CO, 80401, United States of America, dbenson@mines.edu, Diogo Bolster, Tanguy Le Borgne, Marco Dentz

Long-range mass transfer changes the character of mixing of two fluids of different chemical composition and the consequent chemical reaction. For mixing-limited equilibrium reactions following the space-fractional Advection-Dispersion equation (fADE), the scalar dissipation and global reaction rates decay as power-laws in time. As opposed to the Fickian (local) transport model, local reaction rates are not zero where the concentration has zero gradient.

2 - Diffusive Processes Run with Non-linear Clocks: Complexity, Ergodicity and Fractional F-P Equations

John Cushman, Professor, Purdue University, 550 Stadium Mall Drive, West Lafayette, IN, 47906, United States of America, 75674.1670@compuserve.com

We study stochastic processes run with deterministic, but non-linear clocks. The clock is used to stretch or compress the process. The clock does not change the fractal dimension or complexity of the process. Ergodicity is analyzed for several processes and compared to their classical analogs. Fokker-Planck equations for several of the processes are derived and in some cases shown to possess fractional derivatives. A number of misconceptions concerning power-law second moments are discussed.

3 - Influence of Anomalous Diffusion on the Robustness and Time Evolution of Morphogen Gradients

Katja Lindenberg, Distinguished Professor, University of California, San Diego, Department of Chemistry & Biochemistry, 9500 Gilman Drive MC 0340, La Jolla, CA, 92093-0340, United States of America, klindenberg@ucsd.edu, Santos B. Yuste, Enrique Abad

Crowded cellular environments are subdiffusive. The usual picture of morphogen gradients evolving as a result of a source of normal diffusive particles (morphogens) coupled to a degradation mechanism that removes them from the system must be modified. We aim to investigate how subdiffusive motion of the morphogens affects the evolution and robustness of the concentration profile against changes in the degradation rate. We find interesting fluctuation buffering effects caused by subdiffusion.

■ WB36

C - Room 8B, Level 3

Education I

Contributed Session

Chair: Thomas Groleau, Associate Professor of Business Administration, Carthage College, 2001 Alford Park Drive, Kenosha, WI, 53140, United States of America, tgroleau@carthage.edu

1 - Vertical Integration: Results From a Cross-Course Student Collaboration

David Lewis, University of Massachusetts Lowell, 1 University Avenue, College of Management, Lowell, MA, 01854, United States of America, David_Lewis@uml.edu, Thomas Sloan

We report the results of a cross-class project involving Sophomore-level students in a Management Science (MS) class with Junior-level students in an Operations Management (OM) class. The students formed virtual teams and developed a simulation model of a call center. Results were strongly linked with the presence or absence of a team champion.

2 - Approach to Improve the Expense Efficiency of Research Capacity of Universities

Jongwoun Youn, PhD Candidate, KUBS(Korea University Business School), Anam-Dong, Seongbuk-Gu, Seoul, Korea, Seoul, Kr, 136-701, Korea, Republic of, yjw333@korea.ac.kr, Kwang-Tae Park

Competitiveness of university can be expressed by education and research capacity. Research capacity is an essential indicator for estimating the development of university as well as that of our society. Thus, we want to propose the approach to improve the expense efficiency of research capacity.

3 - Teaching Decision Tree Classification using Microsoft Excel

Thaddeus Sim, Assistant Professor of Business Administration, Le Moyne College, 1419 Salt Springs Road, Syracuse, NY, 13214, United States of America, simtk@lemoyne.edu, George Kulick, Kaan Ataman

Data mining is the extraction of useful patterns from data to aid with decision making, and decision makers are increasingly viewing data mining as an essential analytical tool. Unfortunately, data mining does not get as much attention in the traditional OR/MS classroom as other more popular areas. We discuss our experiences in teaching a popular data mining method in an undergraduate OR/MS elective course, and outline a procedure to implement the decision tree algorithm in Microsoft Excel.

4 - A Different IE Teaching Experience: Active Learning

Ali Kefeli, PhD Candidate, North Carolina State University, 2717 Brigadoon Dr., Apt 24, Raleigh, NC, 27606, United States of America, akefeli@ncsu.edu, Michael G. Kay

In this work, we take findings of a Felder and Brent (2008) and provide a critical analysis of a senior level industrial engineering class at North Carolina State University. We investigate each mistake laid out by Felder and Brent and argue how avoiding them resulted in a better educational outcome. We provide sample assessment tools such as class assignments and midterm questions, as well as active learning exercises, technological tools and student evaluations.

5 - Pre-Analytics with Cash for Clunkers

Thomas Groleau, Associate Professor of Business Administration, Carthage College, 2001 Alford Park Drive, Kenosha, WI, 53140, United States of America, tgroleau@carthage.edu

In summer 2009 nearly 700,000 new vehicles were purchased through the U.S. government Cash Allowance Rebate System (CARS). The resulting dataset provides a freely available pre-analytics training ground for a variety of classes. Using basic desktop productivity software, students can practice data cleansing, data organizing, and basic statistics on a very large dataset. Student can also prepare the data for more detailed analysis with specialized geospatial or statistical software.

■ WB37

C - Room 8C, Level 3

Queueing Models of Call Centers

Sponsor: Applied Probability
Sponsored Session

Chair: Itai Gurvich, Assistant Professor, Kellogg School of Management, Northwestern University, 2001 Sheridan Rd., Evanston, IL, 60208, United States of America, i-gurvich@kellogg.northwestern.edu

1 - Approximate Dynamic Programming Techniques for Skill-based Routing in Call Centers

Sandjai Bhulai, VU University Amsterdam, Department of Mathematics, Faculty of Sciences, Amsterdam, 1081 HV, Netherlands, sbhulai@few.vu.nl, Dennis Roubos

We consider the problem of dynamic multi-skill routing in call centers. We obtain near optimal dynamic routing policies that are scalable with the size of the problem instance and can be computed online. The algorithm is based on approximate dynamic programming techniques. We compare the performance with decomposition techniques. Numerical experiments demonstrate that our method outperforms leading routing policies and has close to optimal performance.

2 - Comparing Erlang C and A for Modeling Real Call Centers

Tom Robbins, Assistant Professor, East Carolina University, 1006 Gemstone Circle, Winterville, 28590, United States of America, Robbinst@ecu.edu, DJ Medeiros, Terry Harrison

Erlang C is a widely used model for call centers. Erlang C makes many assumptions with one of the most problematic being no abandonment. Many authors have recently advocated the use of the more complicated Erlang A model. We present the results of a simulation study that compares the performance of these models over a range of realistic call center conditions. We find that while the Erlang A model is often more accurate, it is not always so. We also find the models have different biases.

3 - Routing to Manage Resolution and Waiting Time in Call Centers with Heterogeneous Servers

Yong-Pin Zhou, Michael G. Foster School of Business, Box 353200, University of Washington, Seattle, WA, 98195-3200, United States of America, yongpin@uw.edu, Kevin Ross, Geoff Ryder, Vijay Mehrotra

In many call centers, agents exhibit very different performance for the same call type, where performance is defined by the average call handling time and the call resolution probability. We explore strategies for determining call routing policies, where call assignments are dynamically determined based on the specific attributes of the agents and/or the current state of the system. We test several strategies using data obtained from a financial service firm and present empirical results.

4 - Call Centers with Hyperexponential Patience

Alex Roubos, VU University Amsterdam, Department of Mathematics, De Boelelaan 1081A, Amsterdam, 1081 HV, Netherlands, aroubos@few.vu.nl

We show that customers' patience can be modeled by the hyperexponential distribution; which allows an exact analysis. A framework is developed in order to compute all kinds of practical service levels. This framework utilizes the recursive relation between the queue lengths at successive service completion epochs. Our approach shows overall better performance compared to current algorithms. Moreover, the computation times are short and our approach can therefore readily be applied in practice.

■ WB38

C - Room 9A, Level 3

First-order Optimization Methods and Their Applications

Sponsor: Optimization/Linear Programming and Complementarity (Joint Cluster ICS)
Sponsored Session

Chair: Zaiwen Wen, NSF Math Institutes' postdoc, United States of America, zw2109@columbia.edu

1 - Bundle-type Methods Uniformly Optimal for Smooth and Non-smooth Convex Optimization

Guanghui Lan, Assistant Professor, University of Florida, Department of Industrial and Systems Engineering, Gainesville, FL, United States of America, glan@ise.ufl.edu

The study of Bundle or level-type methods has been focused on non-smooth convex programming (CP) problems. In this talk we present new bundle-type methods which are optimal, not only for non-smooth, but also for smooth convex programming problems. Surprisingly, the optimal rates of convergence are obtained without even requiring any smoothness information. We also demonstrate the superior practical performance of these methods over existing optimal methods for convex programming.

2 - Fast Splitting and Alternating Linearization Methods for Convex Optimization

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

In this talk, we present two classes of splitting and alternating direction methods for which we can obtain iteration complexity bounds. The basic and accelerated versions of these methods require 1/e and 1/e^(1/2) iterations to obtain an e-optimal solution, respectively. These complexity results are the first ones that have been given for splitting and alternating direction type methods.

3 - A Unified Approach for Minimizing Composite Norms

Necdet Aybat, Columbia University, IEOR Department, Columbia University, New York, NY, United States of America, nsa2106@columbia.edu, Garud Iyengar

FALC is a first-order augmented Lagrangian algorithm to solve min{mu1|X|_*+mu2|C(X)-d|_1:A(X)=b},where X in R^{m*n},by inexactly solving a sequence of problems.FALC converges to the optimal X_* if it is unique. For all e>0, iterates are e-feasible, e-optimal in O(1/e) iterations.FALC can also solve: min{mu1|X|_p+mu2|C(X)-d|_q+<R,X>:A(X)=b, F(X)-G is psd, |H(X)-h|_r <=s},with the same convergence guarantees,where |.|_p can be nuclear, Frobenius or L2-operator norm and q,r can be 1,2 or infinity.

■ WB39

C - Room 9B, Level 3

Advances in Mixed Integer Programming II

Sponsor: Optimization/Integer Programming
Sponsored Session

Chair: Jean-Philippe Richard, Associate Professor, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, richard@ise.ufl.edu

1 - A Polyhedral Study of the Mixed Integer Cut

Steve Tyber, Research Assistant, Georgia Tech, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, steve.tyber@gatech.edu, Ellis Johnson

General purpose cutting planes have played a central role in modern IP solvers. In practice, the Gomory mixed integer cut has proven to be among the most useful general purpose cuts. One may obtain this inequality from the group relaxation of an IP, which arises by relaxing non-negativity on the basic variables. We study the mixed integer cut as a facet of the master cyclic group polyhedron and characterize its extreme points and adjacent facets in this setting.

2 - A Probabilistic Comparison Between Split Cuts and Type 1 Triangle Cuts

Qie He, School of Industrial & Systems Engineering, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30332, United States of America, qie.he@gatech.edu, George L. Nemhauser, Shabbir Ahmed

The nontrivial facets for mixed-integer programs (MIP) with two rows and two integer variables are split (or Gomory) cuts, three types of triangle cuts, and quadrilateral cuts. This talk presents a probabilistic comparison of split and type 1 triangle cuts. Under a reasonable distribution of the problem parameters of the MIP, we show that the average performance of a single split cut is better than a single type 1 triangle cut in terms of dominance and volume cut off from the linear relaxation.

3 - A Polyhedral Study of the Triplet Fromulation for Single Row Facility Layout Problem

Sujeevraja Sanjeevi, PhD Student, Texas A&M University, TAMU 3131, College Station, TX, 77843-3131, United States of America, sujeevraja@tamu.edu, Kiavash Kianfar

We present a polyhedral study of the triplet formulation for the Single Row Facility Layout Problem, introduced by Amaral (Dis. App. Math., 2009). We show that this polytope is of dimension n(n-1)(n-2)/3, where n is the number of facilities. We then prove that several valid inequalities (VIs) proposed by Amaral are facet-defining. This provides a theoretical support for the strength of the LP lower bounds obtained by Amaral. We also present a generalized class of VIs that encompass Amaral's VIs.

4 - Finding Good MIP Solutions by Restricted Tree Search

Menal Guzelsoy, Georgia Institute of Technology, mguzelsoy@gatech.edu, George L. Nemhauser, Martin Savelsbergh

Starting with the branch-and-bound tree associated with the solution of a restricted mixed integer program (MIP), i.e., a MIP in which some variables are fixed, we expand certain nodes of the search tree by using dual information to selectively free previously fixed variables in the hope of quickly finding improved solutions.

■ WB40

C - Room 9C, Level 3

Panel Discussion: COIN-OR Technology Forum

Cluster: John Forrest-fest | COIN-OR 10th (Joint Cluster Computing)
Invited Session

Moderator: Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu

1 - Panel Discussion: COIN-OR Technology Forum

Panelists: Ted Ralphs, Associate Professor, Lehigh University, 200 West Packer Avenue, Bethlehem, PA, 18015, United States of America, ted@lehigh.edu, Lou Hafer, Simon Fraser University, Burnaby BC V5A 1S6, Canada, lou@cs.sfu.ca, William Hart, Sandia National Laboratories, PO Box 5800, Albuquerque NM, United States of America, wehart@sandia.gov, Kipp Martin, University of Chicago, 5807 South Woodlawn, Chicago IL 60637, United States of America, kmartin@chicagobooth.edu

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!

■ WB41

C - Room 10A, Level 3

Vehicle Routing II

Contributed Session

Chair: Sam Thangiah, Professor, Slippery Rock University, 250 ATS, Computer Science Department, Slippery Rock, PA, 16057, United States of America, sam.thangiah@sru.edu

1 - Backhaul Vehicle Routing Problem with Time Constraint

Yuanyuan Dong, Southern Methodist University, P.O. Box 750123, Dallas, TX, 75275-0123, United States of America, njdyy03@gmail.com, Junfang Yu

A backhaul vehicle routing problem has been studied in which maximum profit is desired during backhaul trip but travel time is constrained. A heuristic algorithm, adapted from genetic algorithm, has been developed and implemented for the problem. Empirical study has been performed to show the efficiency and effectiveness of the algorithm.

2 - Hybrid Genetic Algorithm for the Split Delivery Vehicle Routing Problem

Joe Wilck, The University of Tennessee - Knoxville, 411 East Stadium, Knoxville, TN, United States of America, jwilck@utk.edu, Gautham Rajappa, Michael Vanderlan

The SDVRP allows customers to be assigned to multiple routes. A genetic algorithm is presented where results from a construction heuristic are used to rank the importance of certain node relationships. If nodes 2 and 9 appear on the same route in many solutions, and those solutions have significantly lower distances when compared to solutions where nodes 2 and 9 are not on the same route, then the nodes 2 and 9 have a higher probability of being placed on the same route in future generations.

3 - Solving Large Scale Dial-A-Ride Problem using a Two-Stage Heuristic Based on Clustering-Routing

Taehyeong Kim, University of Maryland, Dept of Civil & Environmental Eng, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, tommykim@umd.edu, Ali Haghani

In this paper, a static DARP model with time varying travel times and multiple depots is formulated. Also, a heuristic methodology using two-stage is proposed to solve this problem. At first stage, initial solution is constructed using clustering-routing algorithm. And then, it is improved at next stage. The model is used to solve a real world problem that is provided by the MTA in Baltimore, MD and the results of implementing the model are compared with those of current system operations.

4 - Multi-depot, Multi-Destination, Mix-Fleet Vehicle Routing Problem with Real-Life Constraints

Sam Thangiah, Professor, Slippery Rock University, 250 ATS, Computer Science Department, Slippery Rock, PA, 16057, United States of America, sam.thangiah@sru.edu, Joseph Forsythe

This paper presents a real-life multi depot, multi-destination, mix-fleet vehicle routing problem with 1200 pickup locations, 2000 customers and 60 vehicles. The precise distances between pickup locations are obtained using digitized road maps instead of Euclidean distance. Heuristics for solving the problem and results for the real-life data set are reported.

■ WB42

C - Room 10B, Level 3

Computational Optimization and Applications II

Sponsor: Optimization/Computational Optimization and Software (Joint Cluster ICS)
Sponsored Session

Chair: Ali Ekici, Assistant Professor, University of Houston, Department of Industrial Engineering, E221A Engineering Building 2, Houston, TX, 77204, United States of America, aekici@Central.UH.EDU

1 - On the Parallel Computation of Individual Penalties in Scheduling Jobs

Irinel Dragan, Professor Emeritus of Mathematics, University of Texas at Arlington, U.T.Arlington, Mathematics, Arlington, TX, 76019-0408, United States of America, dragan@uta.edu

For scheduling n jobs on a single machine, with a common due date. and given weights, we want to find a schedule which minimizes the total penalty. We build a scheduling game and we propose to compute in parallel the individual penalties as the Shapley Value expressed by means of the Average per capita formula (Dragan,1992).

2 - Experience in Developing Heuristic Algorithms to Solve Large-scale Non-convex NLP Problem

Vladimir Krichtal, Senior Development Engineer, Transpower NZ, 96 The Terrace, P.O. Box 1021, Wellington, New Zealand, Vladimir.Krichtal@transpower.co.nz, Conrad Edwards

Transpower, as the New Zealand power system operator, uses an LP dispatch and pricing model. The model is derived from a non-convex NLP one, with quadratic circuit losses approximated by piece-wise linear functions. Sometimes the solver does not solve the resulting LP model correctly. The types of incorrect solutions are identified. Some of these incorrect solutions are prevented via market rule changes. Other can be fixed using heuristic iterative MIP algorithms.

3 - Cutting Stock Problem with Setup Costs

Ali Ekici, Assistant Professor, University of Houston, Department of Industrial Engineering, E221A Engineering Building 2, Houston, TX, 77204, United States of America, aekici@Central.UH.EDU, Azadeh Mobasher

We study the weighted cutting stock problem which is a more general version of the well-known cutting stock problem. The objective in weighted cutting stock problem is to minimize total production cost including both waste and setup costs. Since the problem is NP-hard, we develop heuristic algorithms to find good solutions and test their effectiveness on randomly generated instances.

■ WB44

C - Room 2, Level 2- Mezzanine

Appointment Scheduling in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Serhan Ziya, University of North Carolina, 356 Hanes Hall CB# 3260, Chapel Hill, NC, 27599, United States of America, ziya@email.unc.edu

Co-Chair: Nan Liu, Mailman School of Public Health, Columbia University, 600 W 168th ST, 6th Floor, New York, NY, 10032, United States of America, nl2320@columbia.edu

1 - A Comparison of Traditional and Open-access Appointment-scheduling Policies
Rachel Chen, University of California at Davis, Graduate School of Management, Davis, CA, 95616, United States of America, rachen@ucdavis.edu, Lawrence Robinson

Under traditional scheduling, patients are booked in advance, but may not show up. Under open-access scheduling, a random number of patients call in the morning to make an appointment for that same day. Thus under either policy the number of patient arrivals will be random, for different reasons. We find that the open-access schedule in general outperforms the traditional schedule, except when patient waiting time is held in little regard or when no-show probability is small.

2 - Adaptive Appointment Systems with Patient Preferences
Wen-Ya Wang, University of Minnesota, 111 Church St SE, Minneapolis, MN, 55455, United States of America, wenya@ie.umn.edu, Diwakar Gupta

We propose a framework for the design of the next generation of appointment systems that dynamically learn and update patients' preferences, and use this information to improve booking decisions. Analytical results leading to a partial characterization of an optimal booking policy are presented. Examples show that heuristic decision rules, based on this characterization, perform well and reveal insights about tradeoffs among a variety of performance metrics important to clinic managers.

3 - Controlling Demand for Appointment-based Services in the Presence of No-show Customers
Nan Liu, Mailman School of Public Health, Columbia University, 600 W 168th ST, 6th Floor, New York, NY, 10032, United States of America, nl2320@columbia.edu, Serhan Ziya

Customer no-shows is a major problem for many service systems that work with appointments. In this talk, we model the scheduled appointments as a single-server queue and investigate how to maximize system throughput taking into account waiting time dependent no-shows. We also study how to adjust the system design in response to changes in customer no-show behavior. Both analytical and numerical results will be presented.

■ WB45

C - Room 6, Level 2- Mezzanine

Modeling and Optimizing Quality of Care and Efficiency of Delivery

Sponsor: Health Applications
Sponsored Session

Chair: Eva Lee, Professor & Director, Georgia Institute of Technology, Center for Operations Research in Medici, Industrial & Systems Engineeriing, Altanta, GA, 30332-0205, United States of America, eva.lee@gatech.edu

1 - Quantifying Reductions in Variability of Intraoperative Time From Meta-analysis of Trial Results
Franklin Dexter, Professor, University of Iowa, Department of Anesthesia, 6JCP, Iowa City, IA, 52242, United States of America, franklin-dexter@uiowa.edu

Electronic medical record data were used to facilitate meta-analysis of randomized clinical trials. For interventions affecting anesthetic durations, usually there are many (> 20) clinical trials each with small N (<20). Analyzing anesthesia EMR data, probability distributions of extubation times were Weibull. Choice of drug did not influence Weibull shape parameters. Appropriate Bayesian and non-Bayesian random effect meta-analyses were then used to quantify reduction in time variability.

2 - A Systems Approach to Reducing Medication Errors
Niquelle Brown, Georgia Institute of Technology, Atlanta, GA, United States of America, niquelle.brown@gatech.edu, Deniz Cinalioglu, Hyo Jung Kang, Eva Lee

Medication errors pose significant impact on patient safety and quality of care. In this study, a systems perspective is adopted in developing simulation-optimization models for describing the medication work flow in a pediatric setting. The system allows for derivation and validation of effective intervention strategies for error mitigation. This work is joint with Children's HealthCare of Atlanta.

3 - Optimizing Emergency Department Workflow
Anna Yang, Georgia Institute of Technology, Atlanta, GA, United States of America, anna.yangyang@gatech.edu, Eva Lee

In this work, we study the ED workflow of a large public hospital, design a computer model that can capture the current processes, identify major bottlenecks, and develop effective intervention and recommendation. The study and recommended systems intervention will enable hospital policy makers to transform existing ED processes so as to improve quality of care, timeliness of care, efficiency, and possible financial gains and investment. This work is joint with Grady Health Systems.

4 - Evaluating and Building a Decision Support System for Trauma Patients
Oguzhan Ozlu, Georgia Institute of Technology, Atlanta, GA, United States of America, aozlu3@isye.gatech.edu, Eva Lee

Trauma patients demand rapid transportation to the most suitable hospital for treatment where timeliness of care, and quality of care are of paramount importance. Some critical objectives include maximizing the best treatment outcome for trauma patients as well as optimal/smart usage of available regional resources. In this talk, we present our work with Georgia Trauma Commission on optimal care delivery aiming to improve trauma care across the Georgia State.

■ WB46

C - Room 7, Level 2- Mezzanine

Game-Theoretic Applications in Healthcare I

Sponsor: Health Applications
Sponsored Session

Chair: Murat Kurt, PhD Student, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15217, United States of America, muk7@pitt.edu

Co-Chair: Reza Yaesoubi, Post-Doctoral Research Fellow, Harvard Medical School, 641 Huntingtone Ave., Boston, MA, 02115, United States of America, reza.yaesoubi@gmail.com

1 - Decentralized Resource Allocation to Control an Epidemic: A Game Theoretic Approach
Shouqiang Wang, PhD Student, Fuqua School of Business, Duke University, 1 Towerview Dr., Durham, NC, 27707, United States of America, sw55@duke.edu, Peng Sun, Francis de Vericourt

This paper examines how two countries would allocate resources at the onset of an epidemic when they seek to protect their own populations. We model this situation as a game between selfish countries, where players strategically allocate their resources in order to minimize the total number of infected individuals in their respective populations during the epidemic. We also consider possible extensions.

2 - Characterization of Payoff Efficient Equilibria in Prearranged Paired Kidney Exchanges
Murat Kurt, PhD Student, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15217, United States of America, muk7@pitt.edu, Mark S. Roberts, Andrew J. Schaefer, M. Utku Unver

We consider a non-zero sum stochastic game formulation to model the transplant timing decisions in a prearranged paired kidney exchange. Due to trade-off between the payoff efficiency and the stability of the equilibria, we characterize the socially efficient stable equilibrium as an optimal solution to an MIP. For large-scale problems, based on single-controller MDP models, we develop an iterative best response algorithm. We present computational results based on clinical data.

3 - Coordinating Contracts in a Preventive Health Care System Under Capacity Restrictions
Reza Yaesoubi, Post-Doctoral Research Fellow, Harvard Medical School, 641 Huntingtone Ave., Boston, MA, 02115, United States of America, reza.yaesoubi@gmail.com, Stephen Roberts

We consider a health care system consisting of two noncooperative parties: a health purchaser and a health provider. The health provider, bounded by capacity, determines the type of patients who should undergo a preventive medical intervention, and then gets reimbursed by the health purchaser according to a contract. We determine the contracts that coordinate this system; i.e., the contracts that allow both parties to maximize their objective functions while maximizing the population's welfare.

4 - Influenza Vaccine Supply Chain: Role of Consumption Externality and Yield Uncertainty

Kenan Arifoglu, PhD Student, Northwestern University, 2145 Sheridan Road, Room C 210, 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.

■ WB47

C - Room 8, Level 2- Mezzanine

Project Scheduling and Risk Management

Cluster: Topics in Project Management
Invited Session

Chair: Richard Wendell, Professor, Katz Graduate School of Business, University of Pittsburgh, Pittsburgh, PA, 15260, United States of America, wendell@katz.pitt.edu

Co-Chair: Timothy Lowe, Professor, Tippie College of Business, University of Iowa, Iowa City, IA, United States of America, timothy-lowe@uiowa.edu

1 - New Product Design and Pricing in a Duopoly Market with Forward-looking Consumers

Ted Klastorin, Burlington Northern/Burlington Resources Professor, Department of Information Systems & Operations Mgt, Michael G Foster School of Business, University of Washington, Seattle, WA, 98195-3200, United States of America, tedk@u.washington.edu, Aysun Ozler, Yong-Pin Zhou

We study the introduction of a new product into a durable goods duopoly market. In our model, an innovator firm begins to develop a product; after a random time period, information about this product leaks and an imitator firm begins to develop a competing product. Consumers are forward looking and make purchases based on the available product and their expectations on future products. We derive implications for both profit-maximizing firms with respect to the design and pricing of the products.

2 - Planning Stochastic Projects Under the Threat of a Disruptive Event

Gary Mitchell, Assistant Professor, Pamplin School of Business Administration, University of Portland, 5000 N. Willamette Blvd, Portland, OR, 97035, United States of America, mitchelg@up.edu, Ted Klastorin, Issariya Sirichakwal

We consider the issue of planning a stochastic project when there is a threat of an exogenous disruptive event that may stop work on one or more tasks (possibly the entire project). Our goal is to minimize expected total project costs, including resource costs, overhead/indirect costs, and penalty costs. We analyze a model to determine when the project manager should take proactive steps during the planning phase or wait and take contingent actions after a disruption occurs.

3 - Agility in Projects - Theoretical and Computational Results

Karolina Glowacka, Assistant Professor, Stevens Institute of Technology, Howe School of Technology Management, Hoboken, NJ, 07030, United States of America, kglowack@stevens.edu, Richard Wendell, Timothy Lowe

In this research we show that a lack of agility can be a significant factor in project delays. We characterize the concept of agility in projects, show how agility can have a significant impact on the likelihood of achieving a target-time for a project, and give some general properties on agility with respect to a project's structure. We also discuss how and where to build agility into key project activities.

4 - Integration of Project Management and Software Development Processes in a Complex Project

Laura Anderson, Manager, Advanced Estimating & Infrastructure Solutions, IBM Research - Almaden, 650 Harry Road, San Jose, CA, 95120, United States of America, laurac@almaden.ibm.com, Ruoyi Zhou

Project management continues to increase in complexity, with special challenges due to agile methodologies and geographically dispersed teams. We describe our experience in software project management for a medium sized research and development project using IBM's Rational Jazz™. We discuss the observed advantages of Jazz in systematizing the overall process, with narrative observations, quantitative measurements, and objective measures of the value of such a project management system.

■ WB49

C -Room 10, Level 2- Mezzanine

Systems Analysis and Design

Sponsor: Information Systems
Sponsored Session

Chair: Vijay Khatri, Indiana University, 1309 E. 10th Street, BU 560F, Bloomington, IN, 47405, United States of America, vkhatri@indiana.edu

Co-Chair: Jeffrey Parsons, jeffreyp@mun.ca

1 - A Cognitive Perspective on Developing and Interpreting Conceptual Models

Palash Bera, Assistant Professor, Texas A&M InternationalUniversity, 5201, University Blvd., Laredo, TX, 78041, United States of America, palash.bera@tamiu.edu

Conceptual models are often used to document features of the domain to be reflected in the Information Systems. Developing and interpreting conceptual models can be considered as cognitive tasks performed by modelers. In a laboratory setting, this study contrasts the cognitive difficulties faced by two groups of modelers- one who develops the models and the other who interprets the same models. The results indicate that the cognitive difficulties faced by the groups are of different nature.

2 - Business Informational Sabotage: An Exploration into Incidence Rates and Causes

John Erickson, University of Nebraska at Omaha, College of Business, 6001 Dodge Street, Omaha, NE, 68182, United States of America, johnerickson@mail.unomaha.edu, George Gresham, John Hafer

This study represents an exploratory effort into the occurrence rates of nineteen types of organizational information sabotage, moral attitudes towards the acts and the saboteurs. Roughly 40% of the respondents indicated awareness of sabotage and up to 31% admitted committing one/some acts of sabotage. Demographic variables were tested for significance.

3 - Experiments in Paired Software Development

Radha Mahapatra, Associate Professor, University of Texas at Arlington, 701 S. West St., Arlington, TX, 76019-0437, United States of America, mahapatra@uta.edu, Sridhar Nerur, VenuGopal Balijepally, George Mangalaraj

A core practice in recently popularized agile software development methods is paired development, where two developers work together to jointly design and develop application systems. We have conducted a series of experiments to understand the efficacy of paired development vis-á-vis the traditional practice of software development by developers working individually. Findings from these experiments will be presented.

■ WB50

C -Room 11, Level 2- Mezzanine

Information Systems I

Contributed Session

Chair: Zsolt Ugray, Associate Professor, USU, 3515 Old Main Hill, Logan, United States of America, Zsolt.Ugray@usu.edu

1 - Bundling of Information Sources using the Value of Information

Pantea Alirezazadeh, PhD Student, University of Connecticut, 2100 Hillside rd, Unit 1041, Storrs, CT, 06269, United States of America, pantea.alirezazadeh@business.uconn.edu, Fidan Boylu, Ram Gopal

We present a method for acquiring information from multiple information sources with different reliabilities based on the incremental value of information. We evaluate the value of information that can be provided by third-party data providers and measure the value of different combinations of information sources based on their contribution to expected utility and provide heuristic solutions to select an optimal combination of these information sources.

2 - Understanding Time Inconsistent Preferences in Real Options Based it Investment Justification

Ram Kumar, UNC- Charlotte, 9201 University City Blvd, Charlotte, NC, United States of America, rlkumar@uncc.edu, Sarah Khan

The literature on the use of Real Options in IT (and other) investment justification assumes that decison makers will be able to exercise options optimallly. However, in practice, decision makers can have time inconsistent preferences. The effects of these preferences on the use of Real Options Analysis is analyzed. This analysis has important implications for decision makers

3 - Multicriteria Model for Selecting Information Systems Based on the PROMETHEE Method

Jônatas Almeida, Federal University of Pernambuco, Recife-PE, Brazil, jonatasaa@yahoo.com.br, Ana Paula Costa, Adiel Almeida

This paper discusses the importance of the process of selecting Information Systems (ISs) integrated with an IS planning methodology. A model which integrates an adapted version of an IS planning methodology called Business System Planning (BSP) and the multicriteria method PROMETHEE II is presented. As a contribution, this paper identifies the need for ISs to start from the company's strategic vision, including how value is to be added to the business, considering aspects for the organization.

4 - Franchisee Attitudes Toward the Adoption of Advanced Internet Technologies and Innovations

Zsolt Ugray, Associate Professor, USU, 3515 Old Main Hill, Logan, United States of America, Zsolt.Ugray@usu.edu, Kelley O'Reilly

We present findings from a case study exploring franchisees' attitudes and perceptions of using advanced Internet technologies and innovations. We illustrate that the dual role of owner-operators, in which they are both decision makers and users of technologies, provides a dichotomy of perspectives that yield insights into aspects of business leadership, customer service, and operational proficiency.

■ WB51

C -Room 12, Level 2- Mezzanine

Analyses for Rotary Wing Aircraft

Sponsor: Military Applications
Sponsored Session

Chair: Caolionn O'Connell, Institute for Defense Analyses, 4850 Mark Center Drive, Alexandria, VA, 22311, United States of America, coconnel@ida.org

1 - Rotary Wing Aircraft Capacity for Operations in Afghanistan

Matthew Grund, Research Analyst, CNA, 4825 Mark Center Drive, Alexandria, VA, 22311, United States of America, grundm@cna.org, Greg Cox

Senior leaders in the Department of Defense have expressed concern that there is insufficient rotary wing capacity in Afghanistan to effectively carry out the required missions. Our work broadly explores three ways of increasing rotary wing capacity in Afghanistan: increasing the number of aircraft in theater, increasing the hours flown by aircraft already in theater, and increasing the efficiency of flight hours already being flown by aircraft in Afghanistan.

2 - Utility Assessment of Rotary Wing Aircraft

Dana Paterson, Senior Analyst, Naval Air Systems Command, Bldg 2109, Room S211, Patuxent River, MD, 20670, United States of America, dana.paterson@navy.mil

Decision makers faced with making a choice among a finite set of rotary-wing aircraft, aircraft designs or aircraft concepts must have information products describing the utility of each member of the set. This briefing is a description of a senior analyst's method beginning with identification of the decision to be made and ending with an exposition of his preferred method for describing the decision space for the decision maker.

3 - A Forensic Analysis of Cost Growth in Rotary Wing Programs

Caolionn O'Connell, Institute for Defense Analyses, 4850 Mark Center Drive, Alexandria, VA, 22311, United States of America, coconnel@ida.org

An analysis of cost growth in rotary wing (RW) programs and how it compares to other major defense acquisition programs (MDAPs). The brief will also include a discussion of possible root causes for RW cost growth and a suggested cost estimating methodology for future programs.

4 - Army Aviation Force Structure

Steven Stoddard, US Army, Burke, VA, United States of America, steven.stoddard@us.army.mil

The Army has the responsibility to provide manned, trained, and equipped units to support operations. We explain how the Army manages the supply of helicopter units to meet as much demand as possible. We answer three questions: 1. What happens if the Army adds more helicopters? 2. What happens if the Army uses its helicopter units more often? 3. What happens if the Army alters its active - reserve mix?

■ WB52

C -Room 13, Level 2- Mezzanine

Assessing Terrorism Probabilities and All-Hazards Risk in the U.S. Department of Homeland Security

Cluster: Homeland Security and Defense
Invited Session

Chair: Steve Bennett, Asst. Director, Risk Analytics Division, Office of Risk Management and Analysis, U.S. Department of Homeland Security, Washington, DC, 20528, United States of America, steve.bennett@dhs.gov

1 - Relative Probabilities of Terrorist Attacks: Rational Adversaries with Uncertain Value Tradeoffs

Evan Levine, DHS Office of Risk Management and Analysis, 2929 Connecticut Ave NW, Apt 709, Washington, DC, 20008, United States of America, evan.levine@dhs.gov

Many analyses conducted to inform counterterrorism decisions depend on estimates of the relative probabilities of different attack types. We describe a method of using uncertainty in utility function value tradeoffs to model the adversary's decision process and solve for the relative probabilities of attacks in closed form. The process we describe is an extension of value-focused thinking, and is suitable for application outside of counterterrorism, including general business decision-making.

2 - Informing All-hazards Decision-making at the U.S. DHS: Constructing an Appropriate Scenario Set

Julie Waters, Risk Analyst, Office of Risk Management and Analysis, U.S. Department of Homeland Security, Washington, DC, 20528, United States of America, julie.waters@dhs.gov, Evan Levine, Steve Bennett

The Homeland Security National Risk Assessment (HSNRA) methodology, developed by DHS, uses an order-of-magnitude estimation technique to quantify the dominant risks across the disparate hazards confronted by the Nation. In this presentation, we discuss how the space of possible events relevant to homeland security is discretized into scenarios that form the units of analysis for frequency and consequence elicitation and the process by which dominant scenarios are identified.

3 - Eliciting Probabilities From the Intel Community to Support Terrorism Risk Assessments at U.S. DHS

Natasha Hawkins, Risk Analyst, U.S. Department of Homeland Security, Washington, DC, 20528, United States of America, natasha.hawkins@dhs.gov, Tony Cheesebrough, Steve Bennett

Probability elicitations for terrorism involve engaging intelligence community experts who generally communicate threat judgments in qualitative terms. This presentation will discuss challenges and opportunities in applying expert elicitation methods to the elicitation of intelligence information in DHS and provide an opportunity for the OR/MS community to provide input and suggestions for improvement and enhancement.

4 - RAPID: Supporting Risk-informed Strategic Policy and Resource Allocation Decisions at the U.S. DHS

Debra Elkins, Section Chief, Risk Assessments and Analysis, U.S. Department of Homeland Security, U.S. Department of Homeland Security, Washington, DC, 20528, United States of America, debra.elkins@dhs.gov, Steve Bennett, Tony Cheesebrough, Natasha Hawkins

The Risk Assessment Process for Informed Decision-making (RAPID) is a risk assessment conducted within the DHS Office of Risk Management and Analysis that supports strategic policy and budgetary decision-making across the U.S. Department of Homeland Security. This presentation will describe the technical risk analysis methodologies used in RAPID and provide an opportunity for the OR/MS community to provide input and suggestions for improvement and enhancement.

■ WB53

C -Room 14, Level 2- Mezzanine

Operations/Marketing Interface I

Contributed Session

Chair: Baokun Li, Dr., Southwestern University of Finance and Economics, 555 Liutai Ave, Wenjiang District, Chengdu, 611130, China, flyinghorse1967@yahoo.com

1 - Market-based Joint Decisions on Price, Delivery Time, Service Level, and Supplier Selection

Li Qian, South Dakota State University, Solberg Hall 115B, Brookings, 57006, United States of America, li.qian@sdstate.edu

This paper models the demand as a linear or log-linear function of attributes including price, guaranteed delivery time, and service level. With stochastic delivery time, the service level is not always binding at the minimal value reserved by the manager or the market, as assumed in most literature. A market-oriented approach for supplier selection or investment is proposed in consideration of operation performances in cost, delivery time, service level, and/or quality in an integrated manner.

2 - Cooperative Advertising in a Dynamic Durable Goods Supply Chain

Anshuman Chutani, UT Dallas, School of Management, SM 30, Richardson, TX, 75080, United States of America, anshuman.chutani@student.utdallas.edu, Suresh Sethi

We analyze dynamic advertising and pricing policies in a durable goods supply chain with co-operative advertising. We consider a stackelberg game where manufacturer announces the wholesale price and its share in the retailer's advertising expenditure. The retailer responds with its optimal advertising and pricing policies. The sales dynamics follows the model suggested by Sethi, Prasad and He (2008). We analyze two different demand specifications, linear and iso-elastic.

3 - Can We All Get Along? Incentive Contracts to Bridge the Marketing and Operations Divide

Kinshuk Jerath, Assistant Professor, Carnegie Mellon University, 5000 Forbes Ave, Pittsburgh, PA, 15213, United States of America, kinshuk@cmu.edu

The marketing and operations management arms in a firm must work in coordination. However, a major source of conflict is that marketing compensation is usually heavily weighted towards sales whereas operations compensation is usually heavily weighted towards expense reduction. In this paper, we invoke agency theory to determine compensation plans for sales and operations managers to coordinate their activities in the best interests of the firm.

4 - Computing Reasonable Allocations in Coalition Games

Baokun Li, Dr., Southwestern University of Finance and Economics, 555 Liutai Ave, Wenjiang District, Chengdu, 611130, China, flyinghorse1967@yahoo.com

We introduce a new kind of coalition gain allocation, Proportion Allocation, which is inspired from the Coarsening at Random mechanism in statistics. Based on the Proportion Allocation and traditional Shapley value, a reasonable class of allocations is dened and related algorithm is given for calculating them. Besides, a simulated annealing method is constructed to solve for the stable allocation, nucleolus, for coalition games.

■ WB54

C -Room 15, Level 2- Mezzanine

Characterizing Uncertainty and Learning for Technology Choice Decisions

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Thomas Rand-Nash, Doctoral Candidate, Massachusetts Institute of Technology Materials Systems Laboratory, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, trand@mit.edu

1 - Learning-Derived Cost Evolution in Materials Selection

Trisha Montalbo, MIT, 77 Massachusetts Ave, E38-420, Cambridge, United States of America, trisha@mit.edu, Richard Roth

We investigate the impact of considering cost evolution due to learning by doing in the selection of materials for a manufacturing firm. A multi-product, multi-period selection framework is developed to analyze the problem because single-product selection methods are unable account for benefits realized through shared learning among products. The use of test beds as a strategy for introducing new materials to a firm is also evaluated.

2 - Cost-Optimal Reinspection Plans

Hadi Zaklouta, Graduate Student Researcher, MIT Materials Systems Laboratory, 292 Main Street, E38-435, Cambridge, MA, 02139, United States of America, zaklouta@mit.edu, Randolph Kirchain, Richard Roth

This paper compares single and double inspection plans effect on cost and quality. A cost model is proposed that accounts for appraisal and internal/external failure costs. All units are tested with one or two tests. In plan RR, rejects are retested and replaced after rejection. In plan AR, accepts are retested and rejects replaced. Non-conformance rate and test error rates are known. The AR plan is best for high warranty/scrap cost ratio; the RR plan for low; a single test plan otherwise.

3 - Learning as a Driver Technology Choice Decisions in Manufacturing

Thomas Rand-Nash, Doctoral Candidate, Massachusetts Institute of Technology Materials Systems Laboratory, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, trand@mit.edu

This work explores process technology decision making in the presence of learning effects in manufacturing, and hopes to characterize the conditions under which learning-related production cost effects impact technology choice decision making. Relevant factors considered include learning rates, production volume as a function of demand, market structure, and budget constraints.

4 - Shifting Grounds: How Industry Emergence Changes the Effectiveness of Knowledge Creation Strategies

Sebastian Fixson, Babson College, Babson Park, MA, United States of America, sfixson@babson.edu, Won Hee Lee

The knowledge management literature has identified various aspects, advantageous and disadvantageous, of both inward-looking and outward-looking knowledge creation strategies. With a longitudinal empirical study we explore the dynamics of firms' knowledge creation strategies during the period of industry emergence. We find that the emergence of an industry changes the effectiveness of the different knowledge creation strategies.

■ WB55

C -Room 16, Level 2- Mezzanine

Sustainability and NPD

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Cheryl Druehl, Assistant Professor, George Mason University, 4400 University Dr, MS 5F4, Fairfax, VA, 22030, United States of America, cdruehl@gmu.edu

1 - New Business Models to Enable Clean and Renewable Generation in the Electric Power Industry

Edward Anderson, Associate Professor, University of Texas, 1 University Station B6500, Austin, TX, 78733, United States of America, Edward.Anderson@mccombs.utexas.edu, Geoffrey Parker

Over the coming decades, electric power companies must transform their business models to accommodate the smart grid and growing demand for clean renewable energy. Many researchers are examining aspects of this problem, such as power companies' infrastructure portfolios, consumer behavior, pricing structures, etc. To complement this analysis, we build and analyze a top-down systems model of a typical power company and its market "ecosystem" using the system dynamics methodology.

2 - Does "To Go Green" Translate into Profitability?

Asoo Vakharia, Professor, University of Florida, Department of ISOM, Gainesville, FL, 32611-7169, United States of America, asoo.vakharia@warrington.ufl.edu, Arda Yenipazarli

Consumers are frequently integrating "green" product attributes when making purchasing decisions. We propose a firm level analytical model to enable decisions on whether to upgrade the "green" content of an existing product, replace the existing product with a "green" product, or provide a portfolio of an existing and "green" product.

3 - Reviving the Electric Car Movement: Developing Green Infrastructure for Sustainable Transportation

Cheryl Druehl, Assistant Professor, George Mason University, 4400 University Dr, MS 5F4, Fairfax, VA, 22030, United States of America, cdruehl@gmu.edu, Michael Naor

An innovative new business model for sustainable transportation is described. A case study approach is used to study the unique product and service development process required to electrify the automobile industry, focusing on a clean tech company building innovative green infrastructure for sustainable transportation in Israel.

■ WB56

C - Room 1, Level 1

Human Decision-Making and Social Network Simulation

Sponsor: Simulation Society
Sponsored Session

Chair: Young-Jun Son, Professor, The University of Arizona, Systems and Industrial Engineering, Tucson, AZ, 85721, United States of America, son@sie.arizona.edu

1 - Hyper-Networks and Their Properties
W. K. Victor Chan, Assistant Professor, Rensselaer Polytechnic Institute, ISE Dept, CII 5015, 110 8th Street, Troy, NY, 12180-3590, United States of America, chanw@rpi.edu, Cheng Hsu

A hyper-network is an integration of multi-layered (role-based) connections of members in a community, such as the Internet and an ecosystem. In this talk, we formally define hyper-networks and present their analytical properties. We show that hyper-networks can reveal otherwise hidden social structures and provide estimation formulae for determining average vertex-vertex distances and average vertex degrees.

2 - Simulation-based Workforce Assignment Considering Position in a Social Network
Nurcin Celik, PhD, The University of Arizona, 1127 E James E. Rogers Way, Tucson, AZ, 85721-0020, United States of America, nurcinkoyuncu@gmail.com, Dong Xu, Hui Xi, Young-Jun Son, Robin Lemaire, Keith Provan

A novel modeling framework is proposed to help managers devise optimal workforce assignments that consider both short and long-term aspects of the organizational social network. The framework involves the evaluation module (via agent-based simulation) to calculate the position and equivalence values between each pair of workforce members and the assignment module (via multi-objective optimization) to select an optimal workforce mix. The framework is illustrated with the Kuali organization.

3 - Dynamic Control and Simulation of Manufacturing Process with Different Forms of Uncertainties
Hyunsoo Lee, Texas A&M University, 3131 TAMUS, College Station, TX, 77843, United States of America, hsl@neo.tamu.edu, Amarnath Banerjee

We show a method for capturing and dynamically controlling uncertainties under changes in manufacturing condition. Ambiguity and variance type uncertainties are incorporated into a Fuzzy colored Petri Net with stochastic time delay model and it is controlled using a new and effective learning method for simulation-based optimization. A semiconductor process with serial and batch machines is controlled and a given objective is achieved using the suggested simulation based optimization method.

■ WB57

C - Room 2, Level 1

Financial Optimization in Energy and Communication Systems

Sponsor: Financial Services Section
Sponsored Session

Chair: Jim Bander, Credit Risk Optimization Manager, Toyota Financial Services, 3200 W Ray Road, Chandler, AZ, 85226, United States of America, jim.bander@gmail.com

1 - Energy Portfolio Investment with Entry Decisions
Zhen Liu, Assistant Professor, Missouri University of Science & Technology, United States of America, zliu@mst.edu, Scott Grasman, Jianjun Deng

We formulate energy portfolio problems as an optimization problem to maximize long-term profit through stochastic control and numerical analysis methods, and solve the following problems: (1) the optimal time to build a new alternative green energy power generating plant, and (2) the optimal dispatch from the existing coal plant and the new plant.

2 - Reducing Price Volatility of Electricity Consumption for a Firm's Energy Risk Management
Xiaohua Wu, Rensselaer Polytechnic Institute, 903 Peoples Ave Apt 3, Troy, NY, 12180, United States of America, wux4@rpi.edu, Aparna Gupta

Smart Grid technologies allow firms to manage electricity price volatility and fluctuations. We develop a framework to assess strategies for optimally shifting peak load consumption using distributed storage systems of Smart Grids. Risk management is achieved by optimal investment in storage systems and peak load shifting under stochastic electricity prices.

3 - A Regime-switching Approach to the Valuation of Weather Options
M.I.M Wahab, Ryerson University, Toronto, ON, M5B 2K3, Canada, wahab@ryerson.ca, R. S. Elias, L. Fang

Regime-switching processes are used to model the stochastic behavior of temperature with aim of valuation of temperature-based weather options. Three different models are used to predict the expected heating degree days (HDD) and cooling degree days (CDD) that play a crucial role in valuation of weather options. Temperature dataset from Toronto, Canada, is used for the analysis. Results demonstrate that one of the models captures temperature dynamics more accurately than the other two models.

4 - Path-Vector Contracting: Profit Maximization and Risk Management
Praveen Kumar, Rensselaer Polytechnic Inst, 110 8th Street, Troy, NY, United States of America, muthup@rpi.edu

We consider an Internet Service Provider's problem of providing end-to-end (e2e) services with bandwidth guarantees, using a path-vector based approach. The spot-pricing framework for e2e bandwidth guaranteed services utilizes a path contracting strategy by formulating it as a stochastic optimization problem with the objective of maximizing expected profit subject to risk constraints.

5 - Flash Crashes - Volatility, Smart Order Routing, and Market Fragmentation
Bruce Weber, London Business School, Regent's Park, London, NW14SA, United Kingdom, bweber@london.edu

Advances in IT have lowered costs but also fostered trading practices that may negatively impact the entire market. A national market system for securities with multiple fragmented liquidity pools is simulated. We analyze how trading rules at different exchanges and software for smart order routing can lead to illiquidity and "flash crashes." Under certain conditions, high frequency trading can lead to securities market aberrations, and curbs on computer-driven trading may be warranted.

■ WB58

C - Room 3, Level 1

Finance-Theory and Empirics

Contributed Session

Chair: Vinod Cheriyan, Georgia Institute of Technology, Industrial and Sytems Engineering, 765 Ferst Drive NW, Atlanta, Georgia, vinod.cheriyan@gatech.edu

1 - The Empirical Research of Media Effect in China Stock Market
Yahui Zhang, The School of Management, Xi'an Jiaotong University, #28 Xianning West Road, Mailbox 1875, Xi'an, China, kailey@stu.xjtu.edu.cn, Leiming Fu, Difang Wan

This research explores the existence of media effect in China stock market through event research and analyses the affecting factors. Results show that media effect is significant and presented as negative cumulative abnormal return within the event window, which can be mitigated by better corporate governance. CAR is positively correlated with the B/M ratio of equity, financial leverage, ROA and position accumulation significantly, the affect of firm size and news type are not significant.

2 - MIDAS Instruments for Multiple Parameters
Stephen Goldberger, PhD candidate, UNC, University of North Carolina, Chapel Hill, NC, 27514, United States of America, sgoldber@email.unc.edu

Many Time Series models in Econometrics are dependent on the condition that an error term is expected to be zero given all information available at the beginning of time t. I extend the MIDAS (Mixed Data Sampling) Instruments framework developed by Eric Ghysels and Johnathan Wright to create a GMM estimator for a vector of parameters dependent on this moment condition.

3 - Can Oil Prices Help Estimate Commodity Futures Prices? The Cases of Copper and Silver
Gonzalo Cortazar, P. Universidad Catolica de Chile, Vicuna Mackenna 4860, Santiago, Chile, gcortaza@ing.puc.cl, Francisco Eterovic

We use prices of long term oil futures contracts to estimate copper and silver prices. We show that the Cortazar et al (2008) multi-commodity model applied to oil-copper and oil-silver which have low correlation seems not to be effective. We then propose a modified multi-commodity model that uses the non-stationary long term process of oil to help estimate long term copper and silver futures prices, achieving a much better fit than using available individual or multi-commodity models.

4 - A Bounded-rational Model of Price Bubbles and Business Cycles
Vinod Cheriyan, Georgia Institute of Technology, Industrial and Sytems Engineering, 765 Ferst Drive NW, Atlanta, GA, vinod.cheriyan@gatech.edu, Anton Kleywegt

Various markets exhibit growth and collapse in prices that are sometimes called bubbles. Related to that is the notion of business cycles. We consider a model in which investors behave reasonably, although with imperfect expectations, that attempt to provide insight into the formation of bubbles and business cycles. We also present results on the convergence of the process to an attractor that describes a business cycle, and consider where in the cycle most time is spent.

■ WB61

H - Room 400, 4th Floor

Operations Management VI

Contributed Session

Chair: Andrew Kach, Doctoral Student, New Mexico State University, Department of Management, P.O. Box 3001, Las Cruces, NM, 88003, United States of America, akach@nmsu.edu

1 - Advance Demand Information, Capacity Restrictions and Customer Prioritization
Bisheng Du, PhD Student, Aarhus University, Fuglesangs Alle 4, Department of Business Studies, Aarhus, 8210, Denmark, bisd@asb.dk, Christian Larsen, Alan Scheller-Wolf

We study a single supplier with fixed capacity selling products to buyers having different priorities. The buyers can place pre-orders before their demand is observed, and can also issue additional orders upon observing updating demand information. Since the supplier guarantees delivery of pre-ordered goods (these are not constrained by her capacity) buyers with lower priorities may consider pre-ordering in order to secure inventory. We find optimal policies for the supplier and buyers.

2 - Centrality and Heterogeneity During the Evolution of Inter-organisational Networks
Nuno Oliveira, PhD Student, LSE, Houghton Street, London, United Kingdom, n.r.oliveira@lse.ac.uk

Although extant research has reported a linkage between network centrality and heterogeneity, the understanding on the co-evolution of both variables is little. For a inter-organisatitional network of a 48 million British pounds building project, we show that network heterogeneity decreases whilst network centrality has a U-shape throughout a 3-year period. Implications for researchers and practitioners are also presented.

3 - Security as a Moderator of Stress on Airline Performance
Andrew Kach, Doctoral Student, New Mexico State University, Department of Management, P.O. Box 3001, Las Cruces, NM, 88003, United States of America, akach@nmsu.edu, Jeffrey Teich

Heightened security in airports is used as a preventative action to reduce passenger engagement in terrorist acts or disruptive behavior; however, high safety measures may have an adverse impact on airline performance. More specifically: How does increasing levels of security impact the relationship between passenger stress levels on airline performance?

■ WB62

H - Room 402, 4th Floor

Aviation Applications IV

Contributed Session

Chair: Ioannis Simaiakis, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, ioa_sim@mit.edu

1 - Future Aircraft Network and Schedules
Yan Shu, Graduate Student, Georgia Institute of Technology, 686 Cherry Street, Atlanta, 30332, United States of America, yshu@gatech.edu, Ellis Johnson, Barry Smith, John-Paul Clarke

We propose a three-step approach to build flight schedule from scratch. We implement our algorithms into solutions.

2 - Optimizing Staffing Plans at Airports
Prem Kumar Viswanathan, Scientist, Transport and Mobility Laboratory, Ecole Polytechnique Federale de Lausanne, GC B3 435, EPFL, Ecublens, VD, 1015, Switzerland, prem.viswanathan@epfl.ch, Michel Bierlaire

Minimizing operating costs for maintaining ground personnel at airports is a complex problem due to uneven flight activities, passenger service expectations and staffing inflexibilities due to shift durations. In this work, we develop a method to find optimal shift timings that considers non-productive time due to activity changeovers, the mix of full-time and part-time workers and passenger waiting time criteria.

3 - A Colored Stochastic Petri Net Based Approach to Performance Analysis of JFK International Airport
Poornima Balakrishna, Sensis Corporation, 11111 Sunset Hills Rd, Suite 130, Reston, VA, 20190, United States of America, pbalakri@sensis.com

We model the airport departure process using colored stochastic Petri nets and airport surveillance data. This formal specification of the probabilistic airport system is then analyzed through simulation. The use of surveillance data in the model enables identification of bottlenecks on the airport surface including gate area and taxiway intersections. We measure congestion through analysis of queue lengths, delays and resource utilization and report on both airline and airport performance.

4 - Estimation of Airport Performance Metrics
Ioannis Simaiakis, PhD Candidate, Massachusetts Institute of Technology, 77 Massachusetts Avenue, Cambridge, MA, 02139, United States of America, ioa_sim@mit.edu, Hamsa Balakrishnan

Operational throughput and taxi times are two key metrics of airport performance. In this work, we show how the maximum throughput capacity of an airport can be represented as a function of arrival and departure demand. We also illustrate how unimpeded taxi times may be estimated by representing taxi time as a function of takeoff and the queues. We use convex-optimization to estimate these metrics without assuming the form of the solutions, and by only imposing operational constraints.

■ WB63

H - Room 404, 4th Floor

Game Theory and Homeland Security

Sponsor: Decision Analysis
Sponsored Session

Chair: Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu

1 - Mixed Strategy Nash Equilibria in Symmetric Signaling Games
Barry Cobb, Virginia Military Institute, 335 Scott Shipp Hall, Lexington, United States of America, cobbbr@vmi.edu, Atin Basuchoudhary, Gregory Hartman

Signaling games are characterized by asymmetric information where the more informed player has a choice about what information to provide to its opponent. Decision trees are used to derive the Nash equilibrium strategies for signaling games where the more informed player has an arbitrary number of possible types. The technique is demonstrated by analyzing an interactive game between a terrorist and a governmental agency.

2 - Solving Massive Scale Security Games with Arbitrary Schedules: A Branch and Price Approach
Milind Tambe, University of Southern California, 3737 Watt Way, PHE 410, Los Angeles, CA, 90089, United States of America, tambe@usc.edu, Manish Jain, Fernando Ordonez, Chris Kiekintveld, Erim Kardes

Security games are used in deployed decision-support tools in use by LAX police and the Federal Air Marshals Service. The algorithms used to solve these games find optimal randomized schedules to allocate security resources for infrastructure protection. Unfortunately, the state of the art algorithms fail to scale to large problems with arbitrary scheduling constraints. We introduce ASPEN, a branch-and-price approach that overcomes this limitation.

3 - Quantifying Unobserved Attributes in Expert Elicitation of Terrorist Preferences
Chen Wang, University of Wisconsin-Madison, 3237 Mechanical Engineering, 1513 University Avenue, Madison, WI, 53706, United States of America, cwang37@wisc.edu, Vicki Bier

A terrorist values targets according to a multi-attribute utility function in which some attributes are unknown to the defender. A group of experts ranks potential targets by their attractiveness to the terrorist. The defender infers the weights of the known attributes, and the importance of the unobserved attributes, using either probabilistic inversion or Bayesian density estimation.

4 - Modeling Arbitrary Layers of Continuous Level Defenses in Facing with A Strategic Attacker
Jun Zhuang, Assistant Professor, University at Buffalo, SUNY, 403 Bell Hall, Buffalo, NY, 14260, United States of America, jzhuang@buffalo.edu, Mohsen Golalikhani

We propose a class of models for the optimal assignment of defensive resources in a game between a defender and an attacker. The novelty of our model is that we allow the defender to assign her continuous-level defensive resources to any subset (or arbitrary layers) of targets due to functional similarity or geographical proximity. The results show that our model could significantly increase the defender's payoff, especially when the cost of defense is high, or the attack cost is intermediate.

■ WB64

H - Room 406, 4th Floor

Health Care, Modeling and Optimization VI

Contributed Session

Chair: Song Chew, Assistant Professor, Southern Illinois University Edwardsville, Edwardsville, Edwardsville, IL, 62026, United States of America, schew@siue.edu

1 - Simulating Clinics: The Challenge of Data Collection and Analysis
Helida Dodd, President, Dodd Consulting Group, 10223 SW 89 St, Miami, FL, 33176, United States of America, helida@doddcg.com, Martha Centeno

We discuss a simulation study of an Endoscopy center, challenges, and lessons learned. The goal of the project was to find ways to increase throughput to 80 patients/day. It was quickly apparent that the stumbling block would be the lack of data available. Some data is collected via the information system, but there is no reporting application to measure performance. Data is also collected manually sporadically in different areas, but it is not readily analyzed because of the lack of manpower.

2 - Simulation-based Optimal Staffing Policies Under Cyclic Demand
Mina Loghavi, University of Tennessee, 331 SMC, 916 Volunteer Blvd., Knoxville, TN, 37996, United States of America, mloghavi@utk.edu, Robin Clark, Charles Noon, Bogdan Bichescu

We consider the objectives of minimizing staffing cost and maintaining acceptable patient waiting times in an emergency department (ED). We employ simulation and optimization to explore the best policies for ED staffing over repeating cycles of stochastic demand. In contrast to SIPP-based methods, this approach is feasible in periods when demand temporarily exceeds capacity and when additional constraints are present. We present insights from computational analysis on real-world datasets.

3 - Setting Staffing Levels Under Time-varying Demand in the Context of an Emergency Department
Mieke Defraeye, PhD Student, K.U.Leuven, Naamsestraat 69, Leuven, Belgium, mieke.defraeye@econ.kuleuven.be, Inneke Van Nieuwenhuyse

When determining capacity levels in a healthcare system (such as an emergency department), a key feature that has to be taken into account is the time-varying demand for service. Due to these fluctuations in demand, determining capacity levels to achieve a certain service level is often complicated. In this presentation, an approach to determine staffing levels that results sufficiently small waiting times, will be presented.

4 - Applying Inventory Control Practices Within the Sisters of Mercy Health Care Supply Chain
Server Apras, University of Arkansas, 1343,N.Leverett,15, Fayetteville, AR, 72703, United States of America, sapras@uark.edu

The goal of this research is to lay a foundation for the application and acceptance of more advanced inventory control practices within the healthcare supply chain.The project examines the demand characteristics and optimal control policies for bulk pharmaceuticals within the Sisters of Mercy's network to compare to the current ordering and inventory control strategies to document potential cost savings.Also,a multiechelon inventory analysis examines the benefits of centralized inventory control

5 - Outpatient Appointment Scheduling using Genetic Algorithms
Song Chew, Assistant Professor, Southern Illinois University Edwardsville, Edwardsville, Edwardsville, IL, 62026, United States of America, schew@siue.edu

Outpatient appointment scheduling has been an active area of research. The goal of the research is to strike a balance between patient waiting time, and doctor idle time and overtime. The objective of our work is to determine the optimal total number of patients for a clinical session, and the optimal number of patients assigned to each time slot in the session so as to minimize the total cost using genetic algorithms.

■ WB65

H - Room 408, 4th Floor

Inventory Management VII

Contributed Session

Chair: Haitao Li, University of Missouri - St. Louis, 229 CCB, One University Blvd, St. Louis, MO, 63121, United States of America, lihait@umsl.edu

1 - Making Better Fulfillment Allocation Decisions on the Fly
Jason Acimovic, Massachusetts Institute of Technology, 77 Massachusetts Ave, E62-459, Cambridge, MA, 02139, United States of America, acimovic@mit.edu, Stephen Graves

E tailers manage complicated distribution networks, serving customers with heterogeneous service time requirements. What is the best way to fulfill each of these customers' orders for items with low inventory levels? We partner with an e-tailer to examine this question. We find the value of the improvement gap by comparing a greedy strategy with an ex post facto optimization. We then develop an approximate dynamic programming heuristic and evaluate its performance on toy and actual examples.

2 - Two-stage, Two-product, Capacitated Supplier Problem with Uncertain Demand
Ramesh Bollapragada, Associate Professor, College of Business, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States of America, rameshb@sfsu.edu, Laoucine Kerbache, Kai Luo

We investigate a finite-horizon two-product (expensive and cheaper product from capacitated local and far-away suppliers, respectively), one retailer problem with two-stages, and uncertain demand. In the first stage, we determine the order quantity vector to place with suppliers, and in the second stage we determine the allocation of inventory to the two products given limited shelf-space. Optimal and heuristic solutions are discussed.

3 - Optimal Control of a Manufacturing/Remanuacturing Systems with Quality Grade Differentiation
Morteza Pourakbar, Erasmus University Rotterdam, BurgOudlaan 50, Rotterdam, Netherlands, pourakbar@few.eur.nl, Mohsen Elhafsi, Saif Benjaafar

We consider a manufacturing/remanufacturing system where each demand is coupled with the return of an item that may be remanufacturable. Returned items differ in their quality grades with grades affecting remanufacturing cost and time. Decisions must be made regarding whether or not to accept a returned item and whether to produce a new item or remanufacture a returned one and if so from which grade.

4 - New Model and Heuristics for Safety Stock Placement in General Acyclic Supply Chain Networks
Haitao Li, University of Missouri - St. Louis, 229 CCB, One University Blvd, St. Louis, MO, 63121, United States of America, lihait@umsl.edu, Dali Jiang

We model the safety stock placement problem in general acyclic supply chain networks as a project scheduling problem, for which the constraint programming (CP) techniques are both effective and efficient in finding high quality solutions. We further integrate CP with a genetic algorithm (GA), which improves the CP solution quality significantly. The performance of our hybrid CP-GA algorithm is evaluated on randomly generated test instances. CP-GA is able to find optimal solutions to small problems in fractions of a second, and near optimal solutions of about 5% optimality gap to medium size problems in less than two minutes on average.

■ WB66

H - Room 410, 4th Floor

Facilities Planning and Design

Contributed Session

Chair: Li Zhang, Royal Bank of Scotland, 399 Main Ave., Apt 614, Norwalk, CT, 06851, United States of America, lieezhang@gmail.com

1 - Framework for Measuring Rationale Clarity of Collaborative Design Decisions
John Chachere, Senior Computer Scientist, Stinger Ghaffarian Technologies, 1060 Arbor Road, Menlo Park, CA, 94025, United States of America, john.m.chachere@nasa.gov, John Haymaker

Designers often must convey clear rationale supporting design decisions. We define rationale as a set of assertions about components (managers, stakeholders, designers, gatekeepers, goals, constraints, alternatives, and analysis) with variable clarity (coherent, concrete, connected, consistent, credible, certain, and correct). We relate these definitions in the Rationale Clarity Framework to enhance objectivity in evaluating tools and processes for design decision making.

2 - Order and Inventory Management System for a Food Bank
Arsalan Paleshi, PhD Student, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, Louisville, KY, 40292, United States of America, a0pale01@louisville.edu, Bulent Erenay, Trivikram Rao

This project creates an Excel tool to support a food bank's need for a less labor intensive, inexpensive ordering and inventory management system. Additionally application of lean principles like KANBAN, ANDON and visual management to control inventory are suggested. The extension of similar methods for other cases is also discussed.

3 - A Study of Spine Layout for Semiconductor Manufacturing Plant Under the Multi-Floor Environment
Chikong Huang, Professor, National Yunlin University of Science & Technology, 123 University Rd., Sec. 3, Department of Industrial Management, Touliu, Yunlin, 640, Taiwan - ROC, huangck@yuntech.edu.tw, Ming-Ru Tsai

This study focuses on the spine layout in multiple floors by arranging workstations along several closed-loop moving tracks. The objective is to minimize the horizontal and vertical handling costs. The model and solution algorithm using Tabu search are developed and they are also verified by a numerical example.

4 - Layout Analysis and Lead-time Calculations with PEM Forklifts
Abhijit Gosavi, Missouri University of Science and Technology, 219 Engineering Management, Rolla, MO, 65409, United States of America, gosavia@mst.edu, Suzanna Long, Scott Grasman

PEM forklifts utilize hydrogen-based fuels and have been shown, in certain conditions, to be more economical than traditional battery-powered forklifts. We analyze the impact of using PEM forklifts on manufacturing layout and the lead time, including material-handling time, calculations. We use simulation to compare layouts that use PEM forklifts and battery-powered forklifts on the basis of the lead time and the empty travel time.

5 - Kernel Method of Performance Estimation in Autonomous Vehicle Storage and Retrieval Systems
Li Zhang, Royal Bank of Scotland, 399 Main Ave., Apt 614, Norwalk, CT, 06851, United States of America, lieezhang@gmail.com, Changjian Huang

In this study, a systematic simulation combined with kernel learning method is proposed for use in Autonomous Vehicle Storage and Retrieval Systems (AVS/RSs). The proposed method reflects the nonlinear relationship between system performance and factors and provides universal usage in performance estimation for various system designs. Simulation results indicate that the developed models provide accurate and computational efficient estimations.

■ WB67

H - Room 412, 4th Floor

Simulation II

Contributed Session

Chair: Byung-In Kim, Associate Professor, Pohang University of Science and Technology, Nam-Gu, Hyoja-Dong, POSTECH, Pohang, Korea, Republic of, bkim@postech.ac.kr

1 - Revenue Management Under Customer Choice Behavior
Marco Bijvank, University of Montreal, CP 6128 Succ Centre-Ville, Pavillon André-Aisenstadt, Montreal, QC, H3C 3J7, Canada, bijvankm@iro.umontreal.ca, Pierre L'Ecuyer

Observations from practice and recent research suggest a shift to customer oriented revenue management. During this presentation we discuss how to design a simulation tool to incorporate very general demand processes and different discrete choice models. We also show how this tool can be applied in practice to understand the customer choice decision making.

2 - Formation Control Strategies for Groups of Mobile Autonomous Agents
Wei Zhao, IBM Research - China, Diamond Building,ZGC Software Park, Beijing, China, wzhaow@cn.ibm.com, Wenjun Yin, Jin Dong, Bin Zhang, Ming Xie, Long Wang

This paper presents the control strategies for multiple mobile autonomous agents to achieve leader-following formations. Each follower agent establishes a Bezier trajectory between its current position and that of its leader agent. Considering the nonholonomic properties of the agent, the optimization of Bezier curve's curvature to choose appropriate scale factor is conducted by penalty function method. Simulations and experimental results show the effectiveness of our control strategies.

3 - Demonstrating Simulations of Inventory and Production Management using VBA in Microsoft Excel
Amanda Baty, Texas Tech University, 3424 Frankford Ave Apt 8B, Lubbock, TX, 79407, United States of America, amanda.baty@ttu.edu, Dr. Rafael Moras

Based on simulations by Dr. Paul Jensen and W.G. Lesso, "Advanced PNG Game" is a single product simulation using spreadsheets. The standard deviation of demand, lead time, and production level can be adjusted, for a cost, in each of the 52 simulated weeks. The objective is to minimize total cost.

4 - Agent-based Simulation for Emergency Evacuation of Heterogeneous Populations in a High-rise Building
Jeongin Koo, PhD Student, POSTECH, San31, Hyoja-Dong, Namgu, Pohang, Korea, Republic of, xession@postech.ac.kr, Yong Seog Kim, Byung-In Kim

An efficient evacuation plan is critical for the safety of residents in high-rise buildings during catastrophic events. Although there are some research works on building evacuation using simulation, most of them do not consider the handicapped people. This research presents an agent-based simulation of heterogeneous populations including various types of people with disabilities for a 24-story real world building evacuation. Using the model, several evacuation plans are tested and evaluated.

■ WB68

H - Room 415, 4th Floor

Innovation/Entrepreneurship II

Contributed Session

Chair: David Gomulya, Foster Business School, University of Washington, MacKenzie 355, Box 353200, Seattle, WA, 98195, United States of America, dgomulya@u.washington.edu

1 - Institutional Conditions and Venture Capital Investment in Developing Countries
Theodore Khoury, Oregon State University, Bexell 422B, Corvallis, OR, 97331, United States of America, ted.khoury@bus.oregonstate.edu, Marc Junkunc, Santiago Mingo

Focusing on entrepreneurial ventures in developing countries, we explore how venture capital (VC) investments are shaped by firms' stage of development and host country institutional conditions. Using a panel of 443 VC investments occurring in Latin America over 12 years, we find that larger investments are affiliated with later stage firms, higher transaction costs and lower political hazard risk. Also, political hazards moderate the relationship between development stage and investment size.

2 - New Ventures and Timing of Alliance Formation: The Dynamics of Temporal Congruence and Contingency
David Gomulya, Foster Business School, University of Washington, MacKenzie 355, Box 353200, Seattle, WA, 98195, United States of America, dgomulya@u.washington.edu

While alliances have been shown to increase new-venture survival, the literature remains silent regarding the effect of timing of alliance formations. Related literatures regarding timing have also been unable to explain their conflicting findings, which show the effect of timing can range from positive to negative. To fill gaps, I develop a novel model based on temporal changes during pre- and post-formation phases of an alliance. I show the effect can indeed range from positive to negative.

■ WB69

H - Salon F, 6th Floor

Joint Session TSL/ SPPSN: Risk and Recovery of Transportation Networks to Disaster

Sponsor: Transportation Science and Logistics Society/ Public Programs, Service and Needs
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 - Resilience of Fright Transportation Networks
Xiaodong Zhang, University of Maryland, College Park, MD, 20742, United States of America, xzhang@umd.edu, Elise Miller-Hooks, Reza Faturechi

The problem of measuring network resilience in transportation networks and determining optimal pre-event remedial actions is formulated as a two-stage stochastic program. The formulation explicitly recognizes that post-disaster performance depends not only on the inherent capability of the system to absorb externally induced changes, but also on the actions that can be taken in the immediate aftermath of the disaster to restore system performance. An L-shaped method is proposed for its solution.

2 - Debris Operations
Kael Stilp, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States of America, mstilp3@isye.gatech.edu, Monica Villarreal, Antonio Carbajal, Ozlem Ergun, Pinar Keskinocak

Debris operations following a disaster is a lengthy and costly process, involving multiple interrelated stages. Each stage contains a unique set of social fairness concerns with which need to be considered as well the computationally difficult objectives of efficiency. We present an encompassing set of models with computational analysis of each stage and discuss their interrelated nature.

3 - Many-to-many Transportation Network Risk Assessment
Qixing Wang, University of Connecticut, 261 Glenbrook Road, Unit 2037, Storrs, CT, 06269, United States of America, qiw09005@engr.uconn.edu, Nicholas Lownes

This work presents an extension to game-theoretic network risk models through the many-to-many application. A model that can be applied to large-scale networks is presented along with application results. Results provide a measure of link risk and can be used as decision support for sensor placement strategies.

■ WB70

H - Salon G, 6th Floor

Emerging Applications in Aviation

Sponsor: Aviation Applications
Sponsored Session

Chair: Wenwei Cao, Doctoral Student, Georgia Institute of Technology, 765 Ferst Dr NW, GA-Tech ISyE, Atlanta, GA, 30332-0205, United States of America, cww@gatech.edu

1 - The Role of Air Travel in the Worldwide Spread of Vector Borne Diseases
Lauren Gardner, Graduate Research Assistant, University of Texas at Austin, Earnest Cockrell Jr. Hall, 6.204, Austin, TX, 78712, United States of America, lmgardner@mail.utexas.edu, David Fajardo, Travis Waller

Increased passenger air traffic has lead to an increased risk of importation and establishment of vector-borne diseases. As such, it is critical to be able to identify the risk associated with air travel routes between vector-compatible environments. This problem requires modeling the interaction between three overlapping networks: a vector survivability network, a social network and an airport network. We study the the role of the airport network in connecting the vector-survivability network.

2 - Crew Rostering in Fractional Airlines
Wenwei Cao, Doctoral Student, Georgia Institute of Technology, 765 Ferst Dr NW, GA-Tech ISyE, Atlanta, GA, 30332-0205, United States of America, cww@gatech.edu, Ellis Johnson, Ozlem Ergun

We consider a crew rostering problem in fractional airlines where rosters are generated through a bidding process. Instead of creating bid-lines beforehand, the management can only control the capacities on schedule lines and vacation periods. We propose an optimization based framework for capacity decision-making. Within the framework, a model incorporating training considerations is solved via column generation.

3 - Transforming US Army Supply Chains: An Analytical Architecture for Enterprise Management
Greg Parlier, Institute for Defense Analyses, Madison, AL, United States of America, gparlier@ida.org

A comprehensive analytical architecture to enable US Army Logistics Transformation is presented, incorporating an "engine for innovation" to accelerate and sustain continual improvement. Strategic management challenges are addressed, including decision support systems, human capital investment needs, organizational design and strategic alignment for a learning organization.

■ WB71

H - Salon H, 6th Floor

Health and Education Applications of DEA

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Emmanuel Thanassoulis, Aston University, Operations & Information Management Group, Birmingham, AL, United States of America, e.thanassoulis@btinternet.com

1 - Analysis by DEA of Health Referral Costs in England
Emmanuel Thanassoulis, Aston University, Operations & Information Management Group, Birmingham, AL, United States of America, e.thanassoulis@btinternet.com, Maria C. Portela, Mike Graveney

The paper is drawn from an analysis by DEA of patient referral costs on behalf of a Primary Care Trust (PCT) in England. The paper focuses on General Practitioners (GPs) contracted to the PCT. GPs are the gateway to health services in England. Clinical decisions by GPs heavily influence referral costs incurred by the PCT. The paper formulates models to determine the scope for savings in referrals costs and decomposes them into those attributable to mix of in and out patient referrals and those attributable to price differentials between in and out patient cases.

2 - A Decade of Clinical Productivity Change and the Determinants of Relative Clinical Efficiency in Pennsylvania Coronary Artery Bypass Graft Programs
Jon Chilingerian, Brandeis University, The Heller School for Social Policy and Management, South Street, Waltham, MA, 02454-9110, United States of America, chilinge@brandeis.edu

We present evidence on the growth of clinical productivity change in hospitals performing coronary artery bypass grafts (CABGs) over a decade. Analyzing outcome and severity-adjusted hospital clinical in Pennsylvania between 1994-2004, frontier methodology was used to measure and evaluate clinical productivity change, medical progress (i.e., shifts in the clinical frontiers), and relative clinical efficiency over time. In Pennsylvania, the average hospital's clinical productivity for CABG surgeries grew by more than 30%. We found strong support, however, that medical-technical progress, rather than improvement in clinical efficiency, was the underlying reason for the growth. Factors associated with clinical efficiency included: employing hospitalists; having a higher percent of salaried physicians in relation to FTEs on salary; and strategic choices that focused on open heart cardiovascular surgeries. All of these factors are associated with performance and are under a clinical department's control.

3 - DEA in the 100 Largest U.S. Public School Districts
N.K. Kwak, Saint Louis University, Department of Decision Sciences and MIS, St. Louis, MI, United States of America, kwakn@slu.edu, Walter Garrett

This paper reports on a study of the 100 largest U.S. public school districts, which are together responsible for educating 22 percent of all public school students. Using data from the U.S. Department of Education, we use DEA to assess the efficiencies of those districts and to identify common characteristics of efficient districts. The results may be useful for benchmarking inefficient districts to improve their performance.

■ WB72

H - Salon J, 6th Floor

Facility Logistics III

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Ananth Krishnamurthy, University of Wisconsin, 1513 University Ave, Madison, United States of America, ananth@engr.wisc.edu

1 - Modeling Inventory Visibility in Supply Chain Networks
Sandeep Srivathsan, Research Associate, Oklahoma State University, School of IE&M, 322 EN, Stillwater, OK, 74078, United States of America, sandeep.srivathsan@okstate.edu, Manjunath Kamath

We develop stochastic models of two-echelon supply chains where a retailer has visibility of production facilities' net inventory levels and vice versa. Order placement and fulfillment policies depend on the net inventory levels and the models developed can be used to obtain insights into the benefits of inventory visibility on overall supply chain performance. We present models developed under Markovian assumptions and then discuss strategies to develop models for more general settings.

2 - Evaluation of Decision Criteria to Select Efficient Order Picking Systems
Detlef Spee, Detlef.Spee@iml.fraunhofer.de, Tim Geissen, Michael ten Hompel

Order picking systems contribute to the competitive capability of companies. Increased requirements regarding performance and quality aspects necessitate flexible systems that meet present and future demands. The paper focuses on the decisions which are made during the planning process to select a proper order picking method. Therefore, relevant order picking methods are systematized and selection criteria are evaluated by the use of a market study amongst suppliers of order picking systems.

3 - Estimating the WIP on a Conveyor Based Material Handling System with Multiple Stations
Dima Nazzal, Assistant Professor, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL, 32816, United States of America, dnazzal@mail.ucf.edu, Vernet Lasrado

We present a method to improve the estimates of the work in process (WIP) on a closed loop conveyor. We estimate the total traveling WIP and the WIP waiting to be loaded on the conveyor. A probabilistic distribution has been derived for the loading process and we test this model with a detailed simulation of a semiconductor manufacturing facility.

■ WB73

H - Salon K, 6th Floor

Reducing Transportation Emissions and GHG

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Hakob Avetisyan, PhD Student, University of Maryland, College Park, MD, United States of America, havetisy@umd.edu

1 - Freeway Congestion Mitigation and the Emissions Minimization Problem

Alex Bigazzi, Portland State University, Portland, OR, United States of America, bigazzi@pdx.edu, Miguel Figliozzi

We present a freeway control problem that not only minimizes delays but also takes emissions into account. We formulate several variants of a freeway traffic control problem. Utilizing real-world sensor data from Portland Oregon and calibrated emissions models we present and analyze solution results under different traffic conditions and levels of elasticity.

2 - Modeling a Novel Method for Reducing Transportation Greenhouse Gas Emissions

Erica Wygonik, University of Washington, Seattle, WA, United States of America, ewygonik@uw.edu, Anne Goodchild

A model is developed to evaluate parameters effecting emissions to consider the environmental impacts of aggregating personal travel into shared-use services. This model indicates whether shared-use vehicles show significant benefit to the environment over personal vehicles, and under what conditions those emissions savings would be realized, using grocery store shopping in Seattle, Washington as the first case study to quantify and compare the total environmental impacts.

3 - Greener Construction of Transportation Construction Projects Through Optimization

Hakob Avetisyan, PhD Student, University of Maryland, College Park, MD, United States of America, havetisy@umd.edu, Elise Miller-Hooks, Suvish Melanta

Optimization-based techniques are presented that permit a contractor to develop an equipment-usage plan that adheres to current environmental standards and anticipated new regulations, accounting for recent laws that might affect construction, and possible future carbon tax or cap and trade programs. These techniques aid contractors in trading off project cost, duration and resulting GHG emissions in bid development and aid contractors in making green construction decisions.

■ WB74

H - Room 602, 6th Floor

Public Transit IV

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Luca Quadrifoglio, Assistant Professor, Texas A&M Univeristy, CE/TTI bldg - Room 301I, 405 Spence St., College Station, TX, 77843, United States of America, lquadrifoglio@civil.tamu.edu

1 - A Logit-based Assignment on a Transit Schedule Hypergraph

Mark Hickman, Associate Professor, University of Arizona, Civil Engineering, 1209 E. Second St., Bldg 72, Tucson, AZ, 85721-0072, United States of America, mhickman@email.arizona.edu, Hyunsoo Noh

A hyperpath has been a common network structure in transit assignment. Using the hyperpath, we propose a logit-based transit assignment on a transit scheduled network. We introduce a link-based and time-expanded network and two hyperpath algorithms, and we investigate the stochastic user equilibrium situation under hard capacity constraints.

2 - Evaluating the Use of "Transfers" for Improving Zoning Paratransit Systems

Chung-Wei Shen, Texas A&M University, CE/TTI Building, Room 309C, 3136 TAMU, College Station, TX, 77840, United States of America, tzungwei0610@yahoo.com.tw, Luca Quadrifoglio

For paratransit agencies, the zoning strategy divides their service area into smaller zones to different provider to simplify the management. After dropping customers off for cross zone trips, the vehicles will return without passengers on-board resulting in deadheading miles. Using transfers on boundaries is a promising method to decrease deadheading miles while applying zoning strategies. This study evaluates the performance of transfers on zoning paratransit systems through simulation method.

3 - The Design of Single-Line Demand Adaptive Systems: An Evaluative Framework

Fausto Errico, CIRRELT, 2920, Chemin de la tour, Montreal, QC, H3T 1J4, Canada, Fausto.Errico@cirrelt.ca, Teodor Gabriel Crainic, Federico Malucelli, Maddalena Nonato

Demand-Adaptive Systems (DASs) display features of both traditional fixed-line bus services and purely on-demand systems such as dial-a-ride. A DAS bus line serves a given set of compulsory stops according to a predefined schedule. On the other hand, passengers may issue requests for transportation between two optional stops, inducing detours in the vehicle routes. The design of a DAS line is a complex planning process. We propose, evaluate and compare several possible design strategies.

Wednesday, 1:30pm - 3:00pm

■ WC01

C - Ballroom D1, Level 4

Technology Policy and Energy Markets

Sponsor: Energy, Natural Resources and the Environment/ Energy
Sponsored Session

Chair: Ekundayo Shittu, Assistant Professor, Tulane University, 7 McAlister Dr., New Orleans, LA, 70118, United States of America, eshittu@tulane.edu

1 - Volatility Pricing for Renewable Energy Sources

Xiaoyue Jiang, Assistant Professor, Tulane University, 7 McAlister Dr, New Orleans, LA, 70118, United States of America, xjiang@tulane.edu, Geoffrey Parker, Ekundayo Shittu, Anjali Sheffrin

In recognizing the negative effects of volatility to reliability of the power grid, we have proposed an analytical framework that models capacity volatility by capacity@risk and prices volatility through a QoS-centric capacity market mechanism. In this work, we will apply this framework to renewable sources including solar and wind. We will price each type of sources based on their volatility characteristics. Real data from one of the ISOs in the US will be used to gain practical insights.

2 - Flexible the Better? On the Design of RPS in Presence of Green Consumers and Emissions Trading

Yihsu Chen, Assistant Professor, University of California Merced, Merced, CA, 95343, United States of America, yihsu.chen@ucmerced.edu, Lizhi Wang

Emissions trading, green pricing programs and renewable portfolio standard (RPS) are three concurrent policies implemented in US to reduce reliance on fossil fuel and GHG emissions. Despite their differences in policy targets, they are closely related and integrated with competitive electric markets. We examines market outcomes of two aspects of RPS design in this talk: bundling and double counting.

3 - The Influence of Market Structure and Policy on Technology Portfolio Investments

Ekundayo Shittu, Assistant Professor, Tulane University, 7 McAlister Dr., New Orleans, LA, 70118, United States of America, eshittu@tulane.edu, Geoffrey Parker, Xiaoyue Jiang

We study firms' incentives to invest in a portfolio of technologies under different markets and environmental policies. The impacts of policies are critical to understanding how competition and energy production mix. We pay attention to the representation of the technologies in the portfolio because of implications on cost. We demonstrate intriguing results that describe how investments and adoption incentives are shaped by strategic interactions between market structure and regulatory policy.

■ WC02

C - Ballroom D2, Level 4

Energy I

Contributed Session

Chair: Le Xie, Assistant Professor, Texas A&M University, 3128 TAMU, 216M Zachry Bldg, College Station, TX, 77843, United States of America, lxie@mail.ece.tamu.edu

1 - Why Your Plug-in Vehicle with a 40-mile Battery Pack May Only Go 25

Orkun Karabasoglu, PhD Candidate, Carnegie Mellon University, 5000 forbes ave. 402 Scaife hall, Pittsburgh, PA, 15213, United States of America, karabasoglu@cmu.edu, Jeremy Michalek

We investigate the effects of driving patterns on the range, gasoline consumption, greenhouse gas emissions, and lifecycle costs of conventional, hybrid, and plug-in hybrid vehicles. We find that drive cycle (style) can have a greater effect on consumption, cost and emissions than vehicle design or charging frequency. Plug-in vehicle range drops 35% under aggressive, rather than standard cycles, and drive cycle can affect which vehicles are optimal.

2 - Stochastic Control for Smart Grid Users with Flexible Demand

Yong Liang, PhD Student, University of California-Berkeley, 1117 Etcheverry Hall, Berkeley, CA, 94720, United States of America, yongliang@berkeley.edu, Z. Max Shen, Alan Sanstad

We propose a stochastic optimal control model for smart grid users to make the optimal energy usage decisions incorporating energy consumption and generation. The main feature of this model is its ability to dynamically adjust consumptions by responding to the pricing signals from the electricity grid, deal with stochastic new job arrivals as well as scheduling the jobs based on their own deadlines. The model leads to a dynamic programming problem, which is solved using ADP techniques.

3 - Quantifying the Economic Impact of Variable Energy Forecast on Power System Scheduling

Le Xie, Assistant Professor, Texas A&M University, 3128 TAMU, 216M Zachry Bldg, College Station, TX, 77843, United States of America, lxie@mail.ece.tamu.edu, Haifeng Wang, Jin Dong, Wenjun Yin

The integration of variable resources such as wind and photovoltaic has posed fundamental challenges to the operation of electric energy systems. We attempt to quantify the value of variable energy forecast in improving the efficiency of power system scheduling. We demonstrate in a realistic system that only by explicitly valuing near-term prediction and inter-temporal variations in the system scheduling model could the economic potential of these variable resources be fully utilized.

■ WC03

C - Ballroom D3, Level 4

Environmental Operations

Contributed Session

Chair: Bin Dai, HKUST, A601, HKUST, Kowloon, Hong Kong - PRC, dbbudstar@gmail.com

1 - Stochastic Cost Estimation Approach for Full-Scale Reverse Osmosis Desalination Plants

Seong-Hee Kim, Associate Professor, Georgia Institute of Technology, 765 Ferst Dr, Atlanta, GA, 30332, United States of America, skim@isye.gatech.edu, Pyung-Kyu Park, Jae-Hong Kim, Varun Gandhi, Pranay Mane, Hoon Hyung, Chuljin Park

A stochastic approach was developed to estimate the construction and operation cost of a seawater reverse osmosis (SWRO) desalination plant. The stochastic cost model was further coupled with a process simulation model that predicts performance measures such as water production rate and produced water quality. The case study demonstrates the effectiveness of the coupled model in ranking and comparing a large number of design and operating conditions for the full-scale SWRO plant.

2 - Self-Insurance: The Case of the Canadian Oil Sands

Kalinga Jagoda, Assistant Professor, Mount Royal University, 4825 Mount Royal Gate SW, Calgary, AB, T3E7N9, Canada, kjagoda@mtroyal.ca, Pamini Thangarajah

In Canadian oil sands much of the negative publicity is around land pollution and there are calls for establishment of disaster relief program to manage hazardous events. Using the theory of public goods, we analyze the self insurance aspects of such program and the efficient provision levels.

3 - A Study on Setting Recycling Subsidy for Waste PCs in Taiwan Through Bi-level Nonlinear Programming

Hsu-Shih Shih, Professor, Tamkang University, Taiwan, ROC, 151 Ying-Chuan Rd., Tamsui, Taipei, 25137, Taiwan - ROC, hshih@mail.tku.edu.tw, Chia-Wei Hsu, Bo-Han Huang

The study investigates a recycling subsidy decision for waste PCs in Taiwan through bi-level nonlinear programming (BLNP) for environmental protection. The upper-level unit is RFMB (Recycling Fund Management Board) which hopes to balance the recycling fund and others by controlling the subsidy et al.; the lower-level's is the recycling industry which likes to get maximum profits by controlling the recycling rate. The BLNP model can help obtain an optimal solution for the recycling system.

4 - Design of Solar Radiation Management by Projecting Man-made Particles to Counter Global Warming

Ka Shek Lee, Associate Professor, Department of Industrial Engineering and Logistics Managemen, The Hong Kong University of Science and Technology, IELM, HKUST, Kowloon, Hong Kong - PRC, nlee@ust.hk, Bin Dai

Currently, mitigation efforts to counter global warming such as carbon emission reduction are proving time inefficient, therefore it desires for an alternative to cool the earth on an emergency basis. In this study, we proposed to project atmospheric man-made particles to manage the solar radiation. Fluid dynamics and scattering theory are employed to model particles' life time and radiation forcing to determine particles' size, projection height and amount required for selecting materials.

5 - Performance Analysis on Introducing Intercity High-speed Railway System

Bin Dai, HKUST, A601, HKUST, Kowloon, Hong Kong - PRC, dbbudstar@gmail.com, Ka Shek Lee

Carbon emission reduction contributes to mitigate global warming. Transportation accounts for 20% global carbon emission and electricity-powered railway system is carbon efficient. In this study, discrete choice model is employed to capture the travel demand shift by introducing high-speed railway system. Performance analysis is conducted to evaluate the carbon emission reduction, energy and time saving conditioning on intercity distance and city size. Results show its attractiveness.

■ WC04

C - Ballroom D4, Level 4

Sustainability I

Contributed Session

Chair: Thomas Sloan, University of Massachusetts Lowell, 1 University Avenue, College of Management, Lowell, MA, 01854, United States of America, Thomas_Sloan@uml.edu

1 - Managing Pollution in Oligopolistic Markets with Sustainability Constraints

Sung Hoon Chung, The Pennsylvania State University, 244 Leonhard Bldg., University Park, United States of America, sxc447@psu.edu, Robert Weaver

We present a differential variational inequality framework to consider the equilibrium patterns of oligopolistic markets through pollution taxes and quotas for sustainability. An algorithm is proposed to compute the oligopolistic firms' equilibrium output rate, shipping pattern, and pollution flow with or without the central authority. A numerical example is also presented to illustrate the use of our theory.

2 - Technology Base Second Tier Distribuitors Sustainability in Mexico

Guillermo Torres, PhD in Administration, Tecnologico De Estudios Superiores De Coacalco, Av. 16 de Septiembre # 54, Coacalco de Berriozàbal, 55700, Mexico, chapultepec19@hotmail.com, Eduardo G. Hernandez-Martinez

At present, it has become increasingly hard for businesses to survive in a globalized market, when traditional differentiators must adjust to new circumstances since they are less efficient as opposed to new scenes. This study is focused on identifying competitiveness of small business in Mexico, who are specialized in trading and/or distributing computer equipment, that increasingly find it more difficult to compete against the large chains.

3 - A Stochastic Linear Programming Model for the Management of Emission Rights

Justyna Dyduch, Cracow University of Economics, Department of Industrial and Ecological, ul. Rakowicka 27, 31-510 Kraków, Cracow, Poland, dyduchj@uek.krakow.pl

The management of emission rights means using them to cover enterprise's emissions, selling or buying them on the market, banking and borrowing them. We describe a multi-stage recourse model that optimizes the production, the use and acquisition of emission rights. The model is established to maximize enterprise's total profit.

4 - Sustainable and Maintainable: An Equipment Maintenance Model with Environmental and Economic Inputs

Thomas Sloan, University of Massachusetts Lowell, 1 University Avenue, College of Management, Lowell, MA, 01854, United States of America, Thomas_Sloan@uml.edu, Joseph Sarkis

An MDP model using traditional economic measures and environmental measures is used to optimize equipment maintenance decisions. Increased deterioration leads to more energy usage, more scrap, and greater environmental burdens. Maintenance reduces these burdens but has environmental and economic impacts. The impacts of using different cleaning solvents to perform maintenance are estimated using data from the Toxic Use Reduction Institute (TURI).

■ WC05

C - Ballroom D5, Level 4

Dynamic Programming/Control I

Contributed Session

Chair: Srinivasa Puranam, Rutgers University, 1 Washington Park, Newark, NJ, 07102, United States of America, karti@pegasus.rutgers.edu

1 - Further Insight on Optimizing Taboo Criteria in Markov Decision Processes

Michael N. Katehakis, Professor, Rutgers Business School, 1 Washington Park, Newark, United States of America, mnk@andromeda.rutgers.edu, Srinivasa Puranam

Optimization of systems is often based on costs associated with the states of the system. However, in many applications it is difficult to determine costs for all states. In such situations, one could consider maximizing taboo criteria such as the taboo mean return times for a propitiously defined set of taboo states. This is a hard problem and well-known methods can not be applied. However, we can provide further insight and heuristics for this problem.

2 - Risk-Averse Control Problem for Undiscounted Infinite Horizon Markov Decision Models

Ozlem Cavus, Rutgers Center for Operations Research, 640 Bartholomew Road, Piscataway, NJ, 08854, United States of America, ozlem_cavus@yahoo.com, Andrzej Ruszczynski

The Markov risk measure is introduced and used to formulate risk-averse control problems for finite and infinite horizon models by Ruszczynski. In this study, this new concept is used to formulate and solve an infinite horizon insurance problem where one of the control decisions is to purchase insurance. Furthermore, risk-aversion is introduced for undiscounted infinite horizon Markov control models with absorption.

3 - Managing Data Quality Risk in Accounting Information Systems

Manuel Nunez, Associate Professor, School of Business, UConn, 2100 Hillside Road Unit 1041, Storrs, CT, 06269, United States of America, mnunez@business.uconn.edu, Xue Bai, Jayant Kalagnanam

The quality of data contained in accounting information systems has a significant impact on internal business decision-making and external regulatory compliance. We present a methodology for managing the risks associated with the quality of transactional data in accounting information systems. This methodology models the error introduction and propagation process in transactional data flow, and finds optimal control policies to mitigate data quality risks using a Markov decision process.

4 - Vehicle Routing with Traffic Congestion and Drivers' Driving and Working Rules

Marco Schutten, University of Twente, Fac. Management and Governance, P.O. Box 217, Enschede, 7500 AE, Netherlands, m.schutten@utwente.nl, Leendert Kok, Erwin Hans, Henk Zijm

We develop a solution method for the VRPTW, time-dependent travel times, and driving hours regulations. The major difficulty of this VRPTW extension is to optimize each vehicle's departure times to minimize the duty time of each driver. We propose a restricted dynamic programming heuristic for constructing the vehicle routes, and an efficient heuristic for optimizing the vehicle's departure times for each (partial) vehicle route, such that the complete algorithm runs in polynomial time.

5 - Optimal Bidding in Sequential Auctions with Random External Demand

Srinivasa Puranam, Rutgers University, 1 Washington Park, Newark, NJ, 07102, United States of America, karti@pegasus.rutgers.edu, Michael N. Katehakis

We consider the problem of sequentially bidding in N auctions of identical items when items acquired are sold in a secondary market. The demand size and the sales price are random variables with known distributions. The objective is to acquire items through a sequence of auctions and sell them in the secondary market at maximum expected profit. We present a Markov decision processes model for this problem and study monotonicity properties of the optimal bids, for several cases of interest.

■ WC06

C - Ballroom E, Level 4

Tutorial: Searching and Hiding on Networks

Cluster: Tutorials

Invited Session

Chair: J. Cole Smith, Professor, University of Florida, Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, cole@ise.ufl.edu

1 - Searching and Hiding on Networks

J. Cole Smith, Professor, University of Florida, Industrial and Systems Engineering, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, United States of America, cole@ise.ufl.edu

The problem of deploying and controlling a set of searchers on a network to locate a hidden target is referred to as a search game. There are countless variations of this game, depending on, e.g., whether or not the target is mobile, and the searchers' communication and control capabilities. This tutorial will examine classical results in this field, discuss contemporary search literature, and explore research directions in this field as driven by future security challenges.

■ WC07

C - Ballroom F & G, Level 4

Supply Chain Optimization II

Contributed Session

Chair: Haitao Li, University of Missouri - St. Louis, 229 CCB, One University Blvd, St. Louis, MO, 63121, United States of America, lihait@umsl.edu

1 - Game Theoretic Analysis of Supply Chain

Satish Tyagi, Wayne State University, Department of Industrial, Manufacturing Engineering, Detroit, MI, 48202, United States of America, styagi.nifft@gmail.com, Kai Yang

The aim of this paper is to exploit the salient features of Game Theory in modeling and to investigate SC functioning under various alliances. In order to give a realistic view to model, a comprehensive objective function has been formulated by combining different objectives. This paper introduces a novel approach Gaussian Particle Swarm Optimization which is embedded with beneficial attributes viz. (1) Gaussian probability distribution, and (2) Time Varying Acceleration Coefficients.

2 - Measuring the Bullwhip Effect in the Supply Chain Based on the Demand Forecasting Coordination Level

Seong-Hyun Nam, Associate Professor, University of North Dakota, Management Department, Grand Forks, ND, 58202-8377, United States of America, snam@business.und.edu

This paper studies the role of coordination in relation of the bullwhip effect. It seeks to derive a bullwhip effect measure using a stochastic optimal control theory. In particular, we measure how much the supply chain bullwhip effect mitigation depends on the level of supply chain coordination of demand forecast and develop the strategic coordination policy.

3 - Heuristic Procedures for Biomass-to-Biorefinery Supply Chains

Ambarish Acharya, PhD Candidate, Mississippi State University, Dept of Industrial & Systems Engineering, Mississippi State, MS, 39762, United States of America, ama206@msstate.edu, Daniela Gonzales, Sandra Eksioglu

The objective of this research is modeling and solving coordinated biomass-to-biorefinery supply chain design and management problem. We discuss a number of special cases of this problem where the location, capacity and number of facilities is known. We propose solution procedures to solve the general problem and its special cases.

4 - Optimizing the Supply Chain Configuration for Make-to-Order Manufacturing

Haitao Li, University of Missouri - St. Louis, 229 CCB, One University Blvd, St. Louis, MO, 63121, United States of America, lihait@umsl.edu, Keith Womer

Configuring an MTO supply involves determining both sourcing and scheduling supply chain activities to meet customer's demand in a cost effective and time efficient way. We develop an optimization model and algorithm for optimally configuring MTO supply chains. Managerial insights are derived and discussed.

■ WC08

C - Room 11A, Level 4

Facility Location I

Contributed Session

Chair: Priyanka Verma, Indian Institute of Technology Kanpur, IME Department, Kanpur, 208016, India, priyankav08@gmail.com

1 - A Location-allocation-local Search Procedure for Territory Design with Multiple Balance Constraints

Roger Z. Ríos-Mercado, Universidad Autónoma de Nuevo León, CIDET-FIME, AP 111 - F, Cd. Universitari, San Nicolàs de los Garza, 66450, Mexico, roger@yalma.fime.uanl.mx

In this talk, a commercial territory design problem motivated by a real-world application in the bottled beverage distribution industry is addressed. A novel location-allocation-local search algorithm is presented and fully evaluated over a wide range of instances. The results indicate the excellent performance of some of the procedure components. It also shown how the algorithm finds design plans of significantly better quality than those currently handled by the company.

2 - Hospital Location Planning in Singapore

Kok-Choon Tan, Assoc Prof, National University of Singapore, NUS Bisiness School, 15 Kent Ridge Drive, Singapore, 119245, Singapore, kokchoon@nus.edu.sg, Joe SIM

Singapore is currently served by 6 public hospitals which provide affordable and good quality healthcare. This research aims to enhance the health ministry's capabilities in planning new acute and community hospitals, which are costly investments. We will describe the use of Urban OR techniques to develop a decision support system that allows policy makers to compare the impact among different choices of new hospital locations with the corresponding sizes and capabilities.

3 - Enabling Easy Consumer Access to Services and Products

Baris Hasdemir, UMASS, Isenberg School of Management, Finance and Operations Management, Amherst, 01003, United States of America, hasdemir@som.umass.edu, Agha Ali

Enabling better access to services for spatially dispersed populations is pertinent in today's fiscally constrained socio-political landscape. A network of centers provides better access if the centers are located so as to serve maximal populations within each of multiple threshold distances. Computational studies using a model with distance differentiation of the population involving 1,829 model instances reveal insights about possible access for the 224M people living in 23K places in the US.

4 - Facility Location and Relocation Problem (FLRP-U) Under Uncertainty

Ayse Durukan Sonmez, PhD Candidate, University of Houston, Department of Industrial Engineering, Engr. Bldg 2, Houston, TX, 77204, United States of America, adurukan@uh.edu, Gino Lim

FLRP-U is a facility location and relocation problem that considers future demand changes as well as uncertainties in number of future facilities. The objective is to minimize the sum of the initial weighted distance and the expected future distance, within a given budget for opening and closing of facilities. We propose a decomposition algorithm that can produce near optimal solutions for FLRP-U. Our numerical results compare the performance of our algorithm with exact solution techniques.

5 - Single/two Stage Warehouse Location Problem: Solution Technique and Strong, Weak, Hybrid Formulations

Priyanka Verma, Indian Institute of Technology Kanpur, IME Department, Kanpur, 208016, India, priyankav08@gmail.com, RRK Sharma

For the single stage uncapacitated warehouse location problems, hybrid formulations are shown to be the best performer against weak and strong formulations for large sized problems. Vertical decomposition approach is presented for the single and two stage capacitated warehouse location problem. Large sized complex warehouse location problem is decomposed into the smaller and relatively simpler versions of the capacitated plant location problems by the use of vertical decomposition approach.

■ WC09

C - Room 11B, Level 4

Retail Operations and Assortment Planning

Sponsor: Manufacturing and Service Operations Management

Sponsored Session

Chair: Felipe Caro, UCLA Anderson School of Management, 110 Westwood Plaza, Suite B-420, Los Angeles, CA, 90095, United States of America, fcaro@anderson.ucla.edu

1 - Dynamic Assortment Strategies for Variety-Seeking Consumers

Dorothee Honhon, University of Texas at Austin, IROM, B6500, Austin, TX, United States of America, Dorothee.Honhon@mccombs.utexas.edu, Gurhan Kok

In this project, we first characterize the static optimal assortment for a retailer with variety-seeking consumers. We then characterize the optimal assortment sets in the dynamic strategy that offers possibly different assortments each period. We show that it is possible to generate a high level of satisfaction at the customer level by having a mixed assortment strategy.

2 - Dynamic Assortment Customization with Limited Inventories

Fernando Bernstein, Duke University, 1 Towerview Dr., Durham, NC, 27708, United States of America, fernando@duke.edu, Gurhan Kok, Lei Xie

We consider a retailer with limited inventories of a category of substitutable products and heterogeneous customer preferences. Customers arrive sequentially and the firm decides which subset of the products to offer to a customer depending on the customer type, the inventory levels and the time-to-go in the season. We show that limiting the choice set of some customers can significantly increase profitability.

3 - Dynamic Assortment Models: A Portfolio Approach

Felipe Caro, UCLA Anderson School of Management, 110 Westwood Plaza, Suite B-420, Los Angeles, CA, 90095, United States of America, fcaro@anderson.ucla.edu, Rene Caldentey

We investigate optimal dynamic assortment planning strategies for a retailer with limited shelf space. The retailer can choose among basic and fashion items with low and high risk (and return) respectively. We present two models within this setting. One is theoretical where we explicitly model the vogue trend as a stochastic process that the retailer tries to follow. The second model has a similar objective but a much simpler formulation intended for easy implementation in practice.

■ WC10

C - Room 12A, Level 4

Track and Trace Technologies in Supply Chains

Sponsor: Manufacturing and Service Operations Management

Sponsored Session

Chair: Gary Gaukler, Texas A&M University, TAMU-3131, College Station, United States of America, gaukler@tamu.edu

1 - Item-level RFID Tagging and Inventory Record Accuracy

John Aloysius, University of Arkansas, WCOB 226 University of Arkansas, Fayetteville, United States of America, JAloysius@walton.uark.edu, Bill Hardgrave, Sandeep Goyal

Previous research has demonstrated that case-level RFID tagging can improve inventory record accuracy for consumer packaged goods. The increased visibility provided by item-level tagging however enables tracking items in-store right up to the point-of-sale. We report the results of experiments in the field that investigate the potential of item level tagging in the retail store.

2 - The Impact of Supply Network and Product Characteristics on Tracking Technology Assimilation

Rahul Basole, Tennenbaum Institute, Georgia Tech, 760 Spring Street NW, Atlanta, GA, 30332, United States of America, rahul.basole@ti.gatech.edu, Maciek Nowak

This research examines the influence of supply network and product characteristics on the extent of tracking technology (TT) adoption and use. We develop and test a theoretical model through a global survey of supply chain executives. Our results provide insights into how factors such as product value, handling risk, and supply network complexity impact the level of TT assimilation. This study yields important implications for the management of emerging IT in a supply chain operations context.

3 - The Impact of Product Contamination in the Food Supply Chain
Vijaya Chebolu-Subramanian, Texas A&M University, 3131 TAMU, College Station, TX, 77483, United States of America, cheb12@neo.tamu.edu, Gary Gaukler

In this talk we discuss the impact of product contamination in a food supply chain (e.g., e. coli contamination of spinach). We consider a real world situation in which a contaminated food product has entered a supply chain and is being sold at the retailer. We develop a quantitative model to quantify the overall cost of the contamination event and evaluate the effect of the product and supply chain attributes on the performance metrics of the model.

■ WC11

C - Room 12B, Level 4

Supply Chain Issues & Sustainability

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Chelliah Sriskandarajah, The University of Texas at Dallas, 800 West Campbell Road, SM30, School of Management, Richardson, TX, 75080, United States of America, chelliah@utdallas.edu

1 - Optimal Life Cycle Inventory Management
Burcu Keskin, Assistant Professor, University of Alabama, Alston Hall, Tuscaloosa, AL, United States of America, bkeskin@cba.ua.edu, Charles Schmidt

We consider inventory replenishment of a product with nonstationary, stochastic demand that moves probabilistically from one stage of the life cycle to the next, each with its own demand and cost information, until the end-of-life. The planning horizon is neither infinite nor of a known finite length. Via analytical analysis, we show that stage-dependent base stock policy is optimal. Via numerical analysis, we show the impact of not modeling the random product life on cost and inventory levels.

2 - On the Tradeoff Between Remanufacturing and Recycling
Tharanga Rajapakshe, University of Texas at Dallas, 800 West Campbell Road, SM30, School of Management, Richardson, TX, 75080, United States of America, tharanga@utdallas.edu, Srinagesh Gavirneni, Milind Dawande, Chelliah Sriskandarajah

Motivated by our interactions with two Dallas-based reverse-logistics firms, we analyze the tradeoff between two well-known product-recovery approaches: recycling and remanufacturing. Our analysis exploits the supply- and demand-side implications as well as product design characteristics of these approaches. We provide a complete theoretical characterization of the tradeoff and develop rich insights on the influence of ability of sustainability and disposal costs.

3 - Inventory Models for Medium-size Depository Institutions Under the New Federal Reserve Policy
Yunxia Zhu, The University of Texas at Dallas, 800 West Campbell Road, SM30, School of Management, Richardson, TX, 75080, United States of America, yunxia.zhu@student.utdallas.edu, Milind Dawande, Chelliah Sriskandarajah

We study two new multi-period models — designed specifically to capture the operations of a medium-size Depository Institution — that emerge from its objective to minimize the total cost incurred in managing the inventory of cash over a finite planning horizon under the new Federal Reserve policy. We develop several managerial insights from a comprehensive test bed and demonstrate a procedure to easily adapt the optimal solutions based on projected data to near-optimal real-time solutions.

4 - Scheduling Robotic Cells Served by a Dual-Arm Robot
Manoj Vanajakumari, Texas A&M University, College Station, TX, United States of America, manoj@entc.tamu.edu, Avanti Sethi, Chelliah Sriskandarajah, Neil Geismar

We assess the benefits of implementing a dual-arm robot in a flow shop manufacturing cell. The robot has the ability to tend two adjacent machines simultaneously. We identify optimal sequences for two and three machine cells and also derive structural results for cells with an arbitrary number of machines. For cells processing different part-types, we completely analyze two-machine cells. For each case we compare the productivity of single-arm and dual-arm robotic cells.

■ WC12

C - Room 13A, Level 4

Retail Supply Chain Management

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Sandra Transchel, The Penn State University, University Park, State College, PA, United States of America, sxt37@psu.edu

1 - Multi-echelon Inventory System for E-Retailer Fulfillment Centers
Juan Li, Cornell University, Ithaca, NY, 14853, jl879@cornell.edu, John Muckstadt

The customers of e-retailers have different timeliness requirements on order delivery. The demand process has significant impact on designing the fulfillment centers. In this paper, a multi-echelon system is designed for this type of system. We describe an algorithm to compute the optimal order-up-to level for this system.

2 - Joint Inventory Pricing and Assortment Decisions for Vertically Differentiated
Mrinmay Deb, Student, Penn State University, 462A Business Building, University Park, State College, PA, 16802, United States of America, mud166@psu.edu, Susan Xu

We determine the joint pricing, inventory, and assortment decisions of a retailer stocking quality differentiated products. Consumers choose their first choice based on the vertical choice model. We consider two cases: inventory is abundant (riskless case) and inventory is finite (risky case) and find the optimal prices and optimal assortments in each case.

3 - Joint Pricing and Inventory Decisions Under Stockout-Based Substitution
Sandra Transchel, The Penn State University, University Park, State College, PA, United States of America, sxt37@psu.edu, Anna-Lena Beutel, Stefan Minner

We consider a joint inventory and pricing problem for partially substitutable products in a given assortment. Both price and inventory decisions have to be made under demand uncertainty. Additionally, the retailer has to take into account that customers are willing to substitute their first choice product if this is not available. We present structural properties of the proposed model and provide managerial insights into the interaction of pricing, stocking decision, and product cannibalization.

■ WC13

C - Room 13B, Level 4

Managing Service Systems with Self-interested Actors

Sponsor: Manufacturing and Service Operations Management/ Service Management Special Interest Group
Sponsored Session

Chair: Eren Cil, University of Oregon, 1208 University of Oregon, Lindquist College of Business, Eugene, OR, 97403-1208, United States of America, erencil@uoregon.edu

1 - A Service Marketplace with Multiple Classes and Multiple Skilled Agents
Eren Cil, University of Oregon, 1208 University of Oregon, Lindquist College of Business, Eugene, OR, 97403-1208, United States of America, erencil@uoregon.edu, Gad Allon, Achal Bassamboo

We consider a service marketplace in which customers have different service needs. Each customer can be served by either a group of agents specialized to cater particular needs of that customer or a general pool of agents who can handle any requests but not as competently as the specialized agents. We analyze how the self-interested customers choose between the dedicated and the general service, and characterize the response of the agents in the general pool to the customers' choices.

2 - Price Competition Under Multinomial Logit Demand Funcations with Random Coefficients
Margaret Pierson, Harvard Business School, Morgan Hall, Boston, MA, United States of America, mpp2002@columbia.edu, Awi Federgruen, Gad Allon

We postulate a general class of price competition models with Mixed MNL demand functions under affine cost. By imposing a natural upper bound for the price levels of each firm, we characterize the equilibrium behavior of these models in the case of single-product firms and then generalize the results to the multi-product case. This work provides a justification for the many structural estimation methods which require that equilibria correspond with the solutions to this system of FOC equations.

3 - Coordinating Diagnosis and Service in a Service Supply Chain
Mehmet Fazil Pac, PhD Candidate, Wharton School of Business, University of Pennsylvania, 3730 Walnut Street, Jon M. Huntsman Hall, Office 527.6, Philadelphia, PA, 19104, United States of America, mpac@wharton.upenn.edu

We consider a service consisting of two phases; diagnosis and service. Each phase is provided by a self-interested agent. Diagnostic accuracy depends on the effort exerted by the diagnosis agent. Investing more time in diagnosis leads to higher valuation of the actual service by customers, however it also leads to lower throughput and more congestion for the system. Using a queuing framework, we analyze the agents' diagnosis and pricing decisions under the presence of strategic customers.

4 - Service Control of a Queue Under Different Delay Information Structures
Brent Dooley, Wharton School, 3730 Walnut St., 500 Jon M. Huntsman Hall, Philadelphia, PA, 19104, United States of America, dooleyb@wharton.upenn.edu, Noah Gans, Omar Besbes

We analyze the problem of profit-maximization for an M/M/1 queue with dynamic service rate control when customers have access to varying degrees of state/policy information. In particular, we examine customer equilibrium behavior and its implications on optimal service rate policies.

■ WC14

C - Room 14, Level 4

Supply Chain Management X

Contributed Session

Chair: Jie Yang, Associate Professor, University of Houston-Victoria, 14000 University Blvd, Sugar Land, TX, 77479, United States of America, jieuhv@gmail.com

1 - Mid-term Planning Coordination Between Maker and Retailer by Capacity Reservation
Seung-Jin Ryu, Research Associate, Waseda University, 51-14-07, 3-4-1 Okubo, Shinjuku, Tokyo, 1698555, Japan, sjryu@aoni.waseda.jp, Hisashi Onari

Collaborative SCM is the collaborated initiatives among SC members to deal with various problems over SC. It is the challenging issue, in high-tech industry, especially experiencing severe market demand change, keeping the stable and profitable operation level. We propose the mid-term planning coordination method between maker and retailer by capacity reservation. Also, we verify strengths and weaknesses of the proposed method by dynamic simulation with various business environments.

2 - Transportation Pricing of a Truckload Carrier
Aysegul Toptal, Assistant Professor, Bilkent University, Department of Industrial Engineering, Ankara, Turkey, toptal@bilkent.edu.tr, Safa Bingol

In this study, we investigate the transportation pricing problem of a truckload carrier in a setting that consists of a retailer, a truckload carrier and a less than truckload carrier. Numerical evidence shows that the truckload carrier may increase his/her gainings significantly through better pricing and there is further opportunity of savings if the truckload carrier and the retailer coordinate their decisions.

3 - Does Agility Matter in Improving Supply Chain Performance? Evidence From a Transition Economy
Jie Yang, Associate Professor, University of Houston-Victoria, 14000 University Blvd, Sugar Land, TX, 77479, United States of America, jieuhv@gmail.com

This study develops and empirically tests a conceptual framework to investigate the antecedents of manufacturers' supply chain agility and the connection of their agility with performance in an emerging economy. Drawing upon the information theory, this study argues that technical (IT capability) and relational factors (information sharing and trust, and operational collaboration) are the antecedents of a manufacturer's supply chain agility.

■ WC15

C - Room 15, Level 4

Organization Theory I

Contributed Session

Chair: Theresa Edgington, Baylor University, One Bear Place, #98005, Waco, 76798, United States of America, theresa_edgington@baylor.edu

1 - A Clustering Approach For Multi-Facility Location Problem
Cem Iyigun, Department of Industrial Engineering, Middle East Technical University, Ankara, Turkey, iyigun@ie.metu.edu.tr, Adi Ben-Isreal

A new clustering approach is proposed. The method is a generalization of Weiszfeld method and applied for solving K facilities location problem. The problem is relaxed using probabilistic assignments, and is decomposed into K single facility location problems, that are coupled by the probabilities, and can be solved in parallel.

2 - Considering the Relationship Between Empowerment and Resistance to Change
Nathan Culmer, The University of Iowa, 2800 UCC, Iowa City, IA, 52242, United States of America, nathan-culmer@uiowa.edu

Both psychological and team level empowerment have been shown to have desirable effects in organizations while employee resistance to change can have undesirable effects on organizational or work group progress. Interestingly, these characteristics share some common theoretical elements. This paper considers possible theoretical relationships between empowerment as a motivational construct and the influence that empowerment can exert on employee resistance to change.

3 - Institutional Barriers to Application of Continuous Improvement Processes From Safety to Energy Efficiency
Rodney Lacey, Lecturer, Univ of California Davis, Graduate School of Management, One Shields Avenue, Davis, CA, 95616, United States of America, rolacey@ucdavis.edu

Historic institutional differences between the fields of safety and energy efficiency could limit transfers of continuous improvement programs. Three differences of commensuration (Espeland and Stevens, 1998) between lives and units of energy are potential barriers: being efficient is commendable, rather than inefficiency deplorable; moral value of efficiency gains varies across industries; and there are no moral objections to making tradeoffs between efficiency and other goals.

4 - To Build or Break Away? Exploring the Antecedents of Category Spanning Nanotechnology Innovation
Tyler Wry, U of Alberta, 3-23 Business Building, Edmonton, AB, T6G 2R6, Canada, twry@ualberta.ca

Category spanning has implications for innovation and institutional change. Still, studies have focused primarily on its detrimental effects, eliding consideration of causal antecedents. Examining the nanotube technology field, I argue that patterns of linkage amongst categories enable spanning. Competing hazard rate models are supportive. Further, I find these linkages are shaped endogenously by prominent actors and condition the effects category richness, social networks, and social influence.

5 - Evidentiary Analysis of Organizational Coordination and Questions of Group Fragmentation
Theresa Edgington, Baylor University, One Bear Place, #98005, Waco, TX 76798, United States of America, theresa_edgington@baylor.edu

Analysis processes contribute to organizations by increasing their knowledge, which is necessary to maximize decision-making and resolution outcomes. We investigate whether a core group provides exemplary coordination by investigating its database. Utilizing quantitative analysis, the evidence refutes this claim, contributing to the literature by identifying eleven coordination process indicators.

■ WC16

C - Room 16A, Level 4

Flexible Manufacturing Systems

Contributed Session

Chair: Mabel Chou, Associate Professor, National University of Singapore, BIZ 1 Mochtar Riady Building, #8-66, 15 Kent Ridge Drive, Singapore, 119245, Singapore, mabelchou@nus.edu.sg

1 - Value of Flexibility
Sanjeev Bordoloi, Associate Professor, University of St Thomas, 1000 LaSalle Ave, TMH 434, Opus College of Business, Minneapolis, MN, 55403, United States of America, sbordoloi@stthomas.edu

Economic justification of investments in flexibility has become increasingly important. This paper tries to provide possible measures for flexibility so that managerial decision making for flexibility can be validated. We offer a model that minimized production planning costs and then use some of its characteristics for flexibility measurements.

2 - Joint Maintenance and Operations Decision Making in Flexible Manufacturing Systems

Merve Celen, University of Texas at Austin, 1 University Station C2200, Austin, TX, 78712-0292, United States of America, merve@mail.utexas.edu, Dragan Djurdjanovic

In semiconductor manufacturing, the dynamic interactions among operation types, chamber degradations and wafer yields necessitate a joint decision making of maintenance scheduling and product dispatching. To address this problem, we devise an integrated decision making policy with the objective of maximizing an adaptive profit function with respect to operation-dependent degradation models and production target by using a metaheuristic method based on the results of discrete-event simulations.

3 - Dynamic Control of Closed Flexible Queueing Network with Application to Shipbuilding

Fang Dong, Ph.D Candidate, University of Michigan, Industrial & Operations Engineering, 1205 Beal Ave., Ann Arbor, MI, 48109-2117, United States of America, ppfang@umich.edu, Mark Van Oyen, David Singer

The U.S. Shipbuilding Industry is facing the challenge of building ships on-time and at budgeted cost. We introduce operational flexibility to ship production to mitigate the issues like high variability in production workload and low facility utilization. We formulate this problem as a flexible, controlled closed queueing network with CONWIP release policy. Under an effective control policy, the flexible system can significantly reduce ship completion time, and improve workshop utilization.

4 - A Graph-theoretic Methodology for Deadlock Resolution in Automated Manufacturing Cells

Venkatesh Angirasa, Research Scientist & Manager, Group for Decision Technology Solutions, SETLabs, Infosys Technologies, Electronics City, Hosur Road, Bangalore, 560100, India, venkatesh_angirasa@infosys.com

We present a deadlock detection and resolution strategy for manufacturing cells with alternate part routing. We distinguish between cells with centralized buffers and those with dedicated I/O buffers for individual machines. A unified bipartite graph of the part-machine relationship enables the detection and resolution scheme in both cases. Resolution policies are developed to accommodate varying manufacturing systems requirements. An efficient algorithm is proposed to manage deadlocks.

5 - Value of the Third Chain: Effect of Partial Production Postponement on Process Flexibility

Mabel Chou, Associate Professor, National University of Singapore, BIZ 1 Mochtar Riady Building, #8-66, 15 Kent Ridge Drive, Singapore, 119245, Singapore, mabelchou@nus.edu.sg, Geoffrey A. Chua, Chung Piaw Teo

Using a multi-item newsvendor model with second-stage supply and partial capacity sharing, we discover that the flexibility loss of the 2-chain is no longer negligible under partial postponement. For small systems, this loss can be as high as 20% to 30%. However, we find that by adding another layer of flexibility, a third chain, the flexibility loss can be restored to the same level as 2-chain with full postponement. We show that the value of the third chain extends even to very large systems.

■ WC17

C - Room 16B, Level 4

Supply Chain, Practice and Empirics

Contributed Session

Chair: Orrin Cooper, University of Pittburgh, 233 Mervis Hall, Pittsburgh, PA, 15260, United States of America, orc1@pitt.edu

1 - Key Metrics and Current Industry Practices in Supply Chain Measurement

Ramesh Bollapragada, Associate Professor, College of Business, San Francisco State University, 1600 Holloway Avenue, San Francisco, CA, 94132, United States of America, rameshb@sfsu.edu, Calvin Lee, Tuna Cencki

The paper identifies current business practices and key measurements in supply chain performance management. Our survey based research indicates that supply chain professionals give high importance to quality and reliability factors, increasing company's competitiveness, and not just to cost factors, while creating effective supply chains. The research underlines that more steps need to be taken to connect supply chain partners, and create models for the quantification of intangible metrics.

2 - Information Transmission and the Bullwhip Effect

Robert Bray, PhD Student, Graduate School of Business, Stanford University, 311 Sheridan Ave, Palo Alto, CA, 94305, United States of America, rlbray@stanford.edu, Haim Mendelson

We study the bullwhip effect in a sample of 4,689 public U.S. companies over 1974-2008. The traditional bullwhip is negative, but the "demand-uncertainty" bullwhip is positive. We decompose the total bullwhip into deterministic and stochastic components, and further decompose the latter by information transmission lead times. Bullwhips come in several flavors—firms can anticipate much, but not all, of the bullwhip.

3 - Business Relationship Functions and Supply Chain Relationship Quality: Evidence From China

Yongtao Song, School of Management, PO Box 2341, Xi'an Jiaotong University, Xi'an, 710049, China, xjtusyt@gmail.com, Qin Su

This paper adopts a functional view to analyze the value that buyers attain from buyer-seller relationships and investigates the links between business relationship functions (BRF), supply chain relationship quality (SCRQ) and buyer's performance. The results indicate that BRF have a direct and an indirect effect on buyer's performance through the mediating effect of SCRQ. Moreover, the availability of alternative suppliers has a moderating influence on the relationship between BRF and SCRQ.

4 - 3rd Party Logistics Provider Selection with Performance Metrics and ANP

Orrin Cooper, University of Pittburgh, 233 Mervis Hall, Pittsburgh, PA, 15260, United States of America, orc1@pitt.edu, Jennifer Shang, Pandu Tadikamalla

Selecting a third party logistics provider with the Analytical Network Process (ANP) allows one to measure the interrelated influences of performance metrics in the supply chain. The criteria in the decision matrix are organized according to the temporal stages or flow of a product through the supply chain. A general model is presented and applied to case data and tested for robustness with detailed sensitivity analysis.

■ WC18

C - Room 17A, Level 4

Industry Applications

Contributed Session

Chair: Fubin Qian, PhD Candidate, Molde University College, Britvegen 2, N-6411, Fannestrandveien 76, 6416, Molde, Norway, fubin.qian@himolde.no

1 - Dynamic Capacity Planning for Short Life Cycle Products

Saman Alaniazar, PhD Candidate, Wayne State University, 4815 Fourth St., Detroit, MI, 48202, United States of America, saman.alaniazar@wayne.edu, Alper Murat, Ratna Babu Chinnam

We study capacity planning for short life cycle products. Given the non-stationary and region-based nature of the demand in this type of products, our model employs a hybrid-strategy of short-term demand forecasting and long-term demand modeling to monitor amount and time of expansions. Moreover, we consider and apply a risk model in the process of capacity planning. We report experimental results based on an implementation of the model in an agent based system for Tamagotchi Case.

2 - Optimizing Credit Lines

Lisa Kart, Director, Analytics, FICO, Austin, TX, 78704, United States of America, lisakart@fico.com

Over the past several years, FICO has helped banks optimize credit line decisions using predictive and decision modeling in a framework of constrained optimization. Hear about the approach, how the analytics were implemented, and the results achieved for banks across the globe.

3 - The Industry Emergence Funnel: Towards a Conceptual Framework for Public Sector Coordination, Investment Prioritization and Strategy Development

Eoin O'Sullivan, University of Cambridge, Cambridge, United Kingdom,eo252@cam.ac.uk

This paper introduces a conceptual framework for analyzing the emergence of novel technology-based industries. We make the case for an industry-level analogue of established, firm-level "funnel" models of innovation. The features of the proposed framework are based on observed patterns of historical emergence of technology-based industries analyzed using roadmapping techniques.

4 - A Tabu Search Heuristic for Offshore Helicopter Routing Problem with Focus on Passenger Safety

Fubin Qian, PhD candidate, Molde University College, Britvegen 2, N-6411, Fannestrandveien 76, 6416, Molde, Norway, fubin.qian@himolde.no, Irina Gribkovskaia, Gilbert Laporte, ÿyvind Halskau

A mathematical model is proposed to improve passenger transportation safety by minimizing the expected number of fatalities in offshore helicopter transportation. Tabu search heuristics are developed. Both the mathematical model and heuristics are capable of producing general solutions, namely solutions allowing a second visit to installations. Computational results show that safety performance can be significantly improved by introducing general solution strategy to helicopter routing problem.

■ WC19

C - Room 17B, Level 4

Dynamic Optimization in Energy Pricing

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Canan Uckun, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, cuckun@chicagobooth.edu

1 - Market Power Analysis in Electricity Markets with Time-of-use Pricing

Emre Celebi, University of Waterloo, Department of Management Sciences, 200 University Ave. West, Waterloo, ON, N2L 3G1, Canada, ecelebi@engmail.uwaterloo.ca, David Fuller

We propose variational inequality models for electricity markets with time-of-use (TOU) pricing. The demand response is dynamic in the model through a dependence on the lagged demand. Different market structures are examined within this context. With an illustrative example, the welfare gains/losses are analyzed after an implementation of TOU pricing scheme over the single pricing scheme. Also, break-up of a large supplier into smaller parts is investigated.

2 - Enabling Price-Responsive Demand Management in Electricity Markets

Hung-po Chao, ISO New England, hchao@iso-ne.com

The traditional approach to demand response suffers from the missing property right problem that could undermine electricity market efficiency. A multi-settlement retail tariff solves the problem by allowing each customer to establish a contract-based baseline through demand subscription before joining a demand response program. A two-settlement system with demand subscription and dynamic default rate facilitates price-responsive demand for general consumer benefits.

3 - An ADP Approach to Decomposing Smart Grid Pricing Problems

Canan Uckun, University of Chicago, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, cuckun@chicagobooth.edu, Dan Adelman

In the electricity smart grid, millions of homes will receive price signals simultaneously. We can formulate the problem of optimizing prices through time as a dynamic programming problem, containing state information for each home. However, the problem has such large scale that it is intractable using standard solution methods. We propose a new decomposition approach to solving this dynamic program approximately.

■ WC20

C - Room 18A, Level 4

Pricing and Revenue Management II

Contributed Session

Chair: Oben Ceryan, Ross School of Business, University of Michigan, 701 Tappan St, Ann Arbor, MI, 48109, United States of America, oceryan@umich.edu

1 - Dynamic Revenue Management with Nonlinear Pricing

Wei Wei, Case Western Reserve University, Dept of Operations, Weatherhead School, 10900 Euclid Ave, Cleveland, OH, 44106-7235, United States of America, wei.wei@case.edu, Matthew J. Sobel

We compare linear pricing with multi-part tariffs in a class of dynamic revenue management models with stochastic iso-elastic demand. Each period a firm sets multiple prices corresponding to a multi-part tariff and decides how much inventory to hold back for sale later. There is a nearly explicit myopic optimum that can be computed easily. The results exploit the homogeneity of an associated Markov decision process. We illustrate the results with a numerical example.

2 - Pricing and Timing of New Version Releases in the Presence of Strategic Consumers

Shubin Xu, Lundquist College of Business, University of Oregon, Eugene, OR, 97403, United States of America, sxu@uoregon.edu, Michael Pangburn

We study a firm offering successive product versions. Due to ongoing R&D or improving technology, each new version implies an opportunity cost associated with continued use of the prior product. The firm decides the time between successive introductions, and price. In turn, consumers strategically choose whether to purchase or wait for a later version. We consider the firm's profit maximizing policy assuming a homogeneous market and then extend the analysis to address consumer heterogeneity.

3 - Integrating Capacity Control Concepts into the Locate-to-Order-Systems of Automotive Manufacturers

Thomas Volling, Technische Universität Braunschweig, Institute of Automotive Management and Industrial Production, Katharinenstrasse 3, Braunschweig, 38106, Germany, t.volling@tu-bs.de, Thomas S. Spengler

Lead times in the automotive industry exceed customers' expectations for the delivery of new cars. As a consequence, most manufacturers have established hybrid order fulfillment strategies combining elements from build-to-order and build-to-stock (BTS) production. The focus of the contribution is on the BTS share of vehicles. A capacity control is developed to support the allocation of preconfigured cars to customer requests. Assignments are evaluated based on product specific opportunity costs.

4 - Dynamic Optimal Design for Sequential Online Auctions

Xi Chen, University of Washington, Box 352650, Industrial Engineering, Seattle, 98195, United States of America, chenxi07@uw.edu, Archis Ghate, Arvind Tripathi

Retailers often conduct a sequence of online auctions to sell identical items as a revenue generation and inventory management tool. We show that under a second order condition on the single- auction expected revenue function, a threshold policy is optimal for inventory scrapping and a monotone staircase with unit jump policy is optimal for lot sizing. This condition is met in all common auction mechanisms. We investigate an extension where the minimum bid is also optimized.

5 - Product Upgrades and Pricing with Strategic Consumers

Oben Ceryan, 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 consider a firm that allows upgrading of customers purchasing a lower quality product to a higher quality product if there is excess demand for the former and excess capacity for the latter. We investigate the optimal pricing and capacity decisions in the presence of strategic consumers that consider product prices as well as upgrade possibilities when choosing which product to purchase.

■ WC21

C - Room 18B, Level 4

Service Contract and Incentive Design

Sponsor: Service Science
Sponsored Session

Chair: Hermann Jahnke, Professor, Bielefeld University, Universitaetsstrasse 25, Bielefeld, 33615, Germany, hjahnke@wiwi.uni-bielefeld.de

1 - After-sales Contract Analysis for Service Supply Chains

Dong Li, Rotterdam School of Management, Erasmus University, P.O. Box 1738, Rotterdam, Netherlands, dli@rsm.nl, Yugang Yu, Nishant Mishra, Xinguo Ming

The multiple types of contract of the service supply chain may cause conflicting incentives. We use a game-theoretic frame to model the behavior of a service supply chain, and compare the different type of contracts and show that how the parameters affect the optimal solutions. We also find out that the inefficiency can be coordinated with a revenue-sharing performance based contract.

2 - Incentive Design in Industrial Product Service Systems: A Simulation Study

Partha Datta, Assistant Professor, IIM Calcutta, Diamond Harbour Road, Joka, Calcutta, 700104, India, parthapriya.datta@gmail.com

Powerful incentives and risks are normally used in industrial service contracts to transfer risks to measure compliance with performance measures. This paper studies the uncertainty in service delivery driven by the agreed contract type and incentive mechanism using agent based discrete event simulation model under multiple scenarios.

3 - Lower Price Limits for Flat-fee Service Contracts Under Risk

Hermann Jahnke, Professor, Bielefeld University, Universitaetsstrasse 25, Bielefeld, 33615, Germany, hjahnke@wiwi.uni-bielefeld.de, Jan Thomas Martini

Many manufacturers of capital equipment offer services under flat-fee service contracts. We address the determination of lower price limits for such contracts. Under these contracts, the service providers assume part of the customer's risk. We focus on the impact this risk has on price limits. Our modeling tool, almost stochastic dominance, allows us to examine decision making under risk without precisely knowing the decision makers' risk preferences as well as a multi-person decision context.

4 - Towards a Theory of Service Improvisation

Enrico Secchi, Clemson University, 128 Cochran Rd. Apt. 1, Clemson, SC, 29631, United States of America, esecchi@clemson.edu, Aleda Roth

This paper examines the role of improvisation in the context of service delivery systems. Drawing from organizational improvisation literature and service operations and marketing, we develop antecedents and consequences of service improvisation. First, we define the concept of service improvisation. Second, we highlight the importance of the interplay between planning and execution. Finally, we develop a theoretical link between service delivery and the emergence of service innovations.

■ WC22

C - Room 18C, Level 4

Service System Design and Effectiveness

Sponsor: Service Science
Sponsored Session

Chair: Adelina Gnanlet, Assistant Professor, California State University, Fullerton, 800 N. State College Blvd, Dept of Mgmt, Fullerton, CA, 92832, United States of America, agnanlet@fullerton.edu

1 - Impact of Labor and Capacity Flexibilities on Quality and a Financial Performance of Hospitals

Adelina Gnanlet, Assistant Professor, California State University, Fullerton, 800 N. State College Blvd, Dept of Mgmt, Fullerton, CA, 92832, United States of America, agnanlet@fullerton.edu, Muge Yayla-Kullu, Chris McDermott

To reduce costs and meet variable demand, service firms frequently cross-train employees and use flexible capacity in capital intensive service firms. Higher cross-training is cost-effective but may not provide adequate quality of service due to learning effects. Flexible capacity may not be conducive to provide highest level of quality for certain demand segments. We determine the effects of cross-training and flexible capacity on quality and financial performance of hospitals.

2 - Impact of Task Complexity on Productivity in Professional Services

Anil Akpinar, IE Business School, C/ Maria de Molina 12, Madrid, 28006, Spain, aakpinar.PhD2010@alumno.ie.edu, Fabrizio Salvador

In this paper we explore the effect of task complexity on the flexibility efficiency trade-off in knowledge worker productivity. Using a longitudinal data from one of the largest multinational technology and consulting firm, we provide empirical evidence that while specialization and variety jointly drives productivity, their effects are quite distinct for varying levels of task complexity.

3 - More with Less - Service Resource Scheduling by Time Capacitated Splits

Pasi Porkka, Assistant Professor, Aalto University School of Economics, P.O. Box 21220, Helsinki, Fin-00076, Finland, porkka@hse.fi

The balancing of resource time used for production or services and for capacity consuming set-ups is critical for the realistic planning of high capacity utilization. We combine the allocation of shared resources, the time-based splitting of tasks and variable set-ups in mobile service operations. The potential for substantial capacity time savings is demonstrated. Extensions and solution approaches for realistic applications are discussed.

4 - The Impact of Service Quality Variation on Service Quality, Operational Efficiency, and Performances

Hong-il Kim, PhD Candidate, Korea University Business School, Anam-dong, Seongbuk-gu, Seoul, 136-701, Korea, Republic of, itlime@korea.ac.kr, Hosun Rhim, Shijin Yoo, Daeki Kim

We investigate how service quality variation affects service quality, operational efficiency, and business performances. Data of branch operation in a retail bank is collected. Perceived service quality of customers is surveyed with SERVERPF questionnaire. HLM (Hierarchical Linear Modeling) and DEA (Data Envelopment Analysis) are used.

■ WC23

C - Room 18D, Level 4

Service Management and Virtual Enterprise

Sponsor: Service Science
Sponsored Session

Chair: Munish Goyal, Research Staff Member, IBM Research, AC2 L1, ISB, GACHIBOWLI, Hyderabad, AP, 500032, India, mungoyal@in.ibm.com

1 - Value Based Dynamic Resource Allocation in a Service Cloud

Munish Goyal, Research Staff Member, IBM Research, AC2 L1, ISB, GACHIBOWLI, Hyderabad, AP, 500032, India, mungoyal@in.ibm.com, M Rammohan Rao

Cloud computing is a pool of virtualized computer resources which can be dynamically added or removed in response to changing business demands while meeting service level agreements at the minimal energy or operational cost. In this work, we develop relative value based dynamic resources allocation strategies where a unit of resource is allocated to a customer request with the highest value above the energy value threshold at any time. Algorithm is supported with numerical results.

2 - Negotiation Based Completion Risk Management for Virtual Enterprise

Min Huang, Professor, Northeastern University, Box 135#, Northeastern University, Shenyang, 110004, China, mhuang@mail.neu.edu.cn, Hongyu Jiang, W.H. Ip, Qing Wang, Xingwei Wang

In the view of the distribution feature of decision-making in a virtual enterprise, a novel decision-making framework based-on negotiation is proposed for the completion risk management of VE. Under this framework, according to the characteristics of the problem, the evaluation mechanism of the owner is designed based on PERT, and then the concession tactic is proposed. The example analysis shows that this framework can achieve effective risk management.

3 - Service Parts Inventory Control Under Obsolescence

Cerag Pince, PhD Candidate, Erasmus University, Burg. Oudlaan 50, Rotterdam, 3000 DR, Netherlands, pince@few.eur.nl, Rommert Dekker, Hans Frenk

We consider a single location inventory system of a slow moving item where Poisson demand rate drops to a lower level at a known future time. Under the assumptions of full backordering and fixed lead time, we incorporate obsolescence into a one-for-one policy with the option to reduce the base stock level in advance. We show that when obsolescence can be foreseen, early adaptation of base stock levels leads to important savings.

■ WC24

C - Room 19A, Level 4

Decision Making for Wildfire Response and Evacuation

Sponsor: Public Programs, Service and Needs
Sponsored Session

Chair: Nada Petrovic, Graduate Student, Physics Department, Broida Hall, UC Santa Barbara, Santa Barbara, CA, 93106-9530, United States of America, petrovic@physics.ucsb.edu

1 - Dynamic Resource Allocation in Wildfire Suppression

Nada Petrovic, Graduate Student, Physics Department, Broida Hall, UC Santa Barbara, Santa Barbara, CA, 93106-9530, United States of America, petrovic@physics.ucsb.edu, David Alderson, Jean Carlson

Wildfire response demands dynamic decision tools because fires and suppression evolve simultaneously. Time delays can lead to larger fires and thus greater demand for resources. We capture this tension using a queuing model that treats fire progression as a birth and death process, with rates that incorporate intrinsic fire dynamics and suppression. Using this framework we explore trade-offs in effectiveness and time delay of response.

2 - A Space-Time Flow Optimization Model for Neighborhood Evacuation

David Alderson, Assistant Professor, Naval Postgraduate School, Naval Postgraduate School, 1411 Cunningham Road, Monterey, CA, 93943, United States of America, dlalders@nps.edu, William Langford

We model the evacuation of vehicles in a residential neighborhood using a space-time network flow representation. Our model solves for "best case" evacuation routes and clearing times, as could be identified and implemented by a central authority. Our models are large but can be solved efficiently and quickly. We apply this model to the Mission Canyon neighborhood near Santa Barbara, California, and contrast our results to a previous simulation-based study.

3 - Influence of Information Networks on Collective Evacuation Dynamics

Danielle Bassett, Postdoctoral Research Associate, University of California Santa Barbara, 6213 Broida Hall, Santa Barbara, CA, 93106, United States of America, dbassett@physics.ucsb.edu, Jean Carlson, David Alderson

The collective behavior of humans during an evacuation is a poorly understood, complex phenomenon which we model as a combined centralized-decentralized consensus problem, influenced by information flow over layers of technological, social, and geographic networks. An individual's belief regarding disaster severity is constantly updated until reaching a decision threshold. We describe differential dynamics over these layers, indicating sensitivity of human decision-making to information origin.

4 - Making Emergency Evacuation Decisions with Uncertain Information

Emily Craparo, Naval Postgraduate School, Glasgow Hall Room 226, Monterey, CA, United States of America, emcrapar@nps.edu, David Alderson, Jean Carlson

In emergency situations, time-critical decisions must be made based on uncertain information. Situational awareness is improved through additional observation of the threat; however, observation delays action. We consider an individual decision-maker who faces an uncertain threat and who must decide when (and whether) to perform a costly evacuation. We model this evacuation decision problem using dynamic programming and establish optimal evacuation policies under a variety of cost models.

■ WC25

C - Room 19B, Level 4

Transportation, Planning II

Contributed Session

Chair: Chi Xie, Research Fellow, The University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, chi.xie@mail.utexas.edu

1 - Composite Variable Formulation for Truckload Relay Network Design

Hector Vergara, Graduate Research Assistant, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, hvergara@uark.edu, Sarah Root

Full truckload (TL) trucking usually considers a Point-to-Point dispatching method. Alternatively, multi-zone dispatching under a network configuration of relay points can be used to improve driver retention. We propose a new mathematical formulation for strategic relay network design that places relay points and determines driver routes. Our model minimizes total costs while considering operational constraints such as driver tour length and load circuity within the variable definition.

2 - An Optimal Cycle Length Model for Feeder Transit Services

Shailesh Chandra, Student, Department of Civil Engineering, Texas A&M University, 3136 TAMU, College Station, 77843-3136, United States of America, chandrashailesh@gmail.com, Chung-Wei Shen, Luca Quadrifoglio

A simulation based generic model has been derived for estimating optimal cycle lengths of a demand responsive transit "feeder" services. For input parameters such as the shape size and daily demand density of an area, the success of this model has been validated by a case study.

3 - Transportation Planning for Squatter Developments

Hani Al-Naghi, PhD Candidate, American University of Beirut, P.O.Box 11-0236, Riad El Solh, Beirut 11, Beirut, Lebanon, haa31@aub.edu.lb, Nabil Nehme

This paper addresses urban transportation planning issues related to squatter developments and their integration with the surrounding areas. A general framework encompassing all criteria related to social, economics, land use and political aspects, is formulated and applied to selected case studies in Lebanon.

4 - A Primal-dual Mathematical Programming Framework for Traffic Assignment Problems

Chi Xie, Research Fellow, The University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, chi.xie@mail.utexas.edu, Travis Waller

Traffic assignment problems have been formulated as mathematical programs, variational inequalities, complementarity systems, and fixed-point models. It is well known that the last three modeling techniques all provide a common functional form for modeling different traffic assignment problems. This talk presents a uniform primal-dual mathematical programming framework, which can be used to accommodate a variety of traffic assignment problems.

■ WC26

C - Room 4A, Level 3

Interface Between Efficient Data Collection and Flexible Data Modeling

Sponsor: Data Mining
Sponsored Session

Chair: Peter Qian, University of Wisconsin-Madison, 1300 University Ave, Madison, WI, 53706, United States of America, peterq@stat.wisc.edu

1 - Improvement on Cross-Validation via Sliced Statistical Design

Xinwei Deng, Visiting Assistant Professor, University of Wisconsin-Madison, Department of Statistics, 1300 University Ave., Madison, WI, 53706, United States of America, xdeng@cs.wisc.edu, Peter Qian

A training data is often used to construct models to predict the future response. The cross-validation is a traditional method to compare different models and assess their prediction performance. It can provide a nearly unbiased estimate of prediction error, but can be with high variability. In this work, we proposed a novel sliced statistical design strategy to improve the performance of cross-validation, substantially outperforms the usual method in various classification problems.

2 - Regularized REML for Estimation and Selection of Fixed and Random Effects in Linear Mixed-Effects Mo

Sijian Wang, Assistant Professor, University of Wisconsin, Madison, 1300 University Ave., Madison, WI, 53706, United States of America, wangs@stat.wisc.edu

In the practice of LMM, inference on the structure of random effects component is of great importance not only to yield proper interpretation of subject specific effects but also to draw valid statistical conclusions. In this paper, we propose a novel method of regularized restricted maximum likelihood to select fixed and random effects simultaneously in the LMM. We also investigate large sample properties for the proposed estimation, including the oracle property.

3 - Consistent Selection of the Number of Clusters via Clustering Stability

Junhui Wang, University of Illinois at Chicago, 851 S Morgan St, Chicago, IL, 60607, United States of America, jwang@math.uic.edu

In cluster analysis, one major challenge is to estimate the number of clusters. In this talk, I will present a novel selection criterion that is applicable to all kinds of clustering algorithms. The key idea is to select the number of clusters such that the resulting clustering algorithm has the smallest instability, which measures its robustness against the sampling randomness. Numerical examples and asymptotic selection consistency will be discussed.

4 - Optimal Supersaturated Design for Variable Selection via Lasso

Dadi Xing, PhD Student, Purdue University, 224-7 Arnold Drive, West Lafayette, IN, 47906, United States of America, hwan@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 variable selection with Lasso. The properties of these criteria will be discussed. A computing algorithm will be used to construct such optimal SSD, and examples of simulation and real applications will also be presented.

■ WC27

C - Room 4B, Level 3

Network Optimization II

Contributed Session

Chair: Nan Jiang, Student, University of Texas, Austin, 1 University Station C1761, ECJ 6.2, Austin, TX, 78712, United States of America, njiang@mail.utexas.edu

1 - A Reformulation-Linearization Technique for the Two-level Facility Location Problem

Youngho Lee, Korea University, Sungbuk Ku Anam Dong 5-1, Seoul, Korea, Seoul, Korea, Republic of, shadowpp@korea.ac.kr, Gigyoung Park

In this paper, we deal with an two-level facility location problem based on the tree topology. In particular, we develop a model for this problem and apply the reformulation-linearization technique (RLT) to construct various enhanced tightened versions of the proposed model. And we derive necessary and sufficient conditions for a family of some inequalities to be facet-defining.

2 - Continous Network Design Problem with Emission Constraint
Nan Jiang, Student, University of Texas, Austin, 1 University Station C1761, ECJ 6.2, Austin, TX, 78712, United States of America, njiang@mail.utexas.edu, ManWo Ng, Travis Waller

In this paper, a traffic network design model with emission constraint and its solution method are presented. The resulting solutions are a set of capacity improvements to a given network, for a given demand, subject to user-specified budget constraints and emission constraint and resulting in minimal system total cost. Application results prove this model decreases system emission and provide information useful for planning road network improvements under air quality constraints.

■ WC28

C - Room 4C, Level 3

Manufacturing Process Optimization

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Roshan Vengazhiyil, Coca-Cola Associate Professor, Georgia Institute of Technology, Industrial and Systems Engineering, Atlanta, GA, 30332, United States of America, roshan@isye.gatech.edu

1 - An Interactive Method to Multiresponse Surface Optimization Based on Pairwise Comparisons
Dong-Hee Lee, Pohang University of Science and Technology, Department of Industrial and Management, Pohang, Korea, Republic of, princeps@postech.ac.kr, Kwang-Jae Kim, Murat Köksalan

In multiresponse surface optimization, responses are often in conflict. To obtain a satisfactory compromise, the preference information of a decision maker (DM) on the tradeoffs among the responses should be incorporated into the problem. We propose an interactive method where the DM provides preference information in the form of pairwise comparisons. The results of pairwise comparisons are used to estimate the preference parameter values in an interactive manner. The method is effective in that a highly satisfactory solution can be obtained.

2 - Analysis of Computer Experiments with Functional Response
Ying Hung, Rutgers, Camden, NJ, United States of America, yhung@stat.rutgers.edu, Roshan Vengazhiyil, Shreyes Melkote

We develop an efficient implementation of kriging for analyzing functional responses. The main contribution of this paper is to develop a two-stage model building procedure and a general framework which can be used irrespective of the data structure. The methodology is illustrated using a computer experiment conducted for optimizing residual stresses in machined parts.

3 - New Variable Selection Methods Under Engineering Inequality Constraints
Hin Kyeol Woo, Georgia Institute of Technology, 765 Ferst Drive, Atlanta, GA, 30329, United States of America, hinkyeol@gatech.edu, Andres Hernandez, Jye Chyi Lu, Martha Grover

This presentation discusses new variable selection methods under engineering inequality constraints. A case study of nanoparticle synthesis with a solubility constraint motivates and illustrates the research. Simulation experiments explore properties of the proposed method.

■ WC29

C - Room 5A, Level 3

Maintenance Management and Service Logistics

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Alaa Elwany, Assistant Professor, Eindhoven Unviersity of Technology, Eindhoven, Netherlands, elwany@tue.nl

Co-Chair: Nagi Gebraeel, Associate Professor, Georgia Tech, 765 Ferst Dr., Atlanta, United States of America, nagi.gebraeel@isye.gatech.edu

1 - Modified Block Replacement Can Outperform Age Replacement in Terms of Spare Parts Ordering
Rommert Dekker, Erasmus University Rotterdam, Burg Oudlaan 50, Rotterdam, 3062 PA, Netherlands, rdekker@ese.eur.nl

It is well known that age replacement outperforms block replacement as better information on the likelihood of failures is used. Yet block replacement allows a more appropriate ordering of spare parts as replacements can be planned in time. In this presentation we present a study which shows that the better spare parts planning can offset the advantages of age replacment. The study also reveals what kind of inventory policies are useful in this respect.

2 - Upgrading Policy After Redesign of a Component for Reliability Improvement
Kurtulus Oner, Assistant Professor, Eindhoven University of Technology, P.O. Box 513, Eindhoven, 5600 MB, Netherlands, k.b.oner@tue.nl, Geert-Jan Van Houtum, Gudrun P. Kiesmüller

We introduce a model for studying the following two upgrading policies that an OEM may implement after the redesign of a component: (i) Upgrade all preventively at time 0, (ii) Upgrade one-by-one correctively. We develop a problem formulation for the comparison of the two policies and perform exact analysis. We conduct a numerical study and derive insights on the optimality of the policies.

3 - Component Reliability Criticality or Importance Metrics for Systems with Degrading Components
David Coit, Associate Professor, Rutgers University, Industrial & Systems Engineering, 96 Frelinghuysen Rd., Piscataway, NJ, 08854, United States of America, coit@rutgers.edu, Hao Peng, Qianmei Feng

This paper proposes new importance measures (IMs) for systems with either independent or dependent degrading components. As functions of time, the proposed IMs can provide timely feedback on the critical components based on the observed degradation. The correlation between components and the dependency of failure thresholds are considered through multivariate distributions. Numerical examples show that the proposed IMs are effective in assessing criticality of degrading components.

4 - Maintenance Policy Based on MultiCriteria Decision Aiding
Cristiano Cavalcante, Federal University of Pernambuco, Caixa Postal, 5125, Cep 52070960, Recife, PE, 52070960, Brazil, cristianogesm@gmail.com, Adiel Almeida

Maintenance planning is very sensitive to characteristics of the system, the context and the objectives of the decision maker. Regarding this problem, the most common analyses consist of evaluating the cost rate function. But, in some specific contexts the consequence of failures has distinct dimensions, which are difficult to represent by only one criterion (monetization). Thus, we discuss models based on MCDA (MultiCriteria Decision Aiding) approach, in order to support maintenance planning.

■ WC30

C - Room 5B, Level 3

Statistics/Quality Control II

Contributed Session

Chair: Xuan Huang, Assistant Professor, University of Alabama at Birmingham, 345 Lincoln Ave., Apt 115, Amherst, MA, 01002, United States of America, xuan@som.umass.edu

1 - Comparison of Ozone Levels Among Five Cities using Control Charts
Gautam Eapi, PhD Student, University of Texas at Arlington, Civil Engineering, Box 19308, Arlington, TX, 76019, United States of America, gautam.raghavendra@gmail.com, Melanie Sattler, Mostafa Ghandehari

Ozone is one of the six criteria pollutants, as specified by the USEPA. Statistical quality control can be helpful in improving quality. In this paper, data for ozone levels of five different cities across the U.S. is analyzed by using control charts.Control charts are used to compare the cities. In addition, out of control data points are discussed.

2 - A Bayesian Approach to Estimating Market Implied Risk Neutral Densities
James Delaney, Assistant Professor, Temple University, Department of Statistics (006-12), 1810 N 13th Street, Philadelphia, PA, 19122-6012, United States of America, james.delaney@gatech.edu, Marc Sobel

Contemporaneous prices of financial derivatives provide much information about the so-called "market implied risk neutral distribution" (MIRND) of the security that underlies those derivatives. Here we propose a Bayesian model to provide the regularity necessary for estimating a MIRND that corresponds to a set of options' prices. We provide details on a much more generally useful technique for simulating from the very complex posterior distribution of this model's parameters.

3 - Orthogonal Polynomial and Saddle Point Approximations for Sums of Non-identical Binomial Random Variables
Aysun Taseli, Research Assistant, Northeastern University, 360 Huntington Avenue, 334 Snell Engineering, Boston, 02115, United States of America, aysunt_qpl@yahoo.com, James Benneyan

We compare performance and discuss relative advantages of saddle point approximations (SPA) and cumulant based orthogonal polynomial expansions for estimating the convolution of non-identical binomial distributions. Some important healthcare and service applications of this distribution involve methods that require repetitive computation of probabilities. Both SPA and a normalized Gram-Charlier expansion are shown to be accurate and fast compared to the exact PDF and Monte Carlo estimation.

4 - Beta Model-based Control Chart for Fraction Monitoring with Correlated Process Variables

Michel Anzanello, Professor, Federal University of Rio Grande do Sul, Av. Osvaldo Aranha, 99, Porto Alegre, 90.035-190, Brazil, michel.anzanello@gmail.com, Angelo Sant'Anna, Carla ten Caten

Although widely used to monitor processes where quality characteristics vary with adjustments in control variables, model-based control charts' efficiency is jeopardized by high correlated control variables. Our method integrates Principal Components Analysis to Beta model-based control charts to overcome such limitation. Sensitivity Analysis using Monte Carlo simulation validates the method.

5 - Dimension Reduction of Multivariate Autocorrelated Processes

Xuan Huang, Assistant Professor, University of Alabama at Birmingham, 345 Lincoln Ave., Apt 115, Amherst, MA, 01002, United States of America, xuan@som.umass.edu

In traditional multivariate literature, Principal Components Analysis (PCA) is the standard tool for dimension reduction. For autocorrelated processes, however, PCA fails to take into account the time structure information. It is arguable that PCA is still the best choice. In this presentation I propose an enhanced dimension reduction method which by design takes into account both cross-correlation and autocorrelation information. I demonstrate it through case studies and simulations.

■ WC31

C - Room 5C, Level 3

Health Care, Therapy and Treatment

Contributed Session

Chair: Chunhua Men, University of California, San Diego, 3855 Health Sciences Dr. #0843, La Jolla, CA, 92093, United States of America, cmen@ucsd.edu

1 - Identifying and Quantifying Protein Values for Obtaining Cancer Biomarkers

Chaitra Gopalappa, PhD Student, University of South Florida, 4202 E Fowler Ave, Tampa, United States of America, chaitrag@gmail.com

Identifying proteins that are only produced in the cancerous state of cells (cancer biomarkers) can lead to its use as a diagnostic tool for early detection of cancer. The task prior to detecting biomarkers (proteins that distinguish cases from controls), i.e., identifying and quantifying the amount of all proteins, is an analytically challenging task that requires mathematical models. We present the analytical challenges and the mathematical models.

2 - Retrofitting Tissue and Cell Banking: Best Practices and Emerging Business Models

Katrina Nordstrom, Professor, Aalto University School of Science and Technology, Department Biotechnology and Chemical technol, Kemistintie 1A 16100 Aalto, Espoo, Finland, katrina.nordstrom@tkk.fi, Marko Narhi, Petri Lehenkari, Ari P.J. Vepsalainen, Olli Natri, Mika Pietila

The study explores "retrofitting" of blood banking by development of business models based on best practices for collection, processing, storage and delivery of cells and tissues. Plausible business models examine production of bone marrow, umbilical cord blood stem cells and hematopoietic stem cells. A framework is also specified for classifying and evaluating the capabilities and hurdles of supply chains for living products for safe and traceable future products and therapies.

3 - Turkey Disposal and Recycling Network Design Model for Drug Industry

Ayse Gunes, Assistant Specialist, Industrial Engineer, Scientific and Technical Research Council of Turkey (TUBITAK), 06100 Kavaklidere, Ankara, Turkey, ayse.gunes@tubitak.gov.tr, Bahar Ozyoruk

In Turkey, to determine the tendency of people, we first have made a survey related to drug use, recycling, etc. with military personnel. We have developed a model that provides waste disposal and recycling of paper in the minimum cost. In the developed model, human and environmental health, hazardous waste disposal and recycling for reuse are discussed and the model are solved with GAMS program. This study includes case study, it is important for healthcare logistics and global health topics.

4 - Linearity Effects in Brachytherapy Treatment Planning

Asa Holm, PhD Student, Linköpings Universitet, Matematiska institutionen, Linköpings universitet, Linköping, 58183, Sweden, asa.holm@liu.se, Torbjörn Larsson, Asa Carlsson Tedgren

Modern optimization techniques for inverse planning of HDR brachytherapy makes it possible to efficiently calculate dose plans. On of the tenets of such techniques is the use of linear penalty functions. Plans generated with these techniques tend to have a few dwell positions that dominate the solution, however physicians prefer homogeneous plans. In this talk we show that one reason for the long dwell times is the linear penalties and introduce a solution that reduces the effects of linearity.

5 - Optimization Models for Online Adaptive Radiotherapy

Chunhua Men, University of California, San Diego, 3855 Health Sciences Dr. #0843, La Jolla, CA, 92093, United States of America, cmen@ucsd.edu, Steve Jiang

Traditional treatment plan optimization models based on a snapshot of the patient's anatomy prior to treatment are not suitable for online adaptive radiotherapy (ART) which allows real-time treatment adaptations based on the current patient anatomy. In this work, we develop and evaluate various optimization models for online ART. To obtain real-time treatment plans, we implement the algorithms on GPU. Tests on clinical cancer cases showed the effectiveness and the efficiency of these models.

■ WC32

C - Room 6A, Level 3

Computational Stochastic Programming

Sponsor: Computing Society

Sponsored Session

Chair: Shabbir Ahmed, Associate Professor, Georgia Institute of Tech, 765 Ferst Drive NW, Atlanta, GA, United States of America, sahmed@isye.gatech.edu

1 - A Preconditioning Technique for Schur Complement Systems Arising in Stochastic Optimization

Mihai Anitescu, Computational Mathematician, Argonne National Laboratory, Math and Computer Science Division, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, anitescu@mcs.anl.gov, Cosmin Petra

We discuss a parallel interior-point method for stochastic programming that uses a Schur complement mechanism. We propose a stochastic preconditioner to improve scalability. The spectral analysis of the preconditioned matrix indicates an exponential clustering of the eigenvalues around 1. The numerical experiments performed on the relaxation of a unit commitment problem show good performance, in terms of both the accuracy of the solution and the execution time.

2 - Models and Formulations for Optimization with Multivariate Stochastic Dominance Constraints

James Luedtke, University of Wisconsin-Madison, 1513 University Av., Madison, WI, United States of America, jrluedt1@wisc.edu, Benjamin Armbruster

Multivariate stochastic dominance constraints provide an interesting modeling tool for problems having multiple stochastic objectives. Recently proposed models use extensions of the notion of positive linear stochastic dominance, but appear computationally challenging to use. We propose to use a different notion of dominance, based on expected utility theory, and present linear and integer programming formulations for the corresponding problem.

3 - Learning Price Functions in Cournot Games

Uday Shanbhag, Asst. Professor, University of Illinois at Urbana Champaign, Urbana, IL, United States of America, udaybag@illinois.edu, Sean Meyn, Hao Jiang

We consider a regime where firms compete in a Nash-Cournot game without the knowledge of the precise parameters of the price functions. We show that the resulting trajectory can be characterized. Convergence of the learning update scheme is examined in deterministic and stochastic regimes.

■ WC33

C - Room 6B, Level 3

Optimization Strategies for Real-World Applications

Sponsor: Computing Society

Sponsored Session

Chair: Eva Lee, Professor & Director, Georgia Institute of Technology, Center for Operations Research in Medici, Industrial & Systems Engineeriing, Altanta, GA, 30332-0205, United States of America, eva.lee@gatech.edu

1 - On the Simultaneity of Row and Column Generation

Jon Petersen, PhD Student, Georgia Institute of Technology, 765 Ferst Drive NW, Atlanta, GA, 30309, United States of America, Petersen@gatech.edu, Ellis Johnson

While both constraint generation and column generation have been successfully employed in solving practical real-world problems, they are often thought of as being mutually exclusive. The efficacy of solving large-scale models can be improved by using these two principles concurrently. We propose a new method for doing so, and present computational results to validate our approach.

2 - Audience Space Aggregation for Ad Planning
John Turner, University of California - Irvine, The Paul Merage School of Business, Irvine, CA, 92697, United States of America, john.turner@uci.edu

Whether serving ads on web pages or in newer media such as video games, targeting constraints lead to a combinatorial explosion in the number of audience segments. Using an aggregation heuristic for large transportation problems, we allocate impressions to ad campaigns at an appropriate granularity. Computational results show that a little bit of disaggregation goes a long way: Near-optimal solutions are achieved despite a high degree of aggregation.

3 - Constraint Optimal Selection Techniques (COSTs) for Linear Programming
H. W. Corley, IMSE Department, The University of Texas at Arlington, Arlington, TX, 76019, United States of America, corley@uta.edu, Jay Rosenberger, Goh Saito

We present a Constraint Optimal Selection Technique (COST) for efficiently solving large-scale nonnegative linear programming problems. We provide a geometric interpretation of the COST and computational comparisons with the CPLEX primal simplex, dual simplex, and barrier algorithms.

■ WC34

C - Room 7, Level 3

Optimization on Graphs

Sponsor: Computing Society
Sponsored Session

Chair: Doug Altner, Assistant Professor, United States Naval Academy, United States of America, altner@usna.edu

1 - Integer Programming Techniques for Matroid Circuit Problems
John Arellano, PhD Student, Rice University, 6100 Main St. MS 134, Houston, TX, 77030, United States of America, jda2@rice.edu, Illya Hicks

Although some combinatorial optimization problems associated with matroids can be solved in polynomial time, finding particular circuits in matroids is an NP-hard problem. It is related to compressive sensing and finding the degree of redundancy of sensor networks. In this talk, we attempt to solve these types of problems to optimality using integer programming techniques and present computational results.

2 - Over Restriction of Network Expansion Big M Constraints
Kael Stilp, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, United States of America, mstilp3@isye.gatech.edu, Ozlem Ergun, Pinar Keskinocak

We discuss a multi period network expansion model where flow capacities are big-M constrained and nodes have supply and demand of commodities. The objective is to minimize unsatisfied demand over all of the periods. We show computational results behind restricting the M value to infeasible values as a means of speeding up computation and achieving better solutions. To further understand the results we discuss theoretical reasonings for the occurrence.

3 - Coverings and Matchings in r-Partite Hypergraphs
Doug Altner, Assistant Professor, United States Naval Academy, United States of America, altner@usna.edu, Paul Brooks

We present a few results regarding matchings and coverings in r-partite hypergraphs. First, we present an alternate proof showing the integrality gap of the standard BILP for r-dimensional matching is at least r-k where k is the smallest positive integer such that r-k is a prime power. Second, we prove r-dimensional covering is NP-hard for intersecting hypergraphs. Third, we prove a few upper bounds on the covering number of a special class of intersecting hypergraphs that are not balanced.

■ WC35

C - Room 8A, Level 3

Advances in Anomalous Diffusion III

Sponsor: Applied Probability
Sponsored Session

Chair: Mark Meerschaert, Michigan State University, Department of Statistics and Probability, East Lansing, MI, United States of America, mcubed@stt.msu.edu

1 - Approximation of Tempered Operator Stable Processes
Boris Baeumer, University of Otago, Department of Mathematics and Statistics, Dunedin, New Zealand, bbaeumer@maths.otago.ac.nz, Mihaly Kovacs

Operator stable processes are characterised by the scaling matrix H and mixing measure M. By randomly choosing a direction and then generating a one-dimensional jump distance, the resulting process lies in the domain of attraction of the operator stable process. All tempered processes lie in the domain of attraction of a Gaussian. We show that for some tempered op-stable processes the speed of convergence of the approximant to the tempered process is faster than the convergence to the Gaussian.

2 - Cauchy Problems Solved by Running Subordinate Processes
Erkan Nane, Assitant Professor, Auburn University, 221 Parker Hall, Auburn, AL, 36849, United States of America, ezn0001@auburn.edu

Subordinated Markov processes will be studied. These are obtained by taking Markov processes and replacing the time parameter with other processes such as Brownian motion, symmetric stable process, an inverse of a stable subordinator, or local time of an stable process of index between 1 and 2. We obtain frational Cauchy problems or Cauchy problems involving the powers of the generator of the Markov Process by running these subordinated Markov processes.

3 - Space-time Duality for Fractional Diffusion
Mark Meerschaert, Michigan State University, Department of Statistics and Probability, East Lansing, MI, United States of America, mcubed@stt.msu.edu, Boris Baeumer, Erkan Nane

Fractional diffusion equations govern scaling limits of random walk models. The limit process is a stable Levy motion that models the jumps, subordinated to an inverse stable process that models the waiting times. Using Zolotarev duality, we relate the density of a spectrally negative stable process with index $1<\alpha<2$ to the density of the hitting time of a stable subordinator with index $1/\alpha$, and thereby unify some recent results in the literature.

4 - A Sex Talk: The Matchmaking Paradox
Iddo Eliazar, Professor, Holon Institute of Technology, P.O. Box 305, Holon, 58102, Israel, eliazar@post.tau.ac.il

Medical surveys regarding the number of heterosexual partners per person yield different female and male averages - a result which, from a physical standpoint, is impossible. In this talk we establish a statistical model, based on random attractiveness levels, which explains the aforementioned "matchmaking paradox". Our analysis concludes when, and when not, are surveys capable of well-estimating the female and male averages.

■ WC36

C - Room 8B, Level 3

Education II

Contributed Session

Chair: Helene Caudill, Associate Professor of Management, St. Edward's University, 3001 South Congress Avenue, Austin, TX, 78704, United States of America, helenec@stedwards.edu

1 - Simulating Student Flow Through a College of Business for Policy and Structural Change Analysis
Robert Saltzman, Professor, San Francisco State University, 1600 Holloway Ave, College of Business, San Francisco, CA, 94132, United States of America, saltzman@sfsu.edu, Theresa Roeder

Many public higher education institutions are trying to facilitate student graduation even as institutional resources decline. We describe a model that simulates the flow of undergraduates through a large public college, allowing changes in curriculum policy, prerequisites, and staffing capacity to be tested prior to implementation. Output measures include expected time to degree and graduation rates. The model is used to experiment with both actual and potential scenarios facing the college.

2 - A Simple Management Tool to Increase High School Track Team Participation

Sambhavi Lakshminarayanan, Assistant Professor, Medgar Evers College - CUNY, S-Building, Department of Business Admin, 1637 Bedford Avenue, Brooklyn, NY, 11225, United States of America, sLakshminarayanan@mec.cuny.edu, Ashwin Acharya

Convincing busy high school students to make a significant time commitment to participate in athletics is a challenge. However, schools and athletic coaches consider it highly desirable, if not necessary, for students to participate in athletic activities. This paper discusses an approach developed by the senior members of the track team at an academically focused high school to increase team numbers and retention.

3 - Teaching Business Statistics using Participatory Learning Methods in a Multicultural Setting

Mark Ferris, Saint Louis University, 3674 Lindell Blvd, Room 457, Saint Louis, MO, 63104, United States of America, ferrisme@slu.edu, Reuven Levary

Teaching pedagogy in business schools emphasize participatory learning methods such as class discussion, group problem solving and case studies. The predominant teaching methods for international students may not include a participatory component, rather it is a system that emphasizes the teacher as the prime source of knowledge. A strategy for ensuring the contribution of international students in a participatory learning environment for statistics was developed, implemented and evaluated.

4 - Undergraduate and Graduate Students' Perception about Web-Enhanced and Online Courses

Hiral Shah, Assistant Professor, St Cloud State University, 720 Fourth Ave S - ECC 101, St Cloud, MN, 56301, United States of America, hashah@stcloudstate.edu, Devang Mehta

The purpose of this study was to compare the perceptions of students about completely online courses against web-enhanced courses. Data were collected from both graduate and undergraduate students enrolled at two different higher education institutions. The results of this study will enable instructors to modify their teaching styles using either of these methods of teaching.

5 - What is Academic Quality? A Comparison of Traditional and Adult Students' Perceptions

Helene Caudill, Associate Professor of Management, St. Edward's University, 3001 South Congress Avenue, Austin, TX, 78704, United States of America, helenec@stedwards.edu

There are numerous definitions of academic quality, but the one that I believe affects student satisfaction and faculty reputations most often is the perception of what students believe to be "quality in the classroom." With responses from over 250 students, the results indicate that students focus on three main areas: the credentials of the faculty member, the usefulness of the materials and assignments, and the communication skills of the faculty member.

■ WC37

C - Room 8C, Level 3

Applied Probability

Contributed Session

Chair: Raja Jayaraman, Postdoctoral Research Fellow, University of Arkansas, Industrial Engineering, Bell 4207, Fayetteville, AR, 72701, United States of America, rjayaram@uark.edu

1 - The Action Gambler and Equal-sized Wagering

David Hartvigsen, Professor, University of Notre Dame, 354 Mendoza College of Business, Notre Dame, IN, 46556-5646, United States of America, Hartvigsen.1@nd.edu

A gambler, with a bankroll B, faces a sequence of n identical, independent, win-lose bets. When the total amount wagered (the total action) must be at least B, we show that wagering B/n on each bet maximizes the expected utility of the final bankroll iff the probability of winning a single bet is at most some p* (which is an explicit function of B, n, and the utility function).

2 - Optimal Sequential Selection of a Unimodal Subsequence From a Random Sample

Alessandro Arlotto, University of Pennsylvania, 3730 Walnut Street, 500 Jon M. Hunstman Hall, Philadelphia, PA, 19104, United States of America, alear@wharton.upenn.edu, J. Michael Steele

The length of the longest unimodal subsequence in a random sample of size n is known to be asymptotic to $2\sqrt{2n}$. We study the sequential version of the same problem in which, at every decision time $k\in\{1,...,n\}$, a decision-maker has to select or reject the current observation in order to form a unimodal subsequence of maximal expected length. We show that this expected length is asymptotic to $2\sqrt{n}$.

3 - On Pro-rata Pricing Strategy for Extended Product Warranties

Raja Jayaraman, Postdoctoral Research Fellow, University of Arkansas, Industrial Engineering, Bell 4207, Fayetteville, AR, 72701, United States of America, rjayaram@uark.edu, Timothy Matis

Product warranties play a challenging and decisive role in today's dynamic business environment. Several strategies and models have been proposed assuming fixed cost associated with various repair actions available to the manufacturer towards rectifying product failures. In this presentation we shall address pro-rata pricing and its overall effect towards minimizing expected cost for products carrying extended warranties.

■ WC38

C - Room 9A, Level 3

Theory and Applications in Copositive Programming

Sponsor: Optimization/Linear Programming and Complementarity (Joint Cluster ICS)

Sponsored Session

Chair: Samuel Burer, Associate Professor, University of Iowa, S346 Pappajohn Business Building, Iowa City, IA, 52242-1994, United States of America, samuel-burer@uiowa.edu

1 - New Approximations for Copositive Matrices

Samuel Burer, Associate Professor, University of Iowa, S346 Pappajohn Business Building, Iowa City, IA, 52242-1994, United States of America, samuel-burer@uiowa.edu, Hongbo Dong

We introduce a new hierarchy of inner approximations of the copositive matrices. The distinguishing feature of the hierarchy is its recursive nature, which deals with smaller (but more) matrices as the recursive depth increases. For fixed depth, the resulting inner approximation is a polynomially sized linear-semidefinite program.

2 - Mixed Zero-One Linear Programs Under Objective Uncertainty: A Completely Positive Representation

Chung Piaw Teo, Professor, National University of Singapore, NUS Business School, BIZ1 8-72, NUS, 15 Kent Ridge Drive, Singapore, 119245, Singapore, bizteocp@nus.edu.sg, Zhichao Zheng, Karthik Natarajan

We analyze mixed 0-1 linear programs under objective uncertainty using a moment based approach, assuming descriptive statistics of the objective coefficients are known, but not the exact form of the distribution. Our main result shows that computing the supremum of the expected optimal objective value of such problem is a completely positive program. The result is extended to objective coefficients over Euclidean space, uncertain moments and more complicated objective functions.

3 - Separating Doubly Nonnegative and Completely Positive Matrices

Kurt Anstreicher, Professor, University of Iowa, Department of Management Sciences, Iowa City, IA, 52242, United States of America, kurt-anstreicher@uiowa.edu, Hongbo Dong

Completely Positive (CP) matrices can be used to formulate a variety of NP-Hard problems. A natural issue in the optimization setting is to separate a given Doubly Nonnegative (DNN) but non-CP matrix from the CP cone. We describe constructions for such a separation that apply to 5x5 DNN but non-CP matrices, as well as to larger matrices with block structure. Computational results illustrate the ability of these procedures to generate improved bounds on difficult problems.

■ WC39

C - Room 9B, Level 3

Column Generation in Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Wilbert Wilhelm, Professor, Texas A&M University, Department of Industrial and Systems Eng, TAMUS 3131, College Station, 77843-3131, United States of America, wilhelm@tamu.edu

1 - A Stabilized Dynamic Constraint Aggregation/Column Generation Method for the MDVSP

Guy Desaulniers, Ecole Polytechnique de Montréal and GERAD, CP. 6079, Succ. Centre-ville, Montréal, Canada, Guy.Desaulniers@polymtl.ca, Pascal Benchimol, Jacques Desrosiers

In a column generation context, dynamic constraint aggregation that reduces the number of constraints in the master problem was recently introduced to reduce degeneracy. Dual variable stabilization is also effective at reducing the number of column generation iterations. In this talk, we present a method that combines both techniques and we report computational results for the multi-depot vehicle scheduling problem.

2 - Partial Path Column Generation for the Vehicle Routing Problem
Mads Jepsen, PhD., Technical University of Denmark, Produktionstorvetbygn. 424, Kgs. Lyngby, 2800, Denmark, makj@man.dtu.dk, David Pisinger, Björn Petersen

This paper presents a column generation algorithm for the Capacitated Vehicle Routing Problem (CVRP). The Set Partitioning model with elementary routes, have shown superior results. However, algorithms for solving the pricing problems do not scale well. We suggest to relax the constraint that 'each column is a route' into 'each column is a part of the giant tour'. This way, the length of the partial path can be bounded and a better control of the size of the solution space is obtained.

3 - Unified Branch-Cut-and-Price for Routing and Scheduling
Marcus Poggi de Aragao, PUC-Rio, R. M. S. Vicente 225, Rio de Janeiro, Brazil, poggi@inf.puc-rio.br, Eduardo Uchoa, Artur Pessoa

We extend the 1978 Picard-Queyranne approach to routing and sheduling problems. The resulting Branch-Cut-and-Price adds a number of families of valid inequalities described on variables from the original as well as on the ones from extended formulations. Several variants of these problems are tackled with minor adaptations. We address stabilization and performance issues. A wide range of experimental results are presented. Finally, the generality and the evolution of the approach is discussed.

4 - A Branch-and-cut Equivalent to Branch and Price
Wilbert Wilhelm, Professor, Texas A&M University, Department of Industrial and Systems Eng, TAMUS 3131, College Station, 77843-3131, United States of America, wilhelm@tamu.edu, Deepak Warrier

Branch and price is a leading approach to solve integer programs but suffers from serious shortcomings, including converging slowly, failing to indicate it if prescribes tighter bounds than the linear relaxation of the original problem, and failing to readily incorporate cutting planes to tighten bounds. This paper describes a branch-and-cut equivalent that prescribes the same bounds but overcomes these shortcomings. Computational tests compare the effectiveness of the two approaches.

■ WC40

C - Room 9C, Level 3

Decision Analysis IV

Contributed Session

Chair: Kash Barker, Lecturer, University of Oklahoma, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, kashbarker@ou.edu

1 - Optimal Pricing, Modularity Level and Consumer Return for MC Products using Uncertainty
Na Liu, The Institute of Textiles and Clothing, The Hong Kong Polytechnic University, Hunghom, Kowloon, Hong Kong, Hong Kong, Hong Kong - PRC, 08900900r@polyu.edu.hk, Jason Choi

Mass customization (MC) is a pertinent industrial practice. MC retailers can gain substantial advantages if return is considered. We study the optimal decisions under a mean-variance analytical formulation. Structural properties are revealed and the closed-form optimal solutions are derived. Sensitivity analysis is subsequently conducted to explore how the risk sensitivity and other parameters affect the optimal decisions. Counter-intuitive findings are obtained and insights are generated.

2 - Determining the Objective-based Feasibility of Installing a Sewage Treatment Plant at a University
Mario Chew, Full Time Teacher, Technological Institute of Superior Studies of Coacalco, Av. 16 de septiembre No. 54, Cabecera, Municipal, Coacalco, Edo. de Mexico, México D.F., 55700, Mexico, mchew@tesco.edu.mx, Verónica Velàzquez

A typical feasibility analysis of a Waste Water Treatment Plant (WWTP) calculates economical or technical metrics, which are used to decide if the WWTP is to be installed. If the fundamental objectives of the decision maker aren't technical or economical, such an analysis is not satisfactory; this is the case when a University contemplates acquiring a WWTP. Here, we use Keeney's Value-Focused Thinking to incorporate the fundamental objectives of a University to the feasibility analysis of a WWTP.

3 - Using Decision Analysis to Model the Triune Relationship of Supply, Demand, and Price
Jeff Stonebraker, Assistant Professor, North Carolina State University, College of Management, Raleigh, United States of America, jeff_stonebraker@ncsu.edu

Bayer was deciding whether to develop the third generation product used in the treatment of hemophilia A. Bayer also wanted to right size its production capacity to meet the demand while maximizing profitability. We use decision analysis to model Bayer's supply-demand-price conundrum.

4 - Telling Value Stories with Value Diagrams
Somik Raha, Student, Stanford University, 1329 Park Drive #12, Mountain View, CA, 94040, United States of America, somik.raha@gmail.com

We will examine how decision diagrams currently tell value stories, and propose "Value Diagrams" to tell richer value stories that help clarify the value frame, create mutual understanding on value and inform our value thinking in decision diagrams. We will show through case studies how this can help us make decisions that are aligned with our values.

5 - A Simple Interval-Valued Decision Tree
Kash Barker, Lecturer, University of Oklahoma, 202 W. Boyd, Room 124, Norman, OK, 73019, United States of America, kashbarker@ou.edu

Important to decision making is recognition of what today's decisions have on future options. An oft-used tool to aid in this problem is the decision tree. To address situations when uncertainty arises in the metrics associated with different decision paths, a simple decision tree is developed for uncertain parameters where only bounds, not distributions, are known. Single- and multiobjective trees are discussed.

■ WC41

C - Room 10A, Level 3

Metaheuristics I

Contributed Session

Chair: Heidi Taboada, Assistant Professor in Industrial, Manufacturing and Systems Engineering, Univeristy of Texas at El Paso, 500 W. University Ave., El Paso, TX, United States of America, hataboada@utep.edu

1 - A New Evolutionary Algorithm Based on Adaptive Echolocation
Heidi Taboada, Assistant Professor in Industrial, Manufacturing and Systems Engineering, Univeristy of Texas at El Paso, 500 W. University Ave., El Paso, TX, United States of America, hataboada@utep.edu, Karla Gutierrez

A new evolutionary algorithm that is based on the principle of echolocation, also called biosonar is presented. This principle is active in numerous animals such as bats. These animals use it as radar in order to find food, obstacles or locate objects. The algorithm developed uses the radar method in order to explore the search space to obtain optimal solutions. The new method is tested on the well-known single objective redundancy allocation problem.

2 - A Solution Method for the Constrained Level of Repair Analysis Problem
Jose Espiritu, Assistant Professor in Industrial Engineering, Univeristy of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, jfespiritu@utep.edu, Carlos Ituarte-Villareal

A Level of Repair Analysis model, determines the most cost-effective maintenance/replacement policy for each component within a system. In the present research we develop a heuristic approach to solve the Level of Repair Analysis considering budget constraints to indicate the optimal maintenance levels at which items will be removed, repaired and replaced to meet operational standards in a least optimal cost.

3 - Tabu Search with Strategic Oscillation for a Maximum Dispersion Territory Design Problem
Jabneel R. Maldonado-Flores, Universidad Autonoma de Nuevo Leon, CIDET-FIME, AP111-F, Cd. Universitaria, San Nicolàs de los Garza, NL, 66450, Mexico, jabneelmf@gmail.com, Roger Z. Rios-Mercado, José Luis Gonzàlez Velarde

We address a districting problem motivated by the application of the WEEE recycling directive in the European Union. In contrast to classical territory design, maximum territory dispersion is sought for avoiding the creation of monopolies forbidden by law in some countries. A tabu search with strategic oscillation is proposed and evaluated over a wide range of instances with very promising empirical results.

4 - Bicriteria Optimization of Energy Efficient Placement and Routing in Heterogenous Sensor Networks
Mustafa Baydogan, Research Assistant, Arizona State University, 1802 E Randall Dr. Apt 3, Tempe, AZ, 85281, United States of America, mbaydoga@asu.edu, Nur Evin Ozdemirel

We locate different type of sensors and route data generated to a base station under two conflicting objectives: minimization of network cost and maximization of network lifetime by satisfying connectivity and coverage requirements as well as sensor node and link capacity constraints. We propose formulations and use an exact solution approach to find Pareto solutions and develop a multiobjective GA to approximate the efficient frontier, as the exact solution requires long computation times.

5 - An Evolutionary Approach Based on Viral Replication for Solving Combinatorial Optimization Problems

Claudia Valles, MS student, The University of Texas at El Paso, 500 W. University Av., El Paso, TX, United States of America, cevalles@miners.utep.edu, Heidi Taboada

A new algorithm that mimics the performance of viruses is presented. The replication mechanism as well as the hosts' infection processes are used to develop this new metaheuristic.The problem presented to show the performance of the proposed algorithm is the multiple objective redundancy allocation problem. The solution to this multiobjective problem is a set of Pareto-optimal solutions.

■ WC42

C - Room 10B, Level 3

Optimization and Scheduling for Supercomputers

Sponsor: Optimization/Computational Optimization and Software (Joint Cluster ICS)

Sponsored Session

Chair: Xueping Li, Assistant Professor, University of Tennessee, 408 East Stadium Hall, Knoxville, TN, 37996, United States of America, Xueping.Li@utk.edu

1 - Making Software Maintenance More Efficient on Kraken, the 1st Academic Petaflop Computer

Mark Fahey, Scientific Computing Group Leader, National Institute for Computational Sciences, 1 Bethel Valley Road, P.O. Box 2008 MS 6173, Oak Ridge, TN, 37831, United States of America, mfahey@utk.edu

The National Institute for Computational Sciences is the newest NSF High Performance Computer center delivering 600 millions compute hours yearly to the TeraGrid and is the 3rd fastest machine on the Top500. I will describe Kraken's capabilities and then talk about some infrastructure to (1) improve software installation and maintenance and (2) track library usage by all the users; both with the ultimate goal of improving the user experience while simultaneously make NICS more efficient.

2 - Maintenance and Spare Part Inventory Control of Supercomputers

Xiaoyan Zhu, Assistant Professor, University of Tennessee, 408 East Stadium Hall, Knoxville, TN, 37996, United States of America, xzhu5@utk.edu, Haitao Liao

To ensure the normal operation of a supercomputer, maintenance must be performed effectively with the availability of spare parts to replace degraded or failed units. This work provides a preliminary model that simultaneously manipulates maintenance schedules and the number of spare parts to be held in inventory to minimize the overall operating cost (downtime cost, and procurement and holding costs for spare parts) while ensuring a high fill rate of spare parts.

3 - User Strategies for Super Computer Scheduling

Joe Wilck, The University of Tennessee - Knoxville, 411 East Stadium, Knoxville, TN, United States of America, jwilck@utk.edu, Jonathan Celso, Xueping Li, Mark Fahey

We present strategies exhibited by users when using a super computer that has priority scheduling. The schedule is prioritized to run jobs that utilize the most nodes for the longest amount of time, and then backfills smaller jobs for the remaining capacity. Due to maintenance schedules, the users know that the queue must be cleared weekly.

4 - Supply Chain Management Models and Heuristics for Data Cache Management

Zhe Zhang, Research Staff Member, Oak Ridge National Laboratory, ORNL, 1 Bethel Valley Road, P.O. Box 2008 MS6008, Oak Ridge, TN, 37831-6008, United States of America, zhezhang@ornl.gov, Xiaoyan Zhu, Rui Xu, Galen Shipman, Xiaosong Ma, Xueping Li

For better application I/O performance, modern operating systems place certain data blocks in faster storage devices based on future access predictions. In Computer Science this method is named caching. While enhancing the system cost-effectiveness, caching also creates challenges in data management, including data placement and transfer. In this work we exploit the similarities between the caching and supply chain management problems and apply SCM models and heuristics in data cache management.

■ WC44

C - Room 2, Level 2- Mezzanine

Cost Effectiveness Models in Health Care

Sponsor: Health Applications

Sponsored Session

Chair: Greg Zaric, Associate Professor, Ivey Business School, 1151 Richmond St., London, Canada, gzaric@ivey.uwo.ca

Co-Chair: David Hutton, Stanford University, Palo Alto, CA, United States of America, billdave@stanford.edu

1 - Cost Effectiveness of a Safe Consumption Site in Toronto, Canada

Eva Enns, Stanford University, 117 Encina Commons, Stanford, CA, 94035, United States of America, evaenns@stanford.edu, Greg Zaric, Jennifer Jairam, Ahmed Bayoumi

The establishment of a safe consumption site (SCS) in Toronto, Canada has been proposed to reduce the spread of disease through the sharing of drug use equipment. We developed a compartmental model of the spread of HIV and hepatitis C through populations of drug users and non-drug users matching those of the Toronto area. We account for geographically disparate drug user groups and mixing patterns between them, as well the influence of a centralized SCS on drug user mixing behavior.

2 - Cost-Effectiveness of Stockpiling Masks and Respirators for the Next Influenza Pandemic

David Hutton, Stanford University, Palo Alto, CA, United States of America, billdave@stanford.edu, Nayer Khazeni

Surgical masks were used Mexico during the initial outbreak of the 2009 pandemic influenza (H1N1). Several countries are stockpiling masks to use in future pandemics. We use mathematical models of influenza disease spread to determine the minimal necessary effectiveness and compliance to make stockpiling of masks effective and cost-effective in an influenza pandemic. We compare these results with other mitigation strategies involving pharmaceuticals.

3 - Cost-Effectiveness of a 21-gene Recurrence Score Assay in Patients with Early Stage Breast Cancer

Malek Hannouf, University of Western Ontario, University of Western Ontario, London, ON, Canada, Malek.Bassam@schulich.uwo.ca, Bin Xie, Muriel Brackstone, Greg Zaric

We developed a Markov model to evaluate the cost effectiveness of a 21-gene recurrence score assay versus current Canadian clinical guidelines in women with early stage breast cancer. The model was parameterized using 5 and 10 year follow up data from the Manitoba Cancer Registry and cost data from Manitoba Health.

■ WC45

C - Room 6, Level 2- Mezzanine

Radiation Therapy Optimization

Sponsor: Health Applications

Sponsored Session

Chair: Timothy Chan, Assistant Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, tcychan@mie.utoronto.ca

1 - Quantifying the Trade-off Between Beam-on-time and Treatment Plan Quality

Ehsan Salari, PhD Student, University of Florida, ISE Department, P.O. Box 116595, Gainesville, FL, 32611-659, United States of America, esalari@ufl.edu, Edwin Romeijn

Beam-on-time is an important aspect of IMRT treatment efficiency, but its optimization is traditionally postponed until the leaf sequencing phase of treatment planning. However, there is a trade-off between treatment plan quality and beam-on-time. The aim of this study is to incorporate the beam-on-time into a direct aperture optimization model. We formulate a bi-criteria optimization model and develop a solution method that efficiently obtains the entire set of Pareto-optimal treatment plans.

2 - A Beam Angle Optimization Approach for Intensity Modulated Proton Therapy Treatment Planning

Gino Lim, Associate Professor PhD, University of Houston, E211, Engineering Building 2, Houston, TX, 77204, United States of America, ginolim@uh.edu, Wenhua Cao

We present an LP based local neighborhood search algorithm for solving the BAO problem in IMPT treatment planning. Three prostate cancer cases at M. D. Anderson were tested. Optimized angle sets demonstrated evident advantages comparing with the lateral opposed angles currently used at M. D. Anderson. Furthermore, we applied a worst case robust analysis that accounts for range uncertainties and setup errors on the optimized angles in order to validate the robustness of plan quality.

3 - An Inverse Optimization Approach to Determine Objective Function Weights in Radiation Therapy

Taewoo Lee, PhD student, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, taewoo.lee@utoronto.ca, Timothy Chan, Michael Sharpe, Tim Craig

In a multi-objective optimization model for radiation therapy treatment planning, the determination of weights for different organ-specific objective functions is based on subjective beliefs and manual iterative loops. We present a linear inverse optimization model that objectively and efficiently determines the weights using historical treatment data from prostate cancer patients.

4 - Dynamic Robust IMRT Optimization

Timothy Chan, Assistant Professor, University of Toronto, 5 King's College Road, Toronto, ON, M5S 3G8, Canada, tcychan@mie.utoronto.ca, Velibor Misic

Previous robust IMRT optimization studies used an uncertainty set to model data uncertainty, solved a single treatment planning problem and delivered the solution in all fractions. In this talk, we present a dynamic robust optimization methodology where prior data observations are used to update the uncertainty set and guide treatment re-optimization. We present results for a lung case demonstrating simultaneous improvement in tumor coverage and lung sparing over non-dynamic robust treatments.

■ WC46

C - Room 7, Level 2- Mezzanine

Game-Theoretic Applications in Healthcare II

Sponsor: Health Applications
Sponsored Session

Chair: Murat Kurt, PhD Student, University of Pittsburgh, Department of Industrial Engineering, 3700 O'Hara Street, 1048 Benedum Hall, Pittsburgh, PA, 15217, United States of America, muk7@pitt.edu

Co-Chair: Reza Yaesoubi, Post-Doctoral Research Fellow, Harvard Medical School, 641 Huntingtone Ave., Boston, MA, 02115, United States of America, reza.yaesoubi@gmail.com

1 - Influenza Vaccine Supply Chain Coordination with Certain Delivery and Asymmetric Information

Javad Nasiry, HKUST, Clear Water Bay, Kowloon, Hong Kong - PRC, Javad.NASIRY@insead.edu, Stephen E. Chick, Sameer Hasija

We develop a model to investigate the effects of information asymmetry between a manufacturer and a single buyer on flu vaccine supply chain coordination. We design an optimal menu of output-based screening contracts and develop a simple alternative menu that can achieve screening with no loss of efficiency under some conditions. The policy implications of the model are further discussed.

2 - Imaging Room and Beyond: The Underlying Economics Behind Physicians' Test-Ordering Behavior

Tinglong Dai, PhD Student, Carnegie Mellon University, Tepper School of Business, Pittsburgh, PA, 15213, United States of America, dai@cmu.edu, Sridhar Tayur, Mustafa Akan

Excessive diagnostic tests have long been viewed as one major aspect of health care inefficiency and are often attributed to the fee-for-service payment model. In this study we investigate the underlying operational and economic drives behind physicians' test-prescribing behavior in the outpatient setting, motivated by a collaborative study with a major outpatient clinic. Our work also provides insights into the effects of the increasingly popular "comparison shopping" of health services.

3 - Stochastic Dynamic Allocation of Deceased-donor Kidneys

M Gisela Bardossy, University of Maryland, R.H.Smith School of Business, and Institute for Systems Research, College Park, MD, United States of America, bardossy@umd.edu, Inbal Yahav

Deceased-donor kidneys are currently allocated to candidates through a priority point system that combines waiting times and human tissue matches. In this paper we evaluate a stochastic dynamic programming approach in search of rules of allocation that maximize a multicriteria objective to balance efficiency with equity. We test our approach on the current candidates' kidney waiting list and find promising results.

■ WC47

C - Room 8, Level 2- Mezzanine

Diversification in Projects

Cluster: Topics in Project Management
Invited Session

Chair: Karolina Glowacka, Assistant Professor, Stevens Institute of Technology, Howe School of Technology Management, Hoboken, NJ, 07030, United States of America, kglowack@stevens.edu

1 - Impacts of Change Orders on Project Performance

Young Hoon Kwak, Associate Professor, The George Washington University, Department of Decision Sciences, 2201 G Street, NW, Suite 415, Washington, DC, 20052, United States of America, kwak@gwu.edu, Kunhee Choi, Jane Park

Change orders are inevitable in infrastructure projects that often result in project disruptions, disputes, and delays. We attempt to quantify the impacts of change orders on project performance. Two different benchmarks, the original threshold versus the amended threshold, of project cost, schedule, and other variables are analyzed to measure the effect of change orders using 1372 infrastructure projects. We also apply project portfolio analysis to determine the key effects on change order.

2 - Analytic Contingency Setting: An Algorithm for Estimating Contingencies

Homayoun Khamooshi, Assistant Professor, The George Washington University, Decision Sciences,Funger Hall Room 408, 2115 G Street, NW, Washington, DC, 20052, United States of America, hkh@gwu.edu, Denis Cioffi

To cover contingencies, usually a fixed percentage of a project budget is set aside. Our model uses the binomial probability distribution to estimate the potential number of risk realizations at a given confidence level, and ranked risk impacts are added over this number of risks, yielding the required contingency funds to provide coverage of the accepted risks. The budget found with this method compares extremely well with one ascertained from a numerical simulation of the risk occurrences.

3 - Integrating Innovation Projects and Lean Six Sigma Projects in the Organizational Portfolio

Frank T. Anbari, Clinical Professor, Drexel University, Goodwin College of Professional Studies, 3001 Market St., Suite 100, Philadelphia, PA, 19104, United States of America, anbari@drexel.edu

There are two concurrent, major waves affecting management thinking currently: project management/ innovation and Lean Six Sigma/ process improvement. Management researchers in each of these two important areas are seldom aware of the progress achieved in the other area. We aim to provide a clear vision of the integration of the project management office (PMO)/ innovation and Lean Six Sigma operations to enhance the organization's performance through continual improvement of its total system.

4 - OptForce™: A New Approach to Strategic Workforce Planning

Jay April, OptTek Systems, Inc., 2241 17th Street, Boulder, CO, 80302, april@opttek.com

Companies annually invest billions of dollars in programs to pursue objectives such as improving workforce productivity, customer satisfaction, customer contracting requirements and legal settlements. OptForceTM provides significant benefits in these settings, by evaluating and selecting portfolios of proposed investments in programs to generate new decision alternatives that offer improved returns.

■ WC48

C - Room 9, Level 2- Mezzanine

Tutorial: The Role and Challenges for Optimization in Competitive Electricity Markets

Cluster: Tutorials
Invited 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 - The Role and Challenges for Optimization in Competitive Electricity Markets
Shmuel Oren, Professor, University of California-Berkeley, IEOR Department, 4135 Etcheverry Hall, Berkeley, CA, 94720, United States of America, oren@ieor.berkeley.edu

This tutorial will describe key challenges in designing and operating competitive electricity markets. It will review the basic components of electricity markets and alternative structural approaches adopted in different systems. We will discuss the underlying optimization problems being solved in scheduling, operating and simulating electricity markets. New computational challenges and research activities in this area will also be reviewed.

■ WC49

C -Room 10, Level 2- Mezzanine

Intellectual Property Issues in Technology

Sponsor: Information Systems
Sponsored Session

Chair: Eric Walden, Wetherbe Professor of ISQS, Rawls College of Business, Box 42101, Lubbock, TX, 79409, United States of America, eric.walden@ttu.edu

1 - On the Downloading vs. Uploading of Unauthorized Copies of Intellectual Property
Jared Hansen, Assistant Professor, University of North Carolina at Charlotte, 9201 University City Boulevard, Charlotte, NC, 28223, United States of America, Jared.Hansen@uncc.edu, Eric Walden

This research examines differences in ethical and legal perceptions regarding the downloading versus uploading of music files through unauthorized file sharing. Two explanations are tested (to explain willingness to participate): (1) restrictedness of use, (2) word of mouth (WOM). Survey results indicate different effects for uploading and downloading behavior. In short, consumers use different heuristics in deciding whether to participate in downloading versus uploading.

2 - Digital Piracy: Trends in the Perception of Consequences
Abbe Forman, Assistant Professor Teaching/Instruction, Temple University, 435 Alter Hall, 1805 N. Broad St, Philadelphia, PA, 19122, United States of America, abbe.forman@temple.edu

Digital piracy continues to be an alarming problem. Attempts to slow or stop the theft of intellectual property have been nearly futile. Many people do not believe that digital piracy is a crime or that they will "get caught". This study represents an analysis of the literature regarding perceived consequences of digital piracy between 2001 and 2009. Additionally, the results of an open ended questionnaire asking specifically about perceived consequences will be presented.

3 - Designing Content Licensing Arrangements for Boundary Management in Hybrid Business Models
Karl Lang, Professor of Information Systems, Baruch College, Zicklin School of Business, City University of New York, Karl.Lang@baruch.cuny.edu, Sirkka Jarvenpaa

Using data from economic experiments and case studies from the music industry we find that boundary management, i.e. managing the organizational tension that the overlapping of commercial and sharing economies create, is a key success/failure factor for hybrid business models that combine elements of the private investment and collective action models. We argue that licensing design specifying the content access and reuse rights for consumers is a critical for effective boundary management.

4 - Running in the Pack vs. Running Alone: When Does It Make Sense to Jointly Develop a Technology?
Nitin Aggarwal, Assistant Professor, San Jose State University, 1 Washington Square, San Jose, CA, 95192-0244, United States of America, aggarwal_n@cob.sjsu.edu

We collect data from 436 experts involved in technology development to confirm that technology is made up of bundles of intellectual property, mostly owned by different entities. The data shows that there are significant transaction costs - search, coordination, and opportunism - involved in assembling the bundle. Initially, these costs are lower for hierarchies, but they gradually increase with complexity, non-substitutability, and IP distribution patterns, thereby making networks economical.

■ WC50

C -Room 11, Level 2- Mezzanine

Information Systems II

Contributed Session

Chair: Narges Kasiri, Assistant Professor, SUNY Oneonta, 2004 E Matthews, stillwater, OK, 74075, United States of America, kasiri@okstate.edu

1 - Differential Privacy in the Context of Masking Numerical Data
Krish Muralidhar, Professor, University of Kentucky, School of Management, Lexington, KY, 40506-0034, United States of America, krishm@uky.edu, Rathin Sarathy

Recently, researchers at Microsoft have proposed a new privacy standard called Differential Privacy. In this study, we evaluate the efficacy of using differential privacy when numerical confidential data is masked.

2 - Analysis of Spamming Behavior at Different Aggregation Levels and Implications for IT Security
Serpil Sayin, Dr., Koç University, Rumeli Feneri Yolu, Sariyer, Istanbul, 34450, Turkey, ssayin@ku.edu.tr, John Quarterman, Manoj Parameswaran, Andrew Whinston

Using e-mail spam data from different blocklist sources, we analyze the observed spamming behavior at the single IP and Autonomous System (AS) levels. Our single IP level study reveals the variability in the spamming tactics employed by different botnets. Our AS level analysis indicates that the distribution of spam contribution is highly skewed across organizations. We discuss the role of a reputation system in alternative incentive mechanisms to address IT security concerns.

3 - When Should Software Firms Commercialize New Products via Freemium Business Models
Marius Florin Niculescu, George Institute of Technology, College of Management, 800 West Peachtree Street NW, Atlanta, GA, 30308, United States of America, marius.niculescu@mgt.gatech.edu, D. J. Wu

Freemium approach, whereby a firm gives away for free a certain level or type of consumption while making money on premium consumption, is spreading fast in the software industry. We advance a multiperiod framework with network externalities in order to describe several freemium business models. We solve firm's optimal pricing strategy under each model, derive conditions when freemium models are superior to conventional for-fee and seeding models, and discuss managerial and policy implications.

4 - Valuing RFID Investment in the Retail Sector: A Real Options Model
Narges Kasiri, Assistant professor, SUNY Oneonta, 2004 E Matthews, stillwater, OK, 74075, United States of America, kasiri@okstate.edu, Ramesh Sharda

The investment in Item-level RFID in the retail sector similar to any other IT investments is associated with high uncertainties in its potential benefits and costs. A real options approach is appropriate to analyze the cost and benefits of the investment problem. We apply a system dynamics simulation technique to generate the parameters of the real options model and discuss various options and scenarios retailers have in implementing item-level RFID in retail operations management.

■ WC51

C -Room 12, Level 2- Mezzanine

Analysis at US Army Aviation and Missile Command (AMCOM)

Sponsor: Military Applications
Sponsored Session

Chair: Wayne Bruno, Director, Command Analysis, U.S. Army Aviation & Missile Command, BLDG 5308, Restone Arsenal, Al, 35898, United States of America, wayne.bruno@us.army.mil

1 - A Method for Determining the Mismatch Between Supply and Demand in the Army Supply Chain
David Berkowitz, Professor of Marketing, University of Alabama - Huntsville, 301 Sparkman Drive, College of Business Administration, Huntsville, AL, 35899, United States of America, berkowd@uah.edu, Lucas Neidert, Al Wilhite, Fan Tseng

Our paper develops a method for determining the mismatch between inventory control point supply and the field level demand for a Class IX item. We identify the characteristics of items that are likely to be in short supply. We determine the probability structure for supply. Then we run a regression based model to help predict demand. Finally we match the results to project a supply on hand at the end of a period.

2 - Demonstrating the Business Case for Condition-Based Maintenance (CBM) in Army Aviation

Josh Kennedy, Chief, Ops Analysis Branch, Command Analysis Directorate, US Army Aviation & Missile Command, Bldg 5308, Redstone Arsenal, AL, 35898, United States of America, josh-kennedy@us.army.mil

The Army's Aviation & Missile Command is pursuing a large-scale CBM program for its helicopter fleet. DoD has directed CBM as a reliability and sustainability driver in life cycle systems management. The objectives for AMCOM's CBM program are: decrease Soldier maintenance burden, increase availability, enhance safety, and reduce costs. However, the investment required for a CBM program is substantial. This presentation outlines how AMCOM made a clear business case for this investment.

3 - Application of Cost-Benefit Analysis (CBA) to Respond to Army Aviation Maintenance Issues

Tina Theiss, Operations Research Analyst, Command Analysis Directorate, US Army Aviation & Missile Command, Bldg 5308, Redstone Arsenal, AL, 35898, United States of America, tina.theiss@us.army.mil

Currently, there is no cyclic Army Aviation sustainment program to mitigate risk associated with the long term effects of airframe aging and use. At the same time, the Army has initiated a thorough CBA process to accompany unfunded requirements, the net result of which should be a strong value proposition stating that the benefits of a new requirement more than justify the costs. This presentation discusses how we applied the CBA process to respond to shortfalls with helicopter maintenance.

■ WC52

C -Room 13, Level 2- Mezzanine

Homeland Security

Contributed Session

Chair: Hiram Moya, PhD Candidate, Texas A&M University, 2807 Henry Ct., College Station, TX, 77845, United States of America, Hiram@tamu.edu

1 - Infrastructure Security via Game Theory

Zhe Duan, Rutgers University, 900 Davidson Road, Apt. 94, Piscataway, NJ, 08854, United States of America, duanzhe@gmail.com, Melike Baykal-Gursoy

Recent attacks in Mumbai, Russia, and the attempted attack in New York city have forced governments to devote significant time and resources to secure infrastructures. In this paper, we study how to secure infrastructures via game theory. The uncertainty of the timing and the location of an attack is alleviated by considering the occupancy level of each location. Zero-sum and non-zero sum games are solved and equilibrium policies are obtained.

2 - Protecting Electric Power Systems From Terrorist Attacks

Vanlapha Santithammarak, PhD Student, Texas Tech University, 2619 19th St. Apt 10, Lubbock, 79410, United States of America, vanlapha.santithammarak@ttu.edu, Milton Smith

Terrorist attacks designed to weaken the economy are increasing concern after 9/11. Electrical power systems should be regarded as likely targets of terrorists due to the most effects of economic activities. The objective of this study is to investigate the methods for protecting from physical attacks and reducing vulnerability in power system networks.

3 - Safe Path Optimization with Local Protection Required

Ruben Dario Yie Pinedo, University at Buffalo (SUNY), Department of Industrial & Systems Engg, 308 Bell Hall, Buffalo, NY, 14260, United States of America, rubenyie@buffalo.edu, Rajan Batta, Moises Sudit

The edges in a network can be exposed to certain events that compromise the safety of the vehicle. To reduce the likelihood of an event protection could be used. This talk will discuss the problem of routing several vehicles from multiple origins to multiple destinations. The network contains zones in which local protection is required. Local escorts are not allowed to leave their jurisdiction zones. The main objective is to minimize the total treat level to which the vehicles are exposed.

4 - A Risk Based Sensor Allocation Problem

Amir Ghafoori, PhD Student, Rutgers University, Department of Industrial and Systems Eng, 96 Frelinghuysen Road, Piscataway, NJ, 08854, United States of America, ghafoori@eden.rutgers.edu

We develop a risk based model for underwater sensor allocation to detect divers. The model investigates various aspects of sensor placement problems for underwater application and attempts to put sensors in the set of candidate grid points. Each sensor type brings its specifications to the model and poses a level of complexity. Finally an optimal scheme of sensor positioning is proposed in order to minimize the average total risk in the field.

5 - Transient Analysis of the Border Crossing Process using Congestion Based Policies

Hiram Moya, PhD Candidate, Texas A&M University, 2807 Henry Ct., College Station, TX, 77845, United States of America, Hiram@tamu.edu

Trade is the U.S. depends on an efficient flow of inspected containers in and out of the border ports of entry (POE), while focusing on security, and being cost effective. This research focuses on all commercial traffic at a southern border POE, where there is a non-steady state, terminating system. Using transient analysis, we present analytical and experimental results of congestion based policies with a fixed number of servers, by implementing a primary inspection station service switch.

■ WC53

C -Room 14, Level 2- Mezzanine

Operations/Marketing Interface II

Contributed Session

Chair: Kunpeng Li, Sam Houston State University, Avenue I, Huntsville, TX, United States of America, kli@shsu.edu

1 - The Effect of Traffic on Retail Store Conversion Rate and Sales

Olga Perdikaki, Assistant Professor, Texas A&M, Mays Business School, College Station, 77843-4217, United States of America, operdikaki@tamu.edu, Jayashankar Swaminathan, Saravanan Kesavan

In this paper, we use proprietary data pertaining to a retailer to study the relationship between traffic and store sales performance, measured as the number of transactions and sales volume. We find that store sales performance exhibits diminishing returns to scale with respect to store traffic and increases in traffic variabilities are associated with declines in store sales performance. Finally, we find that store labor moderates the impact of traffic on store sales performance.

2 - Product Line Decision with Incomplete Information

Michael Lim, Asst Professor, University of Illinois, 350 Wohlers Hall, 1206 S. 6th Street, Champaign, 61820, United States of America, mlim@illinois.edu

We study manufacturer's product line length decision under information asymmetry where retailer has a private information regarding local consumers' preference. We use mechanism design to construct a contract that elicits retailer's information rent. Our analysis identifies the condition in which the manufacturer have more (or less) incentive to extend the product line compared to full information case. We will also discuss some insights and policy implications from the model.

3 - Return Policies and Informational Tools in Experience Goods Markets

Eylem Koca, University of Maryland, College Park, Smith School of Business, VMH 3330, College Park, MD, 20740, United States of America, ekoca@umd.edu, Gilvan Souza

We investigate the role of return policies and informational tools provided by the seller in consumer purchasing behavior and on the overall market outcome. We build a model of consumer learning and analyze a seller's decision process in a two-period setting. We attain significant analytical findings with no distributional assumptions, and fully study the joint optimization problem under uniform valuations. Finally, we study competition in a duopoly setting, and look at some extensions.

4 - Shelf Space Competition Between Store and National Brands

Shu-Jung Sunny Yang, Lecturer in Management, The University of Melbourne, Level 10, 198 Berkeley Street, Melbourne, 3010, Australia, sunnyy@unimelb.edu.au, Chia-wei Kuo, Pei-Ju Lu

Shelf space allocation is one of the retailer's most challenging operational decisions. We propose a game-theoretic model in which one retailer, acting as a leader by deciding the total shelf space available and selling both national and store brands, maximizes her category profit, and one national-brand manufacturer, acting as a follower, maximizes his own profit. Our analysis suggests that the allocation of the shelf space depends on two thresholds of total shelf space for both brands.

5 - Optimal Price Reduction Strategy in Product Sales

Kunpeng Li, Sam Houston State University, Avenue I, Huntsville, TX, United States of America, kli@shsu.edu, Chongqi Wu

Consumers with high valuation are willing to pay a higher price than those with low valuation. Therefore, firms should make sure that consumers with high valuation buy first. Later on, firms reduce the product price and sell to consumers with low valuation. Under such a setting, our paper investigates many important questions in the decisions of product design and introduction.

■ WC54

C -Room 15, Level 2- Mezzanine

Innovation Management for Sustainability

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Hsueh-Ming Wang, Associate Professor, University of Alaska Anchorage, ESM Department 3211 Providence Dr., Anchorage, AK, 99508, United States of America, afhsw1@uaa.alaska.edu

1 - Curriculum Development for the Innovation Management Program for Sustainability

Seong Dae Kim, Assistant Professor, University of Alaska Anchorage, PM Department at University Center, Room 155, 3901 Old Seward Highway, Anchorage, AK, 99503, United States of America, afsdk1@uaa.alaska.edu, Hsueh-Ming Wang

The curriculum is focusing on the sustainability through the innovation of quality of life. This program will help students for building industry careers as system designers, architects, project managers, developers, and entrepreneurs and providing students with broad understanding of green engineering, energy saving lighting, and innovation of quality of life as well as to stimulating the development and application of energy efficient lighting, green technologies with quality innovation.

2 - The Critical Factors for Decision-making of the Technology Policies of the Industrialized Countries for Municipal Solid Waste Management

Leslie Simmons, PhD Student, University of Alaska, 3211 Providence Dr, Anchorage, AK, 99508, United States of America, aflfs@uaa.alaska.edu, Hsueh-Ming Wang

In the United States of America, landfill disposal is a major method to handle municipal solid waste. It may generate pollutants and carbon emissions in the environment. Some industrialized countries, such as Germany, Denmark, and Japan, are using technologies to reduce, reuse, recycle, or combust to limit amounts of land disposed municipal solid waste. Technology policies from governments generate different outcomes of solid waste management. Many factors may affect policy-making process. This research evaluates critical factors that impact technology policies by surveying and comparing results in industrialized countries. Critical impact factors for decision-making priorities differ between the USA and other industrialized countries. These different technology policies may affect environmental protection and carbon emissions in the future.

3 - Cognitive Oriented Integration for Innovation Management

Hsueh-Ming Wang, Associate Professor, University of Alaska Anchorage, ESM Department 3211 Providence Dr., Anchorage, AK, 99508, United States of America, afhsw1@uaa.alaska.edu, Muchiu Chang

The acceptance of a new product depends on the market needs of the innovation and service compliance through the product life. We develop an innovation management process by cognitive based consumer behaviors integration. It includes: new ideas to lead the customer needs, adopting new technology in design, patent mapping market anaylsis, and life cycle management. Modeling simulation is a robust solution to virtually validate and verify the life cycle behaviors of various design concepts.

4 - Agility Management for the Project Sustainability

Peter Lang, Graduate Student, University of Alaska Anchorage, ESM Department, 3211 Providence Dr., Anchorage, AK, 99508, United States of America, peter@alaskadatatech.com, Hsueh-Ming Wang

The projectized organization surrounding culturalvalues addresses concerns of balancing versus optimizing various value propositioning factors. Information Technology for project portfolios selection processes may profit by looking across a variety of fields ranging from project management to the cognitive sciences to increase project agility. The solutions may obtain by meta-modeling balancing, aligning, and integrating a proposed adaptive risk management approach.

■ WC55

C -Room 16, Level 2- Mezzanine

Innovation and the Economy

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Erica Fuchs, PhD, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 129, Pittsburgh, PA, 15217, United States of America, erhf@andrew.cmu.edu

1 - Patents, Materials Transfer Agreements (MTAs), and the Flow of Scientific Knowledge

David Mowery, Professor, University of California Berkeley, HAAS, mowery@haas.berkeley.edu, Neil Thompson, Arvids Ziedonis

How does university involvement in academic patenting affect academic science? This paper extends the work of Murray and Stern (2007) to cover a broader sample of published scientific papers in the biomedical and other disciplines, and examines the effects of both patenting and material transfer agreements (MTAs) on citations to scientific papers.

2 - Economic Downturns, Inventor Careers, and Technology Trajectories in the U.S

Wunmi Akinsanmi, PhD Student, Carnegie Mellon University, 5000 Forbes Avenue, Baker Hall 129, Pittsburgh, PA, 15217, United States of America, eyidearie@gmail.com, Erica Fuchs

This research explores the relationship between the telecommunications bubble burst and the quantity, direction and locus of U.S. innovation. We focus on optoelectronics, a general purpose technology with applications in energy, biomedical, telecommunications, computing and military. Leveraging USPTO patents and inventor CVs, we analyze how inventors' pre-bubble productivity, mobility, social capital and degree of specialization influence these same post-bubble and thereby the national trend.

3 - Intellectual Property, Prior Knowledge & New Firm Survival

Sonali Shah, Buerk Fellow and Assistant Professor, University of Washington, Box 353200, Seattle, WA, 98195, United States of America, skshah@u.washington.edu, Sheryl Winston Smith

We examine the joint effects of founders' prior knowledge and intellectual property protection on the survival of young firms. We examine three different sources of a founder's prior knowledge: prior industry experience, prior entrepreneurial experience, and prior entrepreneurial experience in the same industry. Taken together, our findings show the importance of patents as strategic, as well as appropriability, tools and are in-line with evolutionary economic theory.

■ WC56

C - Room 1, Level 1

Simulation and Optimization I

Contributed Session

Chair: Honggang Wang, Stanford University, Department of Energy Resources Engi, Stanford, CA, 94305, United States of America, honggang@stanford.edu

1 - Stochastic Dominance Based Ranking and Selection in Simulation

Demet Batur, University of Nebraska- Lincoln, 175 Nebraska Hall, Lincoln, NE, United States of America, dbatur2@unl.edu, Fred Choobineh

We present a ranking and selection procedure where simulated systems are compared based on the stochastic dominance relationship of a performance metric of interest. The system which stochastically dominates all other systems is deemed as the best system. If there is not a unique best system, but a number of systems with crossing distribution functions, then the proposed procedure selects a set of nondominated systems with a probability of correct selection guarantee.

2 - Modeling the Relative Efficiency of Job Assignment in Differing Social Structures

Paul Kerl, Georgia Institute of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, paul.kerl@gatech.edu, Joel Sokol

In the recent and distant past, people have found their job in many different ways, from inherited positions to national testing and matching. We use stylized assignment models to examine several social structures and measure the relative benefit of structural characteristics. These characteristics include job inheritance, split social structures, heuristic selection versus optimal selection of jobs, job mobility, and the marginal value of information about person-job matching.

3 - Use of Retrospective Optimization for Placement of Oil Wells Under Uncertainty

Honggang Wang, Stanford University, Department of Energy Resources Engi, Stanford, CA, 94305, United States of America, honggang@stanford.edu, David Echeverri Ciaurri, Louis Durlofsky

Determining well locations in oil reservoirs under geological uncertainty remains a challenging problem in field development. We simulate (with a reservoir simulator) multiple model realizations to estimate the expected field performance for a certain well placement. The presented RO framework generates a sequence of sample-path problems with increasing sample sizes. The numerical results show that the RO algorithm finds a solution yielding a 70% increase in the NPV for the problem considered.

4 - Water Quality Monitoring Network Design using Optimization via Simulation

Chuljin Park, PhDStudent, Georgia Technology of Institute, 765 Ferst Dr NE, Main Building #124, Atlanta, GA, 30332, United States of America, cpark41@mail.gatech.edu, Seong-Hee Kim, Ilker Telci, Mustafa Aral

The problem of designing a water quality monitoring network for river systems is to find the optimal location of a finite number of monitoring devices that minimizes the expected detection time of a contaminant spill event with good detection reliability. We set a stochastic constraint on detection reliability and solve the monitoring design problem using optimization via simulation.

■ WC57

C - Room 2, Level 1

Risk Analysis

Contributed Session

Chair: John Chachere, Senior Computer Scientist, Stinger Ghaffarian Technologies, 1060 Arbor Road, Menlo Park, CA, 94025, United States of America, john.m.chachere@nasa.gov

1 - Why Do Groups Cooperate More Than Individuals to Reduce Risks?

Min Gong, Columbia University, 1190 Amsterdam Ave, 406 Schermerhorn Hall - MC 5501, New York, NY, 10027, United States of America, mingong@gmail.com, Jonathan Baron, Howard Kunreuther

We find that groups are less cooperative than individuals in a prisoner's dilemma, but are more cooperative than individuals in a stochastic version of the game.Three processes are tested: risk concern, cooperation expectation, and social pressure. Data shows that guilt aversion and blame avoidance cause groups to be more risk concerned than individuals, which drives groups to cooperate to reduce risks. Groups also have higher cooperation expectations for their counterpart than individuals have.

2 - Decision Support for Inland Waterways Emergency Response

Leily Farrokhvar, University of Arkansas, 4207 Bell Engineering, W Dickson Street, Fayetteville, AR, 72701, United States of America, lfarrokh@uark.edu, Heather Nachtmann, Ed Pohl

Emergency planning involving transportation resources requires thorough contingency planning in case of route destruction due to natural or man-made events. Inland waterways can provide emergency transportation to a large area of the United States. We explore the potential for communities to benefit from inland waterway emergency response through the development of a decision support framework to support an inland waterway-based emergency response system.

3 - Quantitative Method for Analyzing Engineering Defect Risks in Projects

John Chachere, Senior Computer Scientist, Stinger Ghaffarian Technologies, 1060 Arbor Road, Menlo Park, CA, 94025, United States of America, john.m.chachere@nasa.gov

Engineering defects often cause complex systems to fail. I provide a quantitative model of defects linking causes in an upstream development project to effects on downstream operations failure risks. The Model integrates: a simulation of the development project, a probabilistic analysis of operations failure risks, and a rational model of project decisions (e.g., organizational structure) and product decisions (e.g., subsystem redundancies). I evaluate an example project.

■ WC58

C - Room 3, Level 1

Financial Engineering I

Contributed Session

Chair: Arun Chockalingam, Visiting Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, achockal@purdue.edu

1 - Margining Option Portfolios by Offsets with Two, Three and Four Legs

Dmytro Matsypura, Dr, The University of Sydney, Merewether Building H04, Sydney, 2006, Australia, dmytro.matsypura@sydney.edu.au, Vadim Timkovsky

As shown in [Rudd and Schroeder, 1982], the problem of margining option portfolios where option spreads with two legs are used for offsetting can be solved in polynomial time by network flow algorithms. In this paper we extend this result to the case where option spreads with three and four legs can also be used for offsetting and propose a general method of margining option portfolios.

2 - Cross Validation and Various Techniques in Utilizing Financial Time Series Data for Model Validation

Wing-Ho Choi, Gradient Analytics, 14614 North Kierland Boulevard, Scottsdale, AZ, 85254, United States of America, wc447@cornell.edu, Derek Koh

When modeling financial data using insamples and outsamples, one has to account for the information overlap of return information which can create an optimistic bias on results. This is typically done by imposing a blackout period between in and out samples. The period is dependant on the return horizon where a long horizon results in a larger blackout period. This paper modifies the cross-validation technique and explores methods that optimizes the use of data available for financial modeling.

3 - New Estimation Techniques for Fractional Brownian Motion with Applications to Finance

Daniel Scansaroli, PhD Candidate, Lehigh University, 200 West Packer Ave., Industrial Engineering Department, Bethlehem, PA, 18015, United States of America, djse@lehigh.edu, Robert H. Storer, Vladimir Dobric

We explore financial applications of fractional Brownian motion and present two new methods of estimating the parameters of this process based on ergodic theory. We evince that in a fractional Brownian market, the typical assumption of independent increments results in an underestimation of market risk and a term structure of volatility. We conclude by applying our new technique to the equity market to show the behavior of the Hurst index that over the last 35 years.

4 - Moving-boundary Approaches for American Security Valuation

Arun Chockalingam, Visiting Assistant Professor, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, achockal@purdue.edu, Kumar Muthuraman

Pricing American options gives rise to a free-boundary problem in PDEs (PIDEs if the asset price process is discontinuous). We present a computational scheme that solves for the option price and optimal-exercise policy by converting the free-boundary problem into a sequence of fixed-boundary problems. This scheme is general enough to handle a variety of market models. We also discuss error bounds for options priced with sub-optimal exercise policies and the implications of these bounds.

■ WC61

H - Room 400, 4th Floor

Operations Management VII

Contributed Session

Chair: Jieling Han, PhD Student, Department of ISOM / University of Washington, Department of ISOM, Box 353200, University of Washington, Seattle, WA, 98115, United States of America, hanjl@uw.edu

1 - Optimal Pallet Loading Problem with Complex Stacking Constraints

Amit Garg, Senior Logistics Engineer, Penske Logistics, amit.garg@penske.com, Vishwa Ram, Prasad Natarajan, Kevin Troyer, Mitch Plesha

Optimal Pallet Loading Problem is an important problem in the logistics industry. We investigate a particular problem for a food manufacturer where several categories of items need to be placed on the least number of pallets. Each item category primarily differs with other categories in the stacking constraints and product charactrestics. There are also specific business rules that dicatate how any two or more item categories can be placed on the same pallet. Current solution techniques and available commerical software solutions are unable to solve this problem because of the pecularities of the business rules and packing preferences in near real time for several thousand orders every day. Therefore, we implement a heuristc solution that takes various stacking rules and packing preferences and minimizes the number of pallets required for each order.

2 - Profit- vs. Cost-orientation in the Newsvendor Problem: Insights From a Behavioral Study

Sebastian Schiffels, Technische Universitaet Muenchen, TUM School of Management, Muenchen, 80333, Germany, sebastian.schiffels@wi.tum.de, Jens Brunner, Rainer Kolisch, Andreas Fuegener

Our research investigates differences in the behavior of individuals in a profit- vs. a cost- orientated newsvendor problem. Our hypothesis is that individuals order more in the cost orientated than in the profit orientated newsvendor setting. Previous studies (e.g. Schweitzer and Cachon 2000) show that individuals deviate from the expected optimal decision in the newsvendor game. In fact, they tend to order less (more) than the expected profit maximizing order quantity if per unit profit margin is high (low). To test our hypothesis we set up a laboratory study which takes into account the profit or the cost perspective and three critical ratios. Our results confirm our hypothesis as well as the findings of previous studies. In each of the defined critical ratios the average order quantity in the cost orientated newsvendor game is significantly higher than in the profit orientated problem. The results imply that people underlie systematical different biases when facing profit and cost orientated situations.

3 - Dynamic Scheduling Policy in a Make-to-stock System with Two Demand Classes of Different Variability

Jieling Han, PhD Student, Department of ISOM / University of Washington, Department of ISOM, Box 353200, University of Washington, Seattle, WA, 98115, United States of America, hanjl@uw.edu, Apurva Jain

We consider the dynamic scheduling policy in a make-to-stock queue with a single server, exponential processing times, standard holding and backorder cost rates, and two demand classes that differ in their variability. We partially characterize the optimal scheduling policy and propose heuristics. We then analyze the case where the centralized server has information about the arrival process of the more variable demand class and show the value of this information.

■ WC62

H - Room 402, 4th Floor

Transportation, Operations

Contributed Session

Chair: Rodrigo Britto, University of Maryland, 3909 Stoconga Drive, Betlsville MD 20705, United States of America, rbritto@rhsmith.umd.edu

1 - Mapping Transportation Waste

Bernardo Villarreal, Professor, Universidad de Monterrey, I. Morones Prieto 4500 Pte, San Pedro Garza Garcia, NL, 62638, Mexico, bvillarreal@udem.edu.mx

Value stream mapping was developed originally to identify and eliminate waste in the manufacturing area. This is extended to design improvement programs oriented to eliminate waste for transport operations. The definition of several types of waste specific to transportation with the goal of improving efficiency as the relevant performance measure is suggested. Application to real examples is provided.

2 - An Integrated Model for Resource Allocation and Scheduling in a Transshipment Container Terminal

Nabil Nehme, PhD Candidate, American University of Beirut, P.O. Box 11-0236, Riad El Solh, Beirut 11, Beirut, Lebanon, nhn02@aub.edu.lb, Isam Kaysi, Farah Mneimneh, Bacel Maddah

This paper considers the coordination between quay and yard sides in a transshipment process at a container terminal. A model is developed to minimize the number of cranes used and to determine the optimal schedule for unloading containers for a vessel. Several insights are drawn illustrating the importance of coordination.

3 - A New Packing Heuristic Based Approach for the VRP with Three-dimensional Loading Constraints

Yi Tao, PhD Candidate, Sun Yat-sen Business School, Sun Yat-sen University, No.135 West Xinggang Road, Guangzhou, 510275, China, kenjimore@gmail.com, Fan Wang

We consider the Three-Dimensional Loading Capacitated Vehicle Routing Problem which combines the routing of vehicles and the loading of three dimensional shaped goods into the vehicles while minimizing the total cost. We propose a least waste packing heuristic based approach for solving the loading subproblem, which is iteratively invoked by a simple tabu search algorithm for the routing. Numerical experiments on test instances have shown our method outperforms existing ones.

4 - Comparing Organizational Forms in the Trucking Industry

Johan Lundin, PhD Student, Lund University, Box 118, Lund, 22100, Sweden, johan.lundin@tlog.lth.se, Fredrik Eng Larsson

Studies on organizational forms pertaining to efficiency show that pricing and deciding upon the right level of output can vary between forms (Porter and Scully, 1987). Never before has the trucking been studied from this perspective, which is why we focus on exploring the truck investment decision based on economic efficiency. The methodology draw on industrial organization and game theory using a two-stage supply chain model under deterministic demand expressed as a Cournot competition model.

5 - Assessment of the Impact of Undesirable Outputs on the Productivity of US Motor Carriers

Rodrigo Britto, University of Maryland, 3909 Stoconga Drive, Betlsville, MD, 20705, United States of America, rbritto@rhsmith.umd.edu, Thomas Corsi

This research evaluates the impact of undesirable outputs (i.e; crashes and fatalities) on the productivity of motor carriers during the years 1999-2003. The non-parametric direction output distance function and an additive DEA model are used to model both desirable and undesirable outputs. Tobit regression is applied in a second stage to analyze the drivers of efficiency.

■ WC63

H - Room 404, 4th Floor

Decision Analysis V

Contributed Session

Chair: Onur Bakir, Visiting Assistant Professor, Bilkent University, Bilkent Universitesi, Endüstri Mühendisligi B˜lümü, Ankara, 06800, Turkey, nonur@bilkent.edu.tr

1 - Deciding on the Decision Frame (The Most Important Decision of the Analysis)

Roberto Ley-Borras, Director, Consultoria en Decisiones, Oriente 13 A No. 1122, Orizaba, Ver., Mexico, rley@decidir.org

Identifying the right decision frame is generally regarded as a critical part of a decision analysis, but there are few guidelines on how to achieve that. This talk presents a simple algorithm and some advice on generating decision frames and selecting the one that is best for the decision-maker's current priorities and circumstances. Our proposed approach is considering the selection of the decision frame a decision situation by itself and using DA tools to gain clarity on the best frame.

2 - Modified Repertory Grid Approach to Developing Criteria for MCDM

Eric Johnson, Decision Strategies, Inc., 10260 Westheimer Road, Suite 250, Houston, TX, 77079, United States of America, ERJohnson@DecisionStrategies.com

Multi-criterion decision making has been widely used for decisions where stakeholders do not agree on a single overriding objective. Assessment of criterion weights and scores is well understood. But all too often the criteria are too vague to be properly judged, or are understood differently by different judges, leading to results that aren't compelling or don't even make sense. This talk describes a novel protocol for eliciting objectives, and illustrates its benefit in a disguised case.

3 - A Multiple Criteria Sorting Method Based on Support Vector Machines

Esra Karasakal, Industrial Engineering Department, Middle East Technical University, Ankara, 06530, Turkey, esra@ie.metu.edu.tr, Asli Duman

In this study we develop a method based on Support Vector Machines (SVM) for multiple criteria sorting problems. We modify SVM models to handle preference ordering of classes. We compare the proposed method with SVM models on several example problems.

4 - Risk Aversion and Value of Information Under Various Approaches

Onur Bakir, Visiting Assistant Professor, Bilkent University, Bilkent Universitesi, Endüstri Mühendisligi Bölümü, Ankara, 06800, Turkey, nonur@bilkent.edu.tr

A previous study explored the relationship between the value of information and risk aversion using the buying price approach. In this presentation, we discuss whether similar conclusions hold for other approaches to evaluate information. The information acquisition problem is analyzed in a two-action lottery setting. We derive conditions under which there exists a monotonic relationship between the decision maker's risk tolerance and the value of information.

■ WC64

H - Room 406, 4th Floor

Health Care, Processes

Contributed Session

Chair: Imran Hasan, Purdue University, 315 N Grant St., West Lafayette, United States of America, ihasan@purdue.edu

1 - Estimation of Service Value Function

Geun Wan Park, PhD Candidate, Korea University Businsess School, Korea Universtiry, Anam-dong, Seongbuk-gu, Seoul, 136-701, Korea, Republic of, gw_park@hotmail.com, Kwang-Tae Park

We consider a dental clinic service as the series of service stages. We want to estimate service value function of each service stage. The function is usually linear function according to preexisting literatures. However, we think the function can be different based on different service stage (for example, quadratic function or cubic function, etc.) These functions to be estimated will be useful to determine the service value of the dental clinic service appropriately.

2 - A Survey of the Unintended Consequences of Implementing Health Information Technology

Shinyi Wu, Assistant Professor, University of Southern California, 3715 McClintock Ave., GER 240C, Los Angeles, CA, 90089, United States of America, shinyiwu@usc.edu, Caitlin Hawkins

Health information technology (HIT) has demonstrated many benefits but unintended consequences (UCs) of its implementation cause barriers to realization. We analyzed 215 responses to an online survey to discover the types and causes of UCs experienced by various settings of healthcare organizations and how they coped with them. The results showed that UCs persist over years and the most frequent UCs are workflow problems caused by workarounds, software design, and lack of stakeholder engagement.

3 - Utility of Patient Length of Stay Information

Imran Hasan, Purdue University, 315 N Grant St., West Lafayette, United States of America, ihasan@purdue.edu, Yuehwern Yih

Emergency Department Crowding has become a major problem in ED in the US.One of the reasons cited for this problem is the unavailability of beds in the intensive care unit.A large number of models for the prediction of length of stay have been developed, but there has been no research pertaining to the advantages of such predictive models.Our goal is to evaluate the impact of knowing the LOS in advance, and how it can help in the planning of admissions and capacity decisions in the ICU.

■ WC65

H - Room 408, 4th Floor

Inventory Management VI

Contributed Session

Chair: Ozden Cakici, PhD Student, University of Rochester, Carol G Simon Hall 4th Floor, Rochester, NY, 14627, United States of America, engin.cakici@simon.rochester.edu

1 - Managerial Application of Reducing Lead Times on Safety Stock

Zhi Tao, PhD Student, Kent State University, Dep. of M&IS, Kent, 44242, United States of America, ztao@kent.edu

In this paper, I extend Ever's paper (1999) by applying it to normal distribution of lead time and demand and making interactive graphs to show the decision rule of reducing safety stock based on the coefficient of variation of demand. Implication of the findings on vendor managed inventory is further explored.

2 - Comparison of Continuous and Periodic Review Inventory Policies with Continuous Time Costing

Ozden Cakici, PhD Student, University of Rochester, Carol G Simon Hall 4th Floor, Rochester, NY, 14627, United States of America, engin.cakici@simon.rochester.edu, Harry Groenevelt, Abraham Seidmann

We develop a unified analysis characterizing both periodic and continuous inventory review policies assuming a general convex inventory related cost function and stationary demand with independent increments. The use of continuous costing allows us to correctly compare the economic performance of a variety of periodic and continuous review policies, while also providing the ability to assess the impact of tactical measures like lead time reduction and review policy changes.

■ WC66

H - Room 410, 4th Floor

Miscellaneous Applications of Operations Research

Contributed Session

Chair: Scott Parr, Researcher, Florida Atlantic University, 777 Glades rd., Boca Raton, FL, 33431, United States of America, sparr1@fau.edu

1 - Sequential Testing of K-out-of-n Systems Under Precedence Constraints

Tonguç Unlüyurt, Sabanci University, Tuzla, Istanbul, Turkey, tonguc@sabanciUniversityedu, Elif Ozdemir

We consider the minimum expected cost sequential testing problem for k-out-of-n systems under precedence constraints. Mainly the problem is to find a feasible strategy that produces the minimum cost binary decision tree that evaluates the k-out-of-n function at hand when it is costly to learn the values of individual variables. We summarize the results from the literature and report our initial results of the heuristic algorithms that we develop.

2 - Transit Signal Priority for Emergency Evacuation

Scott Parr, Researcher, Florida Atlantic University, 777 Glades rd., Boca Raton, FL, 33431, United States of America, sparr1@fau.edu, Evangelos Kaisar

This research answers the question, during an urban evacuation should regional planners allow transit units signal priority when police assisted traffic controls are not an option. A case study of Washington D.C. shows allowing transit signal priority (TSP) during an urban evacuation has little to no effect on evacuation clearance time or evacuee travel time. Furthermore, four non-prioritized units are required to accomplish the task of three prioritized vehicles.

3 - An Integration of Genetic Algorithm and GIS For Sensor Optimization

Berna Dengiz, Professor, Baskent University, Baglica Kampusu Eskisehir Road 20.km, Etimesgut, Ankara, 06530, Turkey, bdengiz@baskent.edu.tr, Derya Oktay, Orhan Dengiz

This study presents a geographical information system (GIS) based procedure for the optimization of sensor locations and sensor location parameters using genetic algorithms (GAs). The considered problem which is a special case of the well-known setcovering problem is NP-complete. A sensor siting optimization is an integrated system that consists of objects used in numerous subjects which can be called as sensor, like bare eye, camera, radar, radio, base station terminal and sensor coverage area can be defined as viewshed (the total visibility of visible points). The sensor operating parameters are as follows: location, height , range, azimuth, vertical viewing angles, tilt and pitch values. Each different configuration of these parameters results in different coverage area for a sensor. In this work, the optimization of sensor siting mainly focus on finding out sensor sites and sensor running parameters on terrain at the area of interest which provides maximum coverage.

■ WC67

H - Room 412, 4th Floor

Simulation III

Contributed Session

Chair: Javier Faulin Fajardo, Professor, Public University of Navarre, Campus Arrosadia, Pamplona, 31006, Spain, javier.faulin@unavarra.es

1 - Simulation of Contribution Rates to Fund Potential U.S. State and Federal Parental Leave Policies

Beth Neary, PhD Student, Indiana University, 1315 E. 10th St. - Room 341, Bloomington, IN, 47405, United States of America, bneary@indiana.edu

The United States is the only developed nation that lacks a national paid parental leave program. Several U.S. states, including California, New Jersey, and soon Washington, have instituted their own benefit programs. This project seeks to inform state and federal policy development by simulating the costs of potential paid leave provisions. Specifically, Monte Carlo simulation estimates payroll tax contribution rates for varying benefit period lengths, subsidy levels, and weekly caps.

2 - Simulating Team Selection Strategies for Youth Sports Programs

Stephanie Marhefka, Undergraduate Researcher, University of Arkanas, Department of Industrial Engineering, Fayetteville, AR, 72701, United States of America, smarhefk@uark.edu, Scott J. Mason, Ed Pohl

In this presentation we discuss several strategies for forming youth sports teams. The goal is to find a strategy that yeilds a balnced set of teams and accounts for pairing of coaches with children as well as skill levels of children. An Excel-Based VBA model is used to compare three player allocation heuritic models. Once teams are selected a season is simulated and the records of the teams are analyzed for balance. One strategy is shown to be superior.

3 - Calibration of Computer Models using Stochastic Approximation
Szu Hui Ng, Department of Industrial and Systems Engineering National University of Singapore, ISE Department, NUS, Singapore, isensh@nus.edu.sg

Computer models are widely used to simulate real processes. However, there always exist some parameters which are unobservable in the real process but need to be specified in the model. The procedure to adjust these unknown parameters to fit the model to observed data is known as calibration. Here, we propose an effective and efficient algorithm based on the stochastic approximation approach for calibration. We demonstrate its feasibility and apply it to a disease microsimulation model.

4 - Simulation of Multimodal Transport of Goods Between the Regions Atlantic and Mediterranean in Spain
Alejandro Garcia del Valle, Professor, University La Coruna, Mendizabal s/n, Ferrol, 15403, Spain, agvalle@udc.es, Diego Crespo Pereira, Rosa Rios Prado, David del Rio Vilas, Javier Faulin Fajardo

The roads congestion and environmental impacts they generate are a significant problem in developed countries. Spain has road, rail and sea: it is therefore crucial to study the multimodal transport. The sea-road inter-modality presents an interesting case of freight transport simulation. We will study how the goods could be distributed among the existing infrastructure. The proposed simulation model will address the transportation costs and the mechanisms of choice for users.

■ WC68

H - Room 415, 4th Floor

Strategy/Strategic Planning I

Contributed Session

Chair: Dale Amburgey, Director of Enrollment Analysis, Saint Joseph's University, 5600 City Avenue, Philadelphia, PA, 191931, United States of America, dale.amburgey@sju.edu

1 - Temporal Fit, Misfit, and Performance: Testing Pace Entrainment in the Movie Production Industry
Miles Zachary, Texas Tech University, RCOBA Box 42101, Lubbock, TX, 79409, United States of America, miles.zachary@ttu.edu, Jeremy Short, Tyge Payne

Entrainment theory is concerned with the effects of pace and/or phase synchronizations of two or more activities within a system. This paper utilizes entrainment theory to develop hypotheses and longitudinally test a model of temporal fit, misfit, and performance in the movie industry in order to examine the understudied and elusive role of time and timing's relationship to organizational performance.

2 - Competitive Dynamics in Buyer-supplier Relationships
Yan Emma Liu, The University of Melbourne, Level 10, 198 Berkeley Street, Parkville, Melbourne, Australia, yanliu@unimelb.edu.au, Shu-Jung Sunny Yang

This paper studies the impact of co-optitive awareness on buyer-supplier relationships. We develop a behavioral game-theoretic model, based on prospect theory, to investigate the motivation of vertical (dis)integration. Our analysis shows that value creation is directly proportional to downstream organization redundancy and value appropriation is influenced by upstream organization redundancy. Our research highlights the risk of ignoring behavioral drivers in decision making.

3 - The Stakeholders' Involvement in the Strategic Planning Process
Baris Carikci, TUBITAK, Kocaeli, Kocaeli, Turkey, bcarikci@yahoo.com

The tendency of Turkish public organization in favor of strategic management has become a apparent fact in Turkey. The aim of the paper is to explain the tools to uncover the relation between a successful strategic management process and stakeholders' involvement in the examples of distinguished Turkish public institutions. With these basic tools, public sector can improve the tools they use to initiate their stratagic management programs.

4 - Using Business Intelligence in College Admissions: A Strategic Approach
Dale Amburgey, Director of Enrollment Analysis, Saint Joseph's University, 5600 City Avenue, Philadelphia, PA, 191931, United States of America, dale.amburgey@sju.edu, John Yi

Data from first-year enrolling students were analyzed to develop predictive models. A decision tree analysis, a neural network analysis, and a multiple regression analysis were conducted to predict each student's GPA at the end of the first year of academic study. Overall model performance was evaluated by using the average square error. Suggestions for future analysis include expansion of the study to include more student-centric variables and to evaluate GPA at other student levels.

■ WC69

H - Salon F, 6th Floor

Reverse Logistics I

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Theresa Barker, PhD, University of Washington, Box 352650, Seattle, WA, 98115, United States of America, barkertj@u.washington.edu

1 - Coordination in Reverse Supply Chains: A System Dynamics Approach
Fereshteh Mafakheri, PhD Candidate, HEC Montreal, Montreal, QC, Canada, fereshteh.mafakheri@hec.ca, Fuzhan Nasiri

A reverse supply chain is dealing with recovering a maximum value from products at the end of their life cycle by promoting recycling, re-manufacturing, refurbishing, and reusing activities. The objective is to protect the environment while creating profit through material or energy recovery. In this paper, we explore a System Dynamics approach to investigate the benefits of coordination between various parties involved in a reverse supply chain for used printer cartridges.

2 - Incentives and Reverse Logistics Channels with Remanufacturing
Chester Xiang, Assistant Professor, Clarkson University, 8 Clarkson Ave, Potsdam, NY, 13699, United States of America, cxiang@clarkson.edu, Dennis Yu

We study a closed-loop supply chain with remanufacturing. The customer demand is divided into two segments, i.e., business and individual customers, which show different responses to incentives of returning used products. The reverse logistics channels exhibit economies of scale. A third party can be used as a used-product collecting agent. We investigate the manufacture's incentive schemes, reverse logistics channel strategies, and resulting financial and social impacts.

3 - Part Recovery Under Quality and Demand Uncertainty with Environmental Costs
Gonca Yildirim, University of Florida, University of Florida, Gainesville, FL, 32611, United States of America, gonca@ufl.edu, Elif Akcali, Pelin Bayindir

We consider acquisition and stocking decisions, motivated by the operations of 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 model uncertainties in demand and quality classification of the parts and include environmental fees that create a non-negligible tradeoff against the operational costs in acquisition and stocking decisions.

4 - The Impact of Legislation on Product Recovery: Reuse or Recycle?
Ibrahim Karakayali, Post-doctoral Research Fellow, McGill University, Desautels Faculty of Management, 1001 Sherbrooke St. West, Montreal, QC, H3A1G5, Canada, ibrahim.karakayali@mcgill.ca, Luk Van Wassenhove, Tamer Boyaci, Vedat Verter

In this study, we develop stylized models to assess the effects of material recovery targets (induced by legislation such as WEEE) on industry decisions pertaining to product reusability and recycling. We conduct a comparative analysis of centralized setting where there is cannibalization among the new and the remanufactured products. Our analytical framework also incorporates multiple stakeholders including the OEM, consumers, regulator, and environmentally conscious groups.

■ WC70

H - Salon G, 6th Floor

Fleet-Level Environmental Evaluation of New Aircraft and Technologies

Sponsor: Aviation Applications
Sponsored Session

Chair: William Crossley, Professor, Purdue University, School of Aeronautics and Astronautics, 701 W. Stadium Ave, West Lafayette, IN, 47907-2045, United States of America, crossley@purdue.edu

1 - Evaluating Future Environmental Impact of US Aviation via System Dynamics and Resource Allocation
William Crossley, Professor, Purdue University, School of Aeronautics and Astronautics, 701 W. Stadium Ave, West Lafayette, IN, 47907-2045, United States of America, crossley@purdue.edu

This study integrates system dynamics (SD) and resource allocation (RA) to evaluate environmental impact of new aircraft and technologies. SD models observed aviation trends and behaviors like order-delivery, price-demand elasticity, and environmental policy dynamics. RA determines the fleet mix to maximize airline profits subject to constraints. Results illustrate the impact of demand, policies, and new aircraft technologies on emissions and noise over the 2005-2040 period.

2 - Revenue-based Allocation Model for Fleet-level Environmental Impacts of Airline Operations

Muharrem Mane, Post-doctoral Researcher, Purdue University, School of Aeronautics and Astronautics, 701 W. Stadium Ave, West Lafayette, IN, 47907-2045, United States of America, mane@purdue.edu, Dan DeLaurentis, William Crossley

This work uses a resource allocation model of airline operations to estimate the impact that new technology and new aircraft have on fleet-level CO2 and NOx emissions and airport noise. To approximate airline decision-making, we created a simplified revenue model based on flight frequency and trip length. Using this in the resource allocation objective function, we can approximate airline operations and study the impact of aircraft-specific improvements on fleet-level environmental metrics.

3 - Decomposition Approach for Aircraft Allocation Under Environmental Considerations

Isaac Tetzloff, Graduate Student, Purdue University, School of Aeronautics and Astronautics, 701 W. Stadium Ave, West Lafayette, IN, 47907-2045, United States of America, isaact@purdue.edu, William Crossley

Previous work to allocate aircraft amongst 257 domestic and international airports used one large integer programming problem. Assumptions and abstractions simplified the problem to represent a majority of commercial airline operations with at least the arrival or destination airport in the US. Decomposing the problem into smaller allocation problems maintains runtimes similar to the previous model, and now includes multiple airlines, more aircraft models, and 'one-way' routes.

4 - Examining the Potential Environmental Impact of Legacy and Budget Carrier Competitive Balance

Datu Agusdinata, Post-doctoral Researcher, Purdue University, School of Aeronautics and Astronautics, 701 W. Stadium Ave, West Lafayette, IN, 47907-2045, United States of America, bagusdin@purdue.edu

Legacy and budget carriers in the US operate and compete using different business (e.g. cost & fare structure) and operations (e.g. fleet composition, network structure, and level of service) models. Based on a logit model to ascertain the market share of each carrier, this study investigates how the competition may evolve over time and assesses the resulting emissions and noise impact under multiple scenarios of technology improvement rate, demand growth, and relative cost advantage.

■ WC71

H - Salon H, 6th Floor

Decision Support Models in DEA

Cluster: In Honor of Bill Cooper
Invited Session

Chair: Vladimir Krivonozhko, Institute for Systems Analysis, KrivonozhkoVE@mail.ru

1 - DEA Models for Decision Making Support in Negotiation Process

Vladimir Krivonozhko, Institute for Systems Analysis, KrivonozhkoVE@mail.ru, Alexander Piskunov, Andrey Lychev, Maria Piskunova

In this paper, an approach is proposed on evaluation of agreements on transnational projects during the negotiation process. One can show that the negotiation process can be represented as the behaviour of decision making units (countries) in the multidimensional space of economic indicators using DEA models. In this case, the goals that can be reached by units as a result of accomplishment of joint project can be determined as points in the multidimensional space. Optimal directions toward these goals and cones of possible directions can be found with the help of Analytic Hierarchy Process (AHP). Our approach is illustrated on the real-life data taken from open international sources.

2 - The Winner is Kobe: Site Selection for the Next-generation Supercomputing Center in Japan

Kaoru Tone, National Graduate Institute for Policy Studies, Japan, tone@grips.ac.jp

The Next Generation Supercomputer R&D Project is an endeavor to create a 10 Pflop/s system by 2012. It will be considered to be one of the "Key Technologies of National Importance of Japan." Its goals are: (1). Development and installation of the most advanced high performance supercomputer system; (2). Development and wide use of application software to utilize the supercomputer to the maximum extent; (3) Provision of a flexible computing environment by sharing the next generation supercomputer through connection with other supercomputers ; (4) Establishment of an "Advanced Computational Science and Technology Center." In this talk, I will report how the site selection was decided using AHP and DEA.

3 - A Cost-constrained Measure of Energy Efficiency

Kankana Mukherjee, Babson College, kmukherjee@babson.edu, Subhash Ray, Lei Chen

We provide a measure of energy-use efficiency for a firm with cost constraints. Using DEA, we investigate the energy efficiency of the US manufacturing sector across states. Our results indicate that in many states the actual energy use by the typical firm exceeds the optimal use without any increase in cost. We also find that an effective tax on energy use in manufacturing would reduce the aggregate energy usage while at the same time increasing the aggregate labor employment in this sector.

4 - Eco-efficiency Within Selected US Industries using Data Envelopment Analysis

Paul Rouse, University of Auckland, p.rouse@auckland.ac.nz

We set out to provide further empirical evidence on the relationship between firm environmental performance and economic performance. In contrast to other studies which have used either partial productivity measures or purely accounting ratios, we use a frontier production model, data envelopment analysis (DEA), using multiple inputs and multiple outputs to estimate economic performance. Using data from four U.S. industries that are typically viewed as 'highly environmentally sensitive' for a three year (2006 to 2008) period, we find some evidence that higher levels of environmental performance are significantly associated with higher levels of economic efficiency. Our empirical evidence is therefore broadly consistent with the 'Porter' hypothesis; that is greater firm environmental performance is associated with higher levels of economic performance. Results, however, are mixed with positive and statistically significant coefficients on both environmental strengths and weaknesses. We then use the Fare and Grosskopf 'weak disposability' framework to explain the conflicting results in the regression analyses using the KLD strengths and weaknesses.

■ WC72

H - Salon J, 6th Floor

Facility Logistics Interactive Session: Distribution Center Operations

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Russell Meller, Hefley Professor of Logistics and Entrepreneurship, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, rmeller@uark.edu

1 - Decentralized Control of High Density Storage Systems

Kevin Gue, Associate Professor, Auburn University, Department of Industrial & Systems Engin, Auburn, AL, United States of America, kevin.gue@auburn.edu, Kai Furmans

We describe a decentralized control algorithm for a grid-based, high density storage system based on the "slide puzzle architecture." When executed with constant work-in-process, the system provides very high throughput, and yet it consumes less space than a typical automated storage and retrieval system.

2 - The Fishbone Triangle Design for Dual-Command Cycles in a Unit-Load Warehouse

Russell Meller, Hefley Professor of Logistics and Entrepreneurship, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, rmeller@uark.edu, Letitia Pohl, Kevin Gue

The fishbone warehouse design improves upon traditional warehouse designs for single-command cycles, but is not as efficient for the travel-between leg of a dual-command cycle. The fishbone triangle design was developed to address this issue. We have developed a set of analytical expressions for travel-between in the fishbone triangle warehouse, which allows us to optimize this non-traditional warehouse design. We will present results on its performance.

3 - Determining the Optimal Aisle-width for a Semi-automated Picking System in a Distribution Center

Pratik Parikh, Assistant Professor, Wright State University, 3640 Col Glenn Hwy, 207 Russ Eng Center, Dayton, OH, 45435, United States of America, pratik.parikh@wright.edu, Sheena Finney

We consider the aisle-design problem for a semi-automated picking system that uses a person-on-board material handling equipment, such as an order picker truck. Using a previously developed model to determine the optimal storage level for such a system, we conduct a simulation study to determine the aisle-width (narrow or wide) that minimizes total system cost. We also compare our results with those obtained for a manual system to generate managerial insights when designing such systems.

4 - A Network Model for Warehouses with Non-Traditional Aisles
Omer Ozturkoglu, Auburn University, Department of Industrial&Systems Engineering, Auburn, AL, 36849, United States of America, ozturom@auburn.edu, Kevin Gue, Russell Meller

We show how to construct non-traditional aisle designs for unit-load warehouses with multiple pickup and deposit (P&D) points, using a network model to represent storage locations and P&D points. The model uses a meta-heuristic to search for optimal angles of cross aisles and picking aisles.

■ WC73

H - Salon K, 6th Floor

Joint Session TSL/ SPPSN: Methods to Support Regional Evacuation

Sponsor: Transportation Science and Logistics Society/ Public Programs, Service and Needs
Sponsored Session

Chair: Irina Dolinskaya, Assistant Professor, Northwestern University, 2145 Sheridan Road, M235, Evanston, IL, 60208, United States of America, dolira@northwestern.edu

1 - Design of an Evacuation Network for Hurricane Evacuation
Xinghua Wang, Texas A&M University, 303K Zachry, TAMU, College Station, United States of America, wxh55@tamu.edu, Justin Yates, Halit Uster

We consider large scale evacuations in expected extreme event situations such as hurricanes. We present a mixed integer model to minimize total costs under time constraints while determining associated facility locations and traffic flows to construct evacuation routes. We develop a Benders decomposition based solution approach and report numerical results using Texas-based real data facilitated by GIS.

2 - An Integrated Demand-Supply Framework for Evacuation Operations
Yu Ting Hsu, Purdue University, West Lafayette, IN, United States of America, yhsu@purdue.edu, Srinivas Peeta

Evacuation operations involve perspectives from both the demand and supply sides. This study proposes an integrated operational framework to address the interactions between evacuation flow management and individual behavior, by using robust evacuation behavior models that consider the various factors that influence evacuation-related decision-making.

3 - Large-Scale Evacuations with Arc Routing
Mark Hickman, Associate Professor, University of Arizona, Civil Engineering, 1209 E. Second St., 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.

■ WC74

H - Room 602, 6th Floor

Hazardous Material Transportation

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Changhyun Kwon, Assistant Professor, University at Buffalo, 400 Bell Hall, Buffalo, NY, 14260, United States of America, chkwon@buffalo.edu

1 - Value-at-Risk Model for Hazmat Transport
Yingying Kang, PhD Candidate, University at Buffalo - SUNY, Department of Industrial Engineering, 438 Bell Hall, Buffalo, NY, 14260, United States of America, ykang4@buffalo.edu, Rajan Batta, Changhyun Kwon

We propose a new measurement of risk in hazmat transportation, namely Value-at-Risk (VaR). The VaR measurement aims to gauge the cutoff risks within a certain confidence level, instead of minimizing the expected risk or maximal risk of a hazmat path directly. This allows the choice of a hazmat route according to decision makers' risk preferences. Furthermore, we display that the route choice with the VaR model depends on the level of risk tolerance.

2 - Environmental Risk Analysis of Railroad Transportation of Hazardous Materials
Rapik Saat, Postdoctoral Research Associate, University of Illinois at Urbana-Champaign, 205 N Mathews RM3214, Urbana, IL, 61801, United States of America, mohdsaat@illinois.edu, Chris Barkan

This presentation will describe a quantitative risk analysis of rail transportation of hazardous materials using an environmental consequence model in conjunction with a geographic information system (GIS) exposure analysis along the U.S. rail network. The annual risk estimate incorporates the estimated remediation cost, route-specific probability distributions of soil type and depth to groundwater, annual traffic volume, railcar accident rate, and tank car safety features.

3 - Dual Toll Pricing for Hazardous Material Transport with Linear Delay
Jiashan Wang, University at Buffalo- SUNY, Department of Industrial Engineering, Buffalo, NY, United States of America, jw282@buffalo.edu, Yingying Kang, Rajan Batta, Changhyun Kwon

We propose a dual toll pricing method to mitigate risk of hazmat transportation. We aim to control both regular and hazmat vehicles to reduce the risk. We incorporate a new risk measure to consider duration-population-frequency of hazmat exposure. We formulate the model as an MPEC problem and then decompose the formulation into first-stage and second-stage problems. For each stage problem, we present methods to solve them separately. A numerical example is provided.

Wednesday, 3:30pm - 5:00pm

■ WD01

C - Ballroom D1, Level 4

Joint Session ENRE/ QSR: Renewable Energy Integration into Power Systems for Smart Operations

Sponsor: Energy, Natural Resources and the Environment/ Quality, Statistics and Reliability
Sponsored Session

Chair: Eunshin Byon, PhD, Postdoctoral Research Associate, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77840, United States of America, esbyun@neo.tamu.edu

1 - Optimizing the Acquisition and Operation of On-site Electricity Generation
Kris Pruitt, kpruitt@mymail.mines.edu, Rob Braun, Alexandra Newman

We present a mixed-integer, nonlinear program for designing and operating an on-site generation system to supply electricity to a large, commercial building. The system design includes renewable and non-renewable generation, net-metering to the grid, and on-site storage. The model determines the optimal mix of generators and storage units to acquire, along with their operating levels over time, to minimize total cost subject to system performance characteristics and the building's demand.

2 - Simulation and Optimization of Wind Farm Operations Under Stochastic Conditions
Eunshin Byon, PhD, Postdoctoral Research Associate, Texas A&M University, 241 Zachry, 3131 TAMU, College Station, TX, 77840, United States of America, esbyun@neo.tamu.edu

This research aims at developing models and associated solution tools to devise optimal maintenance strategies for wind turbines, helping reduce the operation costs and enhancing the marketability of wind power. We provide an integrated framework including optimization models, and a discrete event-based simulation model characterizing the dynamic operations of wind power systems. We highlight the benefits of the resulting strategies through a case study.

3 - Reliability Evaluation of Wind Turbine via Computer Simulation and Laboratory Experiments
Haitao Liao, Assistant Professor, The University of Tennessee, 211 Pasqua Building, Knoxville, TN, 37996, United States of America, hliao4@utk.edu, Seyed Ahmad Niknam, Janet Twomey

It is important to ensure the long-term reliability of wind generators for secured, uninterrupted power extraction from the wind. This research aims at evaluating the reliability of wind generators in time-varying environments via computer simulation and laboratory experiments.

■ WD02

C - Ballroom D2, Level 4

Energy II

Contributed Session

Chair: Nicolas Lopez, Research Assistant, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, nlopez3@miners.utep.edu

1 - Incorporating Gas Pricing Into Oil & Gas Asset Development Planning - An Example

Chaiyaporn Wiboonkij-Arphakul, Decision Analyst, Chevron, Tower III, SCB Park Plaza, 19 Ratchadapisek Rd, Chatuchak, Bangkok, 10900, Thailand, cwiboonkij@gmail.com, Ing Jye Tsai

As gas is sold in the $ per BTU, there is a clear incentive for one to maximize profits by accelerating the development of high-BTU wells. However, doing so in some environment (e.g., under Gas Sales Agreement) may lead to the loss of low-BTU gas reserves and the delivery shortfall penalty. For Chevron Thailand, profit is maximized through the ranking of drilling projects' profitability index while BTU forecast is only used to ensure that future production meets contractual specifications.

2 - A Framework to Integrate Renewable Energy to Improve the Energy Efficiency: An OR Application

Haifeng Wang, IBM Research - China, Building19, Zhongguancun Software Park, 8 Dongbeiwang West Rd, Haidian District, Beijing, China, whf@cn.ibm.com, Wenjun Yin, Jin Dong, Feng Gao

This paper focuses on developing a framework for smart grid to utilize weather and renewable energy production forecasting to help integrate distributed renewable energy and energy storage into the electric distribution and transmission system. A demand-supply matching model is developed, in which power demand is modeled a given stochastic process, and the optimal unit planning policy is researched. Moreover, the renewable energy efficiency is evaluated for different feasible policies.

3 - A Greedy Approach to Scheduling Outage Tasks for Distribution Power Network

Ming Zhao, IBM Research - China, Diamond building, ZGC Software Park, Haidian District, Beijing, 100193, China, papayazm@gmail.com, Feng Jin, Hairong Lv, Qiming Tian, Jin Dong, Wenjun Yin

Because of the complexity of distribution power network, outage task scheduling problem is usually large-scale, which results in unpractical long running time for many traditional methods. In this paper, combination weight between different tasks was defined. Then, a weight-based greedy algorithm was proposed to facilitate the procedure. In this way, computational complexity was reduced from O(t^n) to O(tn). Test results on a real distribution system show the efficiency of the approach.

4 - Hybrid Power Systems Optimization Considering Different Renewable Energy Technologies

Nicolas Lopez, Research Assistant, The University of Texas at El Paso, 500 West University Avenue, El Paso, TX, 79902, United States of America, nlopez3@miners.utep.edu, Jose Espiritu

Hybrid power systems need to be evaluated based on the requirements of high penetration renewable energy technology applications. Additionally, modeling and analysis storage systems integration are also necessary to increase the effectiveness of hybrid power configurations. In the present talk, a software based simulation to understand the Hybrid power systems response considering various renewable energy technologies and energy storage options is presented.

■ WD03

C - Ballroom D3, Level 4

Interactive Multiple Criteria Decision Making

Sponsor: INFORMS Section on Multiple Criteria Decision Making

Sponsored Session

Chair: Murat Köksalan, Middle East Technical University, ODTU 06531, Ankara, Turkey, koksalan@ie.metu.edu.tr

1 - An Interactive Approach for MCDM using a Hybrid Tchebycheff/Linear Utility Function

Ozgen Ozbey, SUNY Buffalo, 308A Bell Hall, Department of Industrial and Systems Eng, Buffalo, 14260-1900, United States of America, oozbey2@buffalo.edu, Mark H. Karwan

We improve our previously developed MILP formulation to estimate a Decision Maker's (DM) utility function used during an interactive method employing pairwise comparisons. The utility function is approximated by a Tchebycheff or hybrid function with Tchebycheff and linear components. We consider a DM's precision and "strength of preferences" to obtain a most preferred solution among implicit alternatives in an effective manner. We present computational results and comparisons with other methods.

2 - Interactive Evolutionary Multi-Criteria Scheduling

Jon Marquis, Senior Systems Engineer, Raytheon, 1151 East Hermans Road, Tucson, AZ, 85756, United States of America, jonemailbox1@gmail.com, John Fowler, Esma Gel, Pekka Korhonen, Jyrki Wallenius, Murat Köksalan

We present a new approach to multi-criteria scheduling using an interactive evolutionary algorithm with a scheduling heuristic to develop solutions. The algorithm sends a subset of the solutions to the decision maker (DM) for evaluation and uses the resulting preference information to evaluate new solutions and guide the algorithm. We apply the algorithm to the weighted completion time, total tardiness, and maximum lateness criteria.

3 - Solving Multiobjective Mixed Integer Programs using Convex Cones

Murat Köksalan, Middle East Technical University, ODTU 06531, Ankara, Turkey, koksalan@ie.metu.edu.tr, Jyrki Wallenius, Banu Lokman, Pekka Korhonen

We assume that the decision maker's preferences are consistent with a quasiconcave utility function. Based on the convex cones derived from past preferences, we create constraints to prevent solutions in the implied inferior regions. We guarantee finding the most preferred solution and our computational results show that a reasonable number of pairwise comparisons are required.

■ WD04

C - Ballroom D4, Level 4

Sustainability II

Contributed Session

Chair: Amrou Awaysheh, Assistant Professor of Operations Management, IE Business School, Maria de Molina, 12 - 5 planta, Madrid, 28006, Spain, amrou.awaysheh@ie.edu

1 - The Impact of Green Vehicles on the Market Value of Automakers

Qindong Liu, University of Connecticut School of Business, 2100 Hillside Road, Storrs, CT 06269, United States of America, qindong.liu@business.uconn.edu, Jan Stallaert

We conduct an event study to explore how stock markets react to automakers' fuel-efficient product strategies. We find automakers' green technology and product innovations have a positive impact on their market valuation, although the technology and market segment choices have different implications. The abnormal returns could be explained by both internal and external factors. More interesting, our analysis indicates that product design variables moderate those relationships.

2 - A LCA Method Considering Multi-Scenario and System Uncertianty

Jianzhi Li, Assistant Professor, The University of Texas - Pan American, 1201 W University Dr., Edinburg, TX, 78539, United States of America, jianzhi.li06@gmail.com, Xiaowei Wang

Current LCA approaches failed to consider spatial and temporal system uncertainty in its calculation. A new LCA method is proposed which considers uncertain future multi-scenario. The LCI data are collected as per scenario including pollution emissions and character information that are used to generate personal, spatial and temporal factors, which reflect the diversity of environment. The impacts is obtained by summing up the results of each scenario wighted by the scenario probabilities.

3 - The Impact of Social Issues Management on Firm Performance - An Event Study

Amrou Awaysheh, Assistant Professor of Operations Management, IE Business School, Maria de Molina, 12 - 5 planta, Madrid, 28006, Spain, amrou.awaysheh@ie.edu, Robert D. Klassen

The management of social issues can have a substantial impact on a firm's financial performance. Social issues are complex, and managing them requires a range of practices. Examples include establishing workforce policies for safe work practices or diversity; however, a firm may also be involved in negative practices, such as the use of illegal labor practices. This paper will present the results from an ongoing event study that examines the impact of social issues management on a firm's value.

■ WD05

C - Ballroom D5, Level 4

Dynamic Programming/Control II

Contributed Session

Chair: Suleyman Demirel, PhD Candidate, Ross School of Business, University of Michigan, 701 Tappan Ave, Ann Arbor, MI, 48104, United States of America, sdemirel@umich.edu

1 - Ad Valorem Tax and the Cumulated Output of Exhaustible Resources

Runfang Xu, PhD Candidate, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, 710049, China, runfangxu@yahoo.com, Xinmei Liu

This paper, after modifying the Hotelling model and using the dynamic control method, researches the relation between ad valorem tax and cumulated output of exhaustible resources under monopoly. It is shown that the cumulated output is lower than perfect competition when the ad valorem tax rate equals to zero. And the cumulated output is decreased more when the ad valorem tax rate more than zero. However, the cumulated output is increased when the ad valorem tax rate less than zero.

2 - Sensitivity-Based Nested Partitions for Solving Markov Decision Processes

Weiwei Chen, University of WIsconsin-Madison, 1513 University Avenue, Madison, WI, 53706, United States of America, wchen26@wisc.edu, Leyuan Shi, Yanjia Zhao, Xiaohong Guan

This paper introduces an algorithm to solve finite-horizon total-cost Markov decision processes with non-stationary policies. It is based on Nested Partitions (NP) global optimization framework, and combines the search power of a local optimizer using sensitivity-based analysis. An intelligent partitioning approach is developed to determine the new partitions adaptively based on the information from previous iterations. The numerical example shows the effectiveness of the proposed algorithm.

3 - Dynamic Airline Asset Allocation Incorporating Econometric Demand Models

Navindran Davendralingam, Purdue University, School of Aeronautics and Astronautics, 701 West Stadium Avenue, West Lafayette, 47906, United States of America, davendra@purdue.edu, William Crossley

Operational adjustments by airlines translate to latent passenger observations who dictate future demand trends based on cost feasibility and ancillary benefits offered by various ticket itineraries being published. The current proposed research develops a conceptual dynamic framework that builds upon previous paradigms in dynamic programming, econometrics and system engineering to maximize revenue for a given airline using tactical asset allocation subject to reflexive demand feedback.

4 - Resource Taxation and the Cumulated Output of Exhaustible Resource Under the Externality

Runfang Xu, PhD candidate, Xi'an Jiaotong University, No.28, Xianning West Road, Xi'an, 710049, China, runfangxu@yahoo.com, Xinmei Liu

How to enhance cumulated output and how to lengthen the total lifetime of exhaustible resources is a very popular topic. Firstly, this paper constructs a dynamic optimal control model under the condition of externality. Secondly, this paper, applying simulation, analyses the relationship between resource taxation and cumulated output and total lifetime. Finally, the results are confirmed by data from China.

5 - Production and Inventory Control for a Two-Stage Assemble-to-Order System with Uncertain Capacities

Suleyman Demirel, PhD Candidate, Ross School of Business, University of Michigan, 701 Tappan Ave, Ann Arbor, MI, 48104, United States of America, sdemirel@umich.edu, Roman Kapuscinski, Izak Duenyas

Consider a firm assembling product from subcomponents, where both assembly capacity and subassembly capacities are uncertain. The assembly capacity is common, while each component has dedicated subassembly resources. The firm may hold inventory of subassemblies. We analyze a multi-period inventory model for two products, and derive the optimal replenishment policy of the subassemblies as well as the optimal priority scheduling of the assembly resource.

■ WD07

C - Ballroom F & G, Level 4

Supply Chain, Closed-loop II

Contributed Session

Chair: Jo Min, Iowa State University, IMSE Department, 3004 Black, Ames, IA, 50011, United States of America, jomin@iastate.edu

1 - Hybrid Manufacturing/Remanufacturing System in Cascade Reuse

Yasutaka Kainuma, Tokyo Metropolitan University, 6-6, Asahigaoka, Hino, Tokyo, 191-0065, Japan, kainuma@sd.tmu.ac.jp

In this research, we constructed a cascade reuse hybrid manufacturing/remanufacturing model. We proposed the optimal ordering policy minimizing manufacturer's total costs when manufacturing two grades of products. In the data examples, comparing the proposal policy with the policy of the actual operations of company-A, we could confirm the optimality of the proposal policy.

2 - Joint Inventory-promotion Decision in Closed-loop Hybrid Manufacturing System

S. Phil Kim, PhD Candidate, Purdue University, 315 N. Grant Street, West Lafayette, IN, 47907, United States of America, ksphil@purdue.edu, Seokcheon Lee, J. George Shanthikumar

In this paper, Markov decision process is used for the joint inventory-promotion decision problem in a closed-loop hybrid system. The stochastic returns are correlated with the volume of circulation. The demands are also stochastic and influenced by the promotion decision. The state space can be divided into promotion-desired and promotion-not-desired spaces. For a given decision on the promotion, we show that the optimal solution structure is completely defined by two points in the state space.

3 - ANP Methodology and Reverse Supply Chain

Sharon Ordoobadi, University of Massachusetts, 285 Old westport Road, Dartmouth, United States of America, sordoobadi@umassd.edu

The objective is development of a decision tool to help with selection of the third party reverse logistics provider. The criteria to be considered in the evaluation process are identifgied. The ANP methodology is applied to rank the potential providers. The provider with the highest ranking is chosen to perform the reverse logistic function.

4 - Closed-loop Supply Chain with Dynamic Returns and Incentives

Pietro De Giovanni, NOVA School of Business and Economics, Campus Campolide, 1099, Lisbon, Portugal, pietro.degiovanni@fe.unl.pt

In a closed-loop supply chain (CLSC), a single manufacturer and a single retailer invest in green activities to enhance the product return. Coordination is evaluated by means of a pay-back contract while the return policy is managed in an active manner. The return rate is thus modeled as a dynamic equation that evolves over time according to the green activities. We investigate the conditions under which coordination is Pareto-improving.

5 - Product Weight Reduction Investment and Collection Rate in a Closed Loop Supply Chain

Jo Min, Iowa State University, IMSE Department, 3004 Black, Ames, IA, 50011, United States of America, jomin@iastate.edu, Wenbo Shi, Karla Valenzuela

We investigate a Stackelberg game consisting of a manufacturer/remanufacturer who directly sells to customers and a collector of the used products. The collector is the follower who determines the collection rate and the manufacturer is the leader who determines the price and the product weight reduction investment. As the cost saving of remanufacturing increases, the product weight and collection rate both increase. i.e., the environmental policies of reduce and reuse may be self-contradictory.

■ WD08

C - Room 11A, Level 4

Facility Location II

Contributed Session

Chair: Jiamin Wang, Associate Professor, Long Island University, Roth Hall 202, Long Island University, 720 Northern Blvd, Brookville, 11548, United States of America, jiamin.wang@liu.edu

1 - A Heuristic Procedure for the Integrated Facility Layout Design and Flow Assignment Problem

Seyed Ali Taghavi, Wayne State University, 4815 Fourth Street, detroit, MI, 48202, United States of America, dz3738@wayne.edu, Alper Murat

We study integrated lay-out design problem and product flow assignment problem. The lay-out design decisions involve planar location of unequal-area machines with duplicates. The product flows are assigned to machines according to the product processing routes. We propose a heuristic procedure based on the alternating location-assignment heuristic. Then, we apply a perturbation algorithm to escape local optima. A sequential location heuristic is also used to speed up the location problem.

2 - Application of Hybrid Analysis of a Discrete Space Location in a School Location Problem

Farshad Majzoubi, PhD Student, University of Louisville, Department of Industrial Engineering, JB Speed School of Engineering, Louisville, KY, 40292, United States of America, f0majz01@louisville.edu, Bulent Erenay, Trivikram Rao

This research develops a generic Excel model using the Hybrid Analysis method for discrete space location problems, and combines it with an Analytical Hierarchy Process approach to act as a decision support tool to select the optimal location to open a school when both quantitative and qualitative factors are involved.
Keywords: Location allocation, Hybrid analysis, Analytical Hierarchy Process

3 - A Minimax Approach to EMS-Helicopter Station and Heliport Location Problems

Takehiro Furuta, Dr., Assistant Professor, Tokyo University of Science, 1-3 Kagurazaka, Shinjuku-ku, Tokyo, 162-8601, Japan, takef@fw.ipsj.or.jp, Ken-ichi Tanaka

We propose location models for EMS-helicopter systems. The helicopters require their stations and heliports to pick up patients. We formulate the model as an integer programming problem which seeks to find locations of both stations and heliports to minimize the maximum transportation time. Our model is applied to analyzing optimal locations using an idealized city model under various assumptions.

4 - A Median Problem on a Network with Random Travel Speeds and a Desirable Travel Time Level

Jiamin Wang, Associate Professor, Long Island University, Roth Hall 202, Long Island University, 720 Northern Blvd, Brookville, 11548, United States of America, jiamin.wang@liu.edu

We consider a facility location problem on a network when the travel speeds along links are discrete random variables. For each customer, a utility "loss" incurs if travel time to reach a facility is beyond a desirable level. The objective is to locate facilities so as to maximize the expected total customer utility. A dominant point set is identified and solution methods are developed. It is also shown that some classic deterministic models are special cases of the problem under study.

■ WD09

C - Room 11B, Level 4

Service Operations

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Gad Allon, Northwestern University, 2001 Sheridan Road, Evanston, IL, United States of America, g-allon@kellogg.northwestern.edu

1 - The Concert Queuing Arrivals Game: Finite Customer Analysis

Sandeep Juneja, Associate Professor, Tata Institute, HB Road, Colaba, Mumbai, 400005, India, juneja@tifr.res.in, Nahum Shimkin

We consider a queuing system where a finite number of customers arrive. Each customer is free to choose her arrival time (before or after the opening time) and is interested in early service completion with minimal wait. We analyze the equilibrium behavior of this system and study its convergence to the associated fluid limit as the number of customers increases to infinity.

2 - Bounded Rationality in Service Systems

Tingliang Huang, Kellogg School of Management, Northwestern University, Leverone 529, Jacobs Center, 2001 Sheridan Road, Evanston, IL, 60208, United States of America, tingliang-huang@kellogg.northwestern.edu, Achal Bassamboo, Gad Allon

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 - Hyperbolic Discounting in a Service System: Implications for Pricing & Information Provision

Erica Plambeck, Professor, Stanford Graduate School of Business, 518 Memorial Way, Stanford, CA, 94305, United States of America, plambeck_erica@GSB.Stanford.Edu, Qiong Wang

People often lack the self control to undergo an unpleasant service that would be in their long-run self interest. This "hyperbolic discounting" has implications for optimal pricing, scheduling and whether or not to give a customer real-time information about how long he must wait to complete service.

4 - Advance Selling When Consumers Regret

Javad Nasiry, HKUST, Clear Water Bay, Kowloon, Hong Kong, Hong Kong, Hong Kong - PRC, Javad.NASIRY@insead.edu, Ioana Popescu

We develop a model to capture the emotional consequences of decision making under uncertainty. Negative outcomes trigger regret as consumers reflect ex-post what would have been had they decided alternatively. We investigate how regret affects consumers' behavior and how firms can account for consumer regret in designing their pricing policies.

■ WD10

C - Room 12A, Level 4

Pricing Issues in Supply Chain Management

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Srinagesh Gavirneni, Cornell University, 325 Sage Hall, Ithaca, NY, 14853, United States of America, nagesh@cornell.edu

1 - Pricing and Logistics Decisions for a Private-Sector Provider in the Cash Supply Chain

Mili Mehrotra, Assistant Professor, University of Minnesota, 321 19th Ave. S, Carlson School of Management, Minneapolis, MN, United States of America, milim@umn.edu, Vijay Mookerjee, Chelliah Sriskandarajah, Milind Dawande

For secure-logistics providers, the Fed's cash recirculation policy presents an opportunity to offer fit-sorting services to Depository Institutions. We address the logistics and joint pricing of the new fit-sorting and the traditional transportation services. We characterize the behavior of the optimal prices and quantify the impact of the logistics network.

2 - The Multi-Product Newsvendor Problem with Customer-Driven Substitution

Joonkyum Lee, Cornell University, 301A Sage Hall, Cornell University, Ithaca, NY, 14853, United States of America, jl883@cornell.edu, Amr Farahat

We study the stocking problem faced by a newsvendor offering multiple substitutable products where a customer's probability of choosing any given product depends on the set of available products at the time of purchase. We present a tractable method that is guaranteed to yield an upper bound on the optimal expected profit. Numerical tests show that the true expected profits of the solutions obtained typically lie within a few percentage points of the upper bound and often outperform benchmarks.

3 - Robust Pricing with Two Substitutable Products

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, Ming Chen

We study a dynamic pricing problem involving two substitutable products. Given limited demand information, we use three types of bounds to model demand uncertainty. We propose a robust optimization approach for the problem and develop a fully-polynomial time approximation scheme based on a DP formulation. We report computational results and related managerial insights on how the optimal prices change with model parameters.

4 - Quality, Inspection, and Pricing Policies in Supply Chains
Murat Erkoc, Assistant Professor, University of Miami, Miami, FL, United States of America, merkoc@miami.edu, Haresh Gurnani

We consider a decentralized supply chain where market demand depends on the supplier's quality investment and the buyer's inspection policies. The supplier chooses the quality level and the wholesale price, whereas the buyer sets the inspection policy and the resale price. Building quality raises costs for the supplier and inspection is costly for the buyer. However, they reduce external and internal failure costs. We investigate equilibrium quality investment, inspection, and pricing policies.

■ WD11

C - Room 12B, Level 4

Green Supply Chains

Sponsor: Manufacturing and Service Operations Management
Sponsored Session

Chair: Feryal Erhun, Stanford University, 380 Panama St, Stanford, CA, 94305, United States of America, ferhun@stanford.edu

Co-Chair: Tim Kraft, Stanford University, 920 South California Avenue, Palo Alto, CA, 94306, United States of America, tkraft@stanford.edu

1 - Effect of Carbon Emission Regulations on Transport Mode Selection in Supply Chains
Tarkan Tan, T.Tan@tue.nl, Kristel Hoen, Jan Fransoo, Geert-Jan Van Houtum

We investigate the effect of two regulation mechanisms to drive down carbon emissions on the transport mode selection decision: an emission cost and an emission constraint. We use an accurate calculation method to determine the carbon emissions and incorporate them explicitly in our model. Our results show that introducing an emission cost for freight transport, e.g. via a market mechanism such as cap-and-trade, will not result in large emission reductions.

2 - The Carbon-Constrained EOQ
Saif Benjaafar, Professor, University of Minnesota, 111 Church Street SE, Minneapolis, United States of America, saif@umn.edu, Xi Chen

We examine the impact of carbon emission consideration on the management of inventory systems. We do so in the context of the classic economic order quantity model (EOQ). We incorporate carbon emission considerations by accounting for emissions associated with ordering, purchasing, inventory holding, and sales. We examine how different emission control policies (such as strict caps, carbon taxes, and carbon trading) affect ordering decisions and the corresponding costs and emission levels.

3 - Replacement Decisions for Potentially Hazardous Substances
Tim Kraft, Stanford University, 920 South California Avenue, Palo Alto, CA, 94306, United States of America, tkraft@stanford.edu, Dariush Rafinejad, Feryal Erhun, Robert Carlson

As public awareness of environmental hazards increases, a growing concern for firms is the negative environmental impact of their products. We study the decisions of firms and stakeholders when a substance within a product is considered potentially hazardous. We find large firms should plan their replacement decisions to avoid costs, while small firms should invest to establish niche market positions. In addition, NGOs and regulatory bodies should take a pragmatic approach when pressuring firms.

■ WD12

C - Room 13A, Level 4

Different Approaches to Demand Management in Retail

Sponsor: Manufacturing and Service Operations Management/ Supply Chain
Sponsored Session

Chair: Gilvan Souza, Associate Professor, Indiana University, Kelley School of Business, 1309 E 10th St, Bloomington, IN, 47401, United States of America, gsouza@indiana.edu

1 - Shelf Loathing: Cross Docking at an Online Retailer
Kyle Cattani, Associate Professor, Indiana University, Kelley School of Business, 1309 E 10th St, Bloomington, IN, 47405, United States of America, kcattani@indiana.edu, Gilvan Souza, Shengqi Ye

We analyze basic trade-offs inherent in cross-docking transactions at an online retailer. Rather than picking the item from inventory on the warehouse shelves, in a cross-docking transaction the item moves directly from the receiving dock to the shipping dock. While the cross-docking transaction reduces the shelving and picking costs, it potentially increases holding costs and risks changing the customer's expectations for how soon a product will be delivered.

2 - The Impact of Category Captainship on Retail Assortment and Consumers
Mumin Kurtulus, Assistant Professor, Vanderbilt University, Owen Graduate School of Management, 401 21st Avenue South, Nashville, TN, 37203, United States of America, mumin.kurtulus@owen.vanderbilt.edu, Alper Nakkas

Category captainship is a practice where a retailer relies on one of the leading manufacturers in the category for recommendations on retail assortment. In this paper, we investigate the impact of category captainship on the assortment offered at the retailer and its impact on the consumers. We identify the conditions under which category captainship practices can hurt the consumers.

3 - Pricing Policy in a Supply Chain: Negotiation or Posted Pricing?
Goker Aydin, Associate Professor, Indiana University, Kelley School of Business, Bloomington, IN, 47405, United States of America, ayding@indiana.edu, Hyun-Soo Ahn, Chia-wei Kuo

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.

4 - Motivating Marketing Effort Under Price Delegation: Optimal Retail Contract Design
Shanshan Hu, Asst Professor, Indiana University, Kelley School of Business, 1309 E 10th St, Bloomington, IN, 47405, United States of America, hush@indiana.edu, Wenbin Wang, Xinxin Hu, Robert Jacobs

Motivated by the interaction between an appliance manufacturer and its regional retailers, this paper investigates the contract design problem for the manufacturer. We provide answers to three related questions: (a) how to elicit actual demand information from the retailer, (b) how to motivate retailer to promote sales, and (c) how to construct the contract through relatively simple terms used in practice.

■ WD15

C - Room 15, Level 4

Organization Theory II

Contributed Session

Chair: Christopher Rump, Associate Professor, Bowling Green State University, Applied Statistics & Operations Research, Bowling Green, OH, 43403, United States of America, cmrump@bgsu.edu

1 - Assembly of Successful Teams: Insights From the Study of MMORPGs
Mengxiao Zhu, Northwestern University, 2145 Sheridan Rd, C210, Evanston, IL, 60208, United States of America, mzhu@northwestern.edu, Noshir Contractor, Seyed Iravani

Teamwork is crucial to accomplish difficult tasks successfully and efficiently. This paper investigated the influence of compositional and structural factors on team performance. Compositional factors are related to the attributes of team members, such as expertise diversity and demographic homophily. Structural factors measure the intra/inter team social structures of formal and informal relations. An analysis of MMORPG combat teams identifies the impact of these factors on team performance.

2 - Developing Innovative Capabilities in Biotechnology Firms: Internal Building and External Leveraging
Yuanyuan Wu, Doctoral Student, McGill University, Desautels Faculty of Management, 1001 Sherbrooke Street W., Montreal, QC, H3A1G5, Canada, yuanyuan.wu@mail.mcgill.ca, Paola Perez-Aleman

This paper explores the initiation and development of innovative capabilities in Montreal-based biotech firms through a multiple-case study design. The existing literature separately focuses on internal resources or network leveraging. By contrast, this study combines these two aspects, and uncovers different implications of the combination on the path and pace of capability development. The results extend the role of collaboration in firms with different nature and timing patterns.

3 - The Evolution of Product Categories: How 'Spaghetti' Western Impacted American Western Movies
Moritz Fliescher, PhD Candidate, New York University, Leonard N. Stern School of Business, 44 West 4th Street, Room 7-157, New York, NY, 10012, United States of America, moritz.fliescher@stern.nyu.edu, Gino Cattani

We add to the category dynamics literature by arguing that established categories can evolve. We argue that categories that have an overlapping schema for their respective labels have the potential to influence each other. We propose that innovations of one category can drive the evolution of another category through audience legitimization. We highlight one empirical instance of this by looking at the influence of western movies produced in Europe on the meaning of the Western genre in the US.

4 - Towards a Systematic Understanding of How Interest-affiliated Actors Impact Technology Trajectories

Theodore Khoury, Oregon State University, Bexell 422B, Corvallis, OR, 97331, United States of America, ted.khoury@bus.oregonstate.edu, Desiree F. Pacheco

How do specific actors change technology trajectories? Focusing on actors with specific interest-affiliations that are impactful to innovation paths, we propose how the strategic actions available to a specific actor's position can alter the diffusion of technological innovations over time. We reinforce our proposed theory with clean energy technology illustrations, and consider various influential actor positions in both market and non-market roles.

5 - Constrained Clustering for Departmental Reorganization

Christopher Rump, Associate Professor, Bowling Green State University, Applied Statistics & Operations Research, Bowling Green, OH, 43403, United States of America, cmrump@bgsu.edu

Using data collected from a questionnaire asking how faculty viewed their connection to other disciplines in the College of Business, we employed an optimization model to reorganize into fewer departmental clusters in order to rectify large disparities that have developed over time between departmental faculty sizes. We compare these results to those found via traditional hierarchical clustering models as well as ad-hoc groupings proposed by members of the college Faculty Council.

■ WD16

C - Room 16A, Level 4

Managing Product Variety

Contributed Session

Chair: Muge Yayla-Kullu, Asst. Prof., RPI, Lally School of Mgmt., 110 8th St., Troy, NY, 12180, United States of America, YAYLAH@rpi.edu

1 - Allocating Capacity Among Quality Differentiated Products: Evidence From Airline Industry

Praowpan Tansitpong, RPI, 110 8th St, Troy, United States of America, tansip@rpi.edu, Muge Yayla-Kullu

This paper explores how the customer perceived quality and the resource consumption differences of the products may impact the product line and capacity allocation decisions of the firms. We empirically investigate the airline industry in three regions of the world; Asia Pacific, EMEA and North America. We find that both attributes have a significant impact in all the regions.

2 - A Unified Framework for Planning a Platform Achieving Both Strategic and Operational Benefits

Changmuk Kang, Ph.D Student, Seoul National University, 599 Kwanakro, Kwanakgu, Seoul, Korea, Republic of, muk83@snu.ac.kr, Yoo S. Hong

Whereas operational benefit of platform sharing, which is reducing differentiation cost, has been well known, its strategic role of establishing commonly preferred identity has less been noticed in literature. This study presents a unified framework for planning a product platform meeting a firm's strategic goals of both identity establishment and efficient variety offering. A quality function deployment and versatility index based approach is applied to identify appropriate platform components.

3 - Assortment Planning with Multiple Quality Levels: A Dynamic Programming Approach

Mark McElreath, Clemson University, 150 Freeman Hall, Clemson, SC, 29634, United States of America, mmcelre@clemson.edu, Maria Mayorga

The optimal solution to the assortment planning problem with vertical and horizontal differentiation in which consumer preference is described by a locational choice model is unknown. We propose a two part solution: a dynamic program to find the optimal vertical attributes embedded into a line search to find the optimal horizontal attributes. We compare our approach to metaheuristics, explore the optimal solution space, and provide insight into the properties of an optimal assortment.

4 - Product Variety, Out-Of-Stock, and Sales

Xiang Wan, University of Maryland, Van Munching Hall 3354, College Park, MD, 20742, United States of America, xwan@rhsmith.umd.edu, Martin Dresner, Philip Evers

Product variety has been analyzed by an extensive body of literature. High product variety stimulates sales, while it raises the difficulty of logistics management and reduces sales. This paper proposes a framework to investigate the direct and indirect (through logistics performance) impacts on sales. The results indicate that the influence of product variety on sales depends on variety in both the degree and dimensions.

■ WD17

C - Room 16B, Level 4

Manufacturing III

Contributed Session

Chair: Zulal Gungor, Prof., Gazi University, Maltepe, Ankara, Turkey, zulalg@gazi.edu.tr

1 - Total Productive Maintenance Policy Framework and Implementation of 5s Rules

Bahar Ozyoruk, Assistant Prof.Dr., Gazi University, Faculty of Egineering, Department of Industrial Engineering Maltepe, Ankara, 06570, Turkey, bahar@gazi.edu.tr

Total Productive Maintenance (TPM) has attracted the attention of industries all over the world. Many companies benefit from this policy by increasing the overall efficiency of machine is trying to use existing capacity more efficiently. In this study, a firm which produces foam in the process of transition to implement TPM and 5S implementation of the rules are discussed. The results obtained were presented as comparatively.

2 - Multi-objective Decision Making (MODM) Approach in Optimizing Product Design by the Help of House of Quality: A Case Study

Zulal Gungor, Prof., Gazi University, Maltepe, Ankara, Turkey, zulalg@gazi.edu.tr, Elif Kilic

In practice, the values of design requirements (DRs) having only a few alternatives can be discrete in the Quality Function Deployment. We propose a Mixed Integer Goal Programming (MIGP) formulation to get the optimum solution from a limited number of DRs alternatives. The solution of MIGP model provides decision makers with different alternative results by the usage of the lexicographic goal programming (LGP) approach. The applicability of the proposed models is demonstrated with a problem.

■ WD18

C - Room 17A, Level 4

Business Applications

Contributed Session

Chair: Alba Bonko, President, Biz Intelligence Solutions, LLC, 9737 NW 41st Street, Miami, FL, 33178, United States of America, alba_n_nunez@hotmail.com

1 - Work as a Love Object. A New Framework for Analyzing the Work-self Relation

Brad Almond, Assistant Professor of Management, Texas A&M University, Division of Business, 1901 S. Clear Creek Rd., Killeen, TX, 76549, United States of America, brad.almond@ct.tamus.edu

Building on popular fascination with the idea of "loving what you do," this paper explores how work functions as a love object by developing a multi-dimensional model and testing its structure and relation to key work outcomes using factor analysis and structural equation modeling. Explores implications for management and organizations.

2 - Allocation of Bulk Tanks to Customer Sites

Tejinder Pal Singh, Sr. Research Associate, American Air Liquide, 12800 W. Little York Rd, Houston, TX, 770941, United States of America, tejinder.singh@airliquide.com, Kimberly Ellis

Bulk tank allocation (BTA) problem consists of allocation of tanks to customer sites for distribution of gases. Distribution is based mainly on Vendor Managed Inventory (VMI) model. In BTA problem, the goal is to minimize the distribution costs by having right tank sizes at customer sites. A right tank size at a customer will ensure that the customer doesn't run out of the product often and at the same time doesn't need deliveries frequently.

3 - Optimal Contract Problems in Online Advertising with Risk Considerations

Md. Tanveer Ahmed, University at Buffalo, SUNY, 333 Bell Hall, Buffalo, NY, 14260, United States of America, mtahmed@buffalo.edu, Changhyun Kwon

In this paper, we study the optimal contract problem for online display advertisements with pay-per-view pricing scheme. We first provide and analyze a single contract model, which is shown to be equivalent to the newsvendor problem. We then consider a stochastic optimization problem with two different contracts and show that no mixed contract is optimal. However, we show that a mixed strategy may be optimal when we consider the risk attitude of the publisher.

4 - Development of a Global Part Sourcing Optimization Model with Currency Risk Analysis

Don Zhang, Cost Optimization Analyst, Ford Motor Company, 2101 Village Rd., Dearborn, MI, 48121, United States of America, xzhang35@ford.com, Mark Everson, Leonardo Vaquero, Dawn Gontko, David Shepps

Ford Motor Company operates globally across six continents. Under the "One Ford" initiative, Ford has been leveraging increased economies of scale. One of these efforts is to source globally the common parts shared by many vehicle programs. We have developed a mixed integer programming optimization model and exchange rate risk assessment methodology to optimize sourcing decisions. We will discuss our approach for deciding the optimal sourcing decisions and risk assessment for various scenarios.

5 - Continuous Improvement and Efficiency Training: Challenges and Opportunities

Alba Bonko, President, Biz Intelligence Solutions, LLC, 9737 NW 41st Street, Miami, FL, 33178, United States of America, alba_n_nunez@hotmail.com, Rebeca Lergier, Martha Centeno

We discuss paradigms used in training courses, and highlight some of their strengths and weakness. Training courses paradigms range from the "recipe" to the "academic". The former disregards foundations of the methods, whereas the latter fails to show practical applications. We propose a scheme that is enterprise-centered, so that practicing professionals can effectively use quantitative methods, and with management policies, as part of the continuous improvement cycle of the enterprise.

■ WD19

C - Room 17B, Level 4

Practical Applications of Pricing and RM Theory

Sponsor: Revenue Management and Pricing Section
Sponsored Session

Chair: Scot Hornick, Partner, Oliver Wyman, 155 N. Wacker Drive, 16th Floor, Chicago, IL, 60606, United States of America, Scot.Hornick@oliverwyman.com

1 - Market-Response-Based Inventory Management for Airlines and Hotels

James Rider, Associate Partner, Oliver Wyman, 55 Baker Street, London, W1U 8EW, United Kingdom, James.Rider@OliverWyman.com, Jessica McLaughlin, Bejugum Rao, Daniel Sack

Most of the prevalent seat and room inventory management methods are no longer adequate to serve the needs of today's dynamic marketplace. In our novel Market Response-Based Inventory Management (MRBIM) approach, we generate recommendations for pricing and availability decisions by taking into account dynamic marketplace data. Demand is managed more effectively by understanding customer's willingness to pay and knowing prevailing competitor prices and availability. Revenue is maximized by adjusting own fares/rates and availability, possibly multiple times a day. To facilitate MRBIM implementation, we developed statistical methods to estimate demand parameters with data that is likely to be readily available at a typical airline or hotel company. We developed approaches to interface with current inventory allocation models. Piloting of MRBIM approach at multiple airlines has revealed consistent revenue benefits.

2 - Dynamic Pricing for Aftermarket Auto Parts

Bruce Spear, Associate Partner, Oliver Wyman, 1166 Avenue of the Americas, New York, NY, 10036, United States of America, Bruce.Spear@OliverWyman.com, Todd Ebe, Bejugum Rao

We present an application of dynamic pricing at an auto-glass wholesaler. We estimate customer's sensitivity to the wholesaler's price by customer type, part type and geography. We determine optimal prices that maximize the wholesaler's contribution, i.e. revenue minus cost of goods sold, knowing competitors' prices. We show the revenue benefits (>4%) due to optimal prices evaluated in a test-control setting. We discuss data and measurement challenges. Our future efforts will include extending the approach to retail auto-glass business as well as optimizing part prices by considering own and competitor inventory levels.

3 - Revenue Management Concepts for Freight Railways Practicing Dynamic Routing

Marc Meketon, Oliver Wyman, 212 Carnegie Center, Princeton, NJ, 08540, United States of America, Marc.Meketon@oliverwyman.com, David Lehlbach

Most railways world-wide operate on a fixed scheduling plan that allows only one route per railcar. However, as railways begin to plan their next generation of car-scheduling systems, they should consider the possibility of dynamic train scheduling that changes the operating plan and the rules for routing cars dynamically. As a simple example, when faced with capacity limitations in a certain corridor, it may make sense to divert some cars to an alternate route. While dynamic planning could increase efficiencies, it could also change customer service. Some customers could get shorter transit times, others longer. Since service levels change, any move towards dynamic planning should involve pricing and revenue management considerations. This talk discusses a number of these considerations and gives guidance to railways looking to make the jump to the next level of planning.

■ WD20

C - Room 18A, Level 4

Pricing and Revenue Management III

Contributed Session

Chair: Dincer Konur, PhD Candidate, University of Florida, Industrial and Systems Engineering Department, Gainesville, FL, 32611, United States of America, dincer@ufl.edu

1 - A Segmentation Study in Applying Revenue Management to the Hospitality Industry

Murtaza Das, The Rainmaker Group, 5755 North Point Parkway, Alpharetta, GA, 30022, United States of America, murtazadas@gmail.com, Renaud Menard

Segmentation is a fundamental step in applying revenue management and pricing which directly impacts forecasting accuracy, and thus revenue optimization. While forecast accuracy and revenue optimization are paramount to a sound revenue management strategy, operational limitations should also be considered in the segmentation analysis. We review the current approaches of segmentation in the hospitality RM industry, present simulation results, and point out challenges.

2 - A Statistical Methodology to Find Segment Level Parameters using Aggregate Level Data

Hamed Hasheminia, Sauder School of Business-UBC, 2053 Main Mall, Vancouver, BC, V6Z2T9, Canada, hamed.hasheminia@sauder.ubc.ca, David Gillen

We develop a novel statistical procedure to estimate segmental demand functions from aggregate level data. To achieve our result we combine the invaluable information hidden in integer numbers, characteristics of integer numbers, and use MLE to estimate parameters at the segment level. The method is applied to estimate how demands for different segments of passengers (i.e. single passengers, couples, and so forth) are affected by price, time to the flight, etc.

3 - Modeling Supplier Wholesale Pricing Decisions with Competitive Buyers Under Cournot Competition

Dincer Konur, PhD Candidate, University of Florida, Industrial and Systems Engineering Department, Gainesville, FL, 32611, United States of America, dincer@ufl.edu, Joseph Geunes

We model a supplier's wholesale pricing decision for competitive non-identical buyers as a Stackelberg game. To determine a Stackelberg equilibrium, we first solve the buyers' game and analyze the buyers' quantity decisions under two different cooperation levels. We then determine the supplier's optimal wholesale price, and conduct numerical studies to characterize the value of the information to the supplier, as well as the effects of buyer and market heterogeneity.

■ WD22

C - Room 18C, Level 4

Service System Development

Sponsor: Service Science
Sponsored Session

Chair: Ari P.J. Vepsalainen, Professor, Aalto University School of Economics, Department of Business Technology, P.O. Box 21220, Helsinki, 00076, Finland, ari.vepsalainen@hse.fi

1 - Functional Selection of Business Processes - Who Works for the Market?

Ari P.J. Vepsalainen, Professor, Aalto University School of Economics, Department of Business Technology, P.O. Box 21220, Helsinki, 00076, Finland, ari.vepsalainen@hse.fi, Mika Raulas, Markku Tinnilä, Jukka Kallio

The analysis of the functional needs of different communities and market processes highlights the full market potential of service development. With extreme functional specialization, companies and workers will be providing narrower service to increasing number and variety of market activities and communities. Our case studies illustrate the working conditions of functional selection and the potential co-evolution of private, public and commercial institutions.

2 - Dynamic Policies in Knowledge-Based Service System with Feedback Information

Qifeng Shao, Northwestern University, 2145 Sheridan RD, IEMS 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 an information feedback mechanism. The feedback system provides information regards correctness of the agent's decisions. With help from the feedback system, the agent adjusts processing strategies to deal with information crises that can change the state of arrival customers. Besides the optimal strategy, we examined several heuristics and found one effective policy with a simple threshold design.

3 - A Simulation Based Framework for Service Facility Internal Layout Design

Ming Xie, IBM Research - China, Diamond Building, ZGC Software Park, Beijing, China, xieming@cn.ibm.com, Jinyan Shao, Bin Zhang, Wenjun Yin, Jin Dong

Service facilities, including bank branches, supermarkets, etc. are closely related to our lives. Whereas, it is a difficult task to make decisions on how to design internal layout and configuration for them. In this paper, we propose a service facility internal layout optimization framework as well as how to model the system into a multi-agent system. Then, a bank branch scenario from real world is adopted to demonstrate the methodology and implementation.

■ WD23

C - Room 18D, Level 4

Retail Managment

Contributed Session

Chair: Mahesh Kumar, Assistant Professor, R.H. Smith School of Business, University of Maryland, 4321 Van Munching Hall, College Park, MD, 20742, United States of America, kumarmahesh@gmail.com

1 - Assortment Planning of Configurable Products

Edward Umpfenbach, PhD Student, Wayne State University, 20011 12 Mile, Roseville, MI, 48066, United States of America, as6964@wayne.edu, Alper Murat, Ratna Babu Chinnam

Considerable work has been done to optimize the assortments of high sales density products. We introduce a method to estimate demand and substitution parameters of a configurable product given sales data, then solve a joint supply chain planning and assortment planning problem.

2 - The Impact of Execution Errors on Inventory Record Inaccuracy and Retail Out-Of-Stock

Howard Hao-Chun Chuang, Doctoral Student, Mays Business School, Texas A&M University, Wehner 301C - TAMU 4217, College Station, TX, 77840, United States of America, hchuang@mays.tamu.edu, Rogelio Oliva

We model a continuous (Q,R) inventory system and analyze the impact of execution errors on inventory record inaccuracy and retail out of stock. The existence of multiple errors could disrupt ordering decisions and reduce on-shelf availability. We formalize the argument analytically and develop a system dynamics model. We perform Monte-Carlo sensitivity simulation to identify the most costly execution errors. Then we provide suggestions to improve operational accuracy within a retail store.

3 - A Pooling Procedure to Improve Sales Forecasts for Retail Fashion Goods with Limited Past Sales Data

Mahesh Kumar, Assistant Professor, R.H. Smith School of Business, University of Maryland, 4321 Van Munching Hall, College Park, MD, 20742, United States of America, kumarmahesh@gmail.com

Most sales forecasting methods are likely to perform poorly if only a small amount of past sales data is available for analysis. The situation is common for new fashion items in a store, especially during the early weeks of a selling season. We overcome this limitation of a forecasting method by pooling data from groups of similar items using a two-step clustering procedure. The new procedure is flexible to use and is computationally fast. Its effectiveness is demonstrated on a real-world data.

■ WD24

C - Room 19A, Level 4

Joint Session SPPSN/ TSL: Decision Support for Emergency Response and Public Safety

Sponsor: Public Programs, Service and Needs/ Transportation Science and Logistics Society

Sponsored Session

Chair: Alex Savachkin, Assistant Professor, University of South Florida, 4202 E. Fowler Avenue ENB 118, Tampa, FL, 33620, United States of America, alexs@usf.edu

1 - Non-Pharmaceutical Interventions (NPI) for the Mitigation of Pandemic Influenza

Dayna Martinez, Doctoral student, University of South Florida, Tampa, FL, 33620, United States of America, dlmartin@mail.usf.edu, Tapas K. Das, Alex Savachkin

In the event of an influenza pandemic, non-pharmaceutical interventions (NPI), such as social distancing, will likely be the only effective containment measure available in the early phase of the pandemic. In this research, we examine various NPI strategies, such as quarantine of isolated cases, household quarantine, school and workplace closures, and study their effect on the infection attack rate and the societal and economic cost of the pandemic.

2 - Developing an Agent-based Model for Poliovirus Transmissions for Post-eradication Outbreak Response

Hazhir Rahmandad, Assistant Professor, Virginia Tech, 7054 Haycock Rd., room 430, falls church, va, 22043, United States of America, hazhir@vt.edu, Kimberly Thompson, Radboud Duintjer-Tebbens, Kun Hu

Given the possibility of reintroductions of live polioviruses into communities after eradication, designing effective and efficient responses to potential outbreaks is necessary. In this study we develop an individual-based simulation model of poliovirus transmission dynamics in a population and use this model the explore alternative response strategies. We also explore the importance of different assumptions with regard to human contact network and transmission mechanisms.

3 - Agent-based Simulation of Mass Egress From Large Public Events: Current State and Next Steps

Douglas A. Samuelson, President and Chief Scientist, InfoLogix, Inc., Annandale, VA, United States of America, samuelsondoug@yahoo.com

We review a variety of recent work on agent-based simulation of mass egress, especially from sports arenas, noting the capabilities, limitations and design compromises in some of the most interesting models. We then discuss next steps, including modeling group movement, movement by emergency responders, placement of treatment centers, effects of toxic air- and water-borne plumes, and integration of planning and training models with real-time crisis management information systems.

4 - Decision Support Systems for Pandemic Influenza (PI) Surveillance

Alfredo Santana-Reynoso, PhD Candidate, University of South Florida, 4202 E. Fowler Avenue ENB118, Tampa, FL, 33620, United States of America, asantan2@mail.usf.edu, Diana Prieto, Alex Savachkin, Sharad Malavade

PI contingency plans have concentrated their efforts into a new virus strain of low transmissibility and high severity originated in SE Asia. The H1N1 2009 outbreak featured higher transmissibility and lower severity than expected, and was originated in North America. This presentation analyzes how these scenarios have been managed by the current PI surveillance systems. Robust multi-epoch decision support systems for PI surveillance adaptable to a more diverse range of situations are presented.

■ WD25

C - Room 19B, Level 4

Transportation, Planning III

Contributed Session

Chair: Wei Fan, Assistant Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd., Tyler, TX, 75799, United States of America, wfan@uttyler.edu

1 - Expansion Planning of Road Networks via Agent-Based Optimization

Alireza Kabirian, University of Alaska - Anchorage, Rasmuson Hall, Suite 318D, 3211 Providence Dr, Anchorage, AK, 99508, United States of America, a_kabirian@yahoo.com

We develop optimization models and methodologies for expansion planning of an existing network of roads over a long-run horizon. Specifically, we aim at determining where and when new roads should be constructed and which and when old roads should be reconstructed to minimize public construction costs as well as travelers' expenses. This decision support model helps transportation managers in public sector make comprehensive and data-driven decisions about expansion of road infrastructures.

2 - The Changes in Users' Perceptions on Transportation Problems in the Last 10 Years

Xiaoyu Zhu, PhD Candidate, University of Florida, 365 Weil Hall, P.O. Box 116580, Gainesville, FL, 32611, United States of America, shuxy03@ufl.edu

To improve the transportation system, it is important to understand the travelers' perceptions about transportation issues to assess user acceptance of the policies. With developments in transportation, the perceptions might change greatly in the last decade. To understand the people's perceptions about the most important transportation issue will provide more information for value the project efficiency and public acceptance.

3 - A Sensor-based Vehicle Routing Problem Algorithm

Chrysafis Vogiatzis, University of Florida, Weil 303, Gainesville, FL, 32611, United States of America, chvogiat@ufl.edu, Panos Pardalos

Vehicle routing has always been a vital problem for transportation and traffic congestion. Throughout the years, solutions have been proposed but are usually hard to implement because of the continuous time nature of the problem, which cause alterations in conditions and constraints. We propose an online algorithm which searches for an optimal solution based on the input provided by vehicle to vehicle sensor communication using augmented lagrange relaxation.

4 - Optimal Toll Design with Uncertain Demand

Wei Fan, Assistant Professor, The University of Texas at Tyler, Department of Civil Engineering, 3900 University Blvd., Tyler, TX, 75799, United States of America, wfan@uttyler.edu

An optimal toll design problem (OTDP) under a second-best link based congestion pricing scheme is discussed in this presentation, in which the selection of both toll locations and toll levels needs to be optimally determined with uncertain demand. A bi-level optimization model is formulated and a simulation-based genetic algorithm procedure is proposed to solving the OTDP. Numerical results are presented and future research directions are also given.

■ WD27

C - Room 4B, Level 3

Networks and Graphs

Contributed Session

Chair: Alex Sprintson, Assistant Professor, Texas A&M University, TAMU 3128, College Station, 77843, United States of America, spalex@tamu.edu

1 - Screen Sizes of Paths

Anthony Harrison, Texas State University, 601 University Drive, San Marcos, United States of America, ah1411@txstate.edu, Nathaniel Dean

Sphere of infuence graphs (SIGs) are a representation of spatial relationships between points. They can be useful in areas related to pattern matching. We consider a graph invariant for SIGS called the screen size. This is the smallest integer k such that a given SIG can be realized on a k by k grid. We find the screen size for paths and then explore integer programming formulations for the problem and explain some of the difficulties encountered with this approach.

2 - Reliable Networks That Can be Modeled by Graphs with Edge Connectivity Equal to Two

Leandro Teixeira, Centro de Anàlises de Sistemas Navais, Praça Barao de Ladàrio, AMRJ , Centro, rio de janeiro, RJ, 20091-000, Brazil, leandrodteixeira@yahoo.com.br, Nair Abreu, Leonardo Lima

Deterministic and probabilistic parameters can be used to measure the reliability of a graph that models a network. Consider that each node of the network is reliable and its failure is related to the probabilities of the edge failures of the graph when these probabilities occur randomly and independently. In this work, a class of graphs with maximum reliability among all graphs with edge connectivity equal to two is presented.

3 - An Efficient Algorithm for the Distributed Data Retrieval Problem

Alex Sprintson, Assistant Professor, Texas A&M University, TAMU 3128, College Station, 77843, United States of America, spalex@tamu.edu, Zakia Asad, Mohammad Asad R Chaudhry

We consider the problem of accessing large volumes of data stored on multiple locations across a storage network. We assume that data is stored in either original or encoded form on multiple servers across the network. Our goal is to find a set of disjoint paths of minimum total cost that connect the client with some of the servers across the network such that client is able to retrieve the required data. We present an efficient polynomial-time algorithm for this problem.

4 - An Efficient Heuristic Algorithm for Minimum Labeling Spanning Tree Problem

Kaveh Farokhi Sadabadi, Faculty Research Assistant, University of Maryland, ENCE Department, 1173 Glenn L. Martin Hall, College Park, MD, 20742, United States of America, kfarokhi@umd.edu, Ali Haghani

We propose a heuristic algorithm to solve Generalized Minimum Labeling Spanning Tree problem. This is an NP hard problem with applications in telecommunications and network design. Many algorithms are proposed to solve GMLST. Maximum Vertex Covering (MVCA) and Genetic Algorithm (GA) are well-known. Global optimality of these methods is not guaranteed, nor are they efficient to deal with large problems. Reported examples show the efficiency and quality of the proposed method compared to others.

■ WD28

C - Room 4C, Level 3

Computer Models: Prediction and Calibration

Sponsor: Quality, Statistics and Reliability

Sponsored Session

Chair: Lulu Kang, Assistant Professor, Illinois Institute of Technology, Engineering 1 Building, Applied Math, 10 West 32nd Street, Chicago, IL, 60616, United States of America

1 - Model Calibration with Minimal Adjustments

Chia-Jung Chang, PhD Student, Georgia Institute of Technology, 755 Ferst Drive, Atlanta, GA, United States of America, cchang43@gatech.edu, Roshan 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.

2 - Improving Prediction by Integrating Analytical Models with Finite Element Models

Shan Ba, Georgia Institue of Technology, 765 Ferst Drive, NW, Atlanta, GA, 30332, United States of America, shan.ba@gatech.edu, Roshan Vengazhiyil, Ramesh Singh

For the micro grooving process, we develop an innovative two-step design of experiments approach to efficiently extract information from both the simple analytical force model and the complex finite element model. The simple but less accurate analytical model can be adjusted by data from the time-consuming finite element simulations, and finally forms an effective surrogate micromachining cutting model which is fast, accurate and economically viable to use.

3 - Kernel Sum Regression and Interpolation

Lulu Kang, Georgia Institute of Technology, Atlanta, GA, 30332, United States of America, lkang@isye.gatech.edu, Roshan Vengazhiyil

In this paper, we propose a new nonparametric regression method, called kernel sum regression method. It utilizes iterative kernel regression to achieve better prediction accuracy. Meanwhile, if the the number of kernel regression goes to infinity, the kernel sum regression becomes an interpolation method. We also investigated some properties of the kernel sum regression and interpolation methods, and provide algorithm to estimate the bandwidth parameters.

■ WD29

C - Room 5A, Level 3

Quality Improvement in Complex Systems

Sponsor: Quality, Statistics and Reliability
Sponsored Session

Chair: Ran Jin, Georgia Institute of Technology, 755 Ferst Dr. NW, Atlanta, United States of America, jinr@gatech.edu

1 - Challenges of using Feature Selection Methods for Waveform Signals

Nasim Arbabzadeh, Rutgers University, 23667 BPO WAY, Piscataway, NJ, 08854, United States of America, nasim@eden.rutgers.edu, Susan Albin

Recent technological advances in data capture and processing result in high-dimensional waveform signals, making the analysis difficult for the process engineers. Feature selection methods can be used to reduce the features to a manageable number. In this paper, different feature selection methods have been compared on several real datasets, including NIR spectra and vertical depth profile, and the impact of different sampling frequencies on their performances has been investigated.

2 - Generalized Selective Assembly

Matthias H Tan, Student, Jeff Wu/ Department of Industrial & Systems Engineering, Georgia Institute of Technology, 301 10th Street NW, Apt 208A, Atlanta, GA, 30318, United States of America, mtan6@gatech.edu, Jeff Wu

This paper develops a generalized version of selective assembly, called GSA, for improving the quality of assemblies of single units of different component types. Two variants are considered: direct selective assembly, which uses measurements on component characteristics, and fixed bin selective assembly, which only requires sorting components into bins. We formulate the problem of matching N components of each type to give N assemblies that minimize quality cost as linear integer programs.

3 - Relationship Between Seamless Tube Quality and Piercing Vibration Data

Weidong Zhang, Vice Director and Associate Professor, National Cecter for Materials Service Safety,University of Science and Technology Beijing, 30 Xueyuan Road, Haidian District, Beijing, 100083, China, zwd@ustb.edu.cn, Ran Jin, Jianjun Shi

We can get vibration data of seamless tube piercing by two cameras. There may be some relationship between quality of seamless tube and vibration data. We can find the relationship by system informatics method.

■ WD30

C - Room 5B, Level 3

Statistics/Quality Control III

Contributed Session

Chair: David Han, Assistant Professor, University of Texas at San Antonio, One UTSA Circle, San Antonio, TX, 78249, United States of America, david.han@utsa.edu

1 - A Variable Sampling Hotelling T2 Chart for Monitoring Simple Linear Quality Profiles

Galal Abdella, PhD Student, Wayne State University, 4815 4th Street, Detroit, MI, 48202, United States of America, bb2941@wayne.edu, Kai Yang, Adel Alaeddini

We design a variable sampling T2 scheme to enhance the detecting speed of off-target conditions while keeping the total number of samples low. We constructed an optimization model solved by using the genetic algorithm. The performance of the proposed scheme is compared with its fixed sampling counterparts under different conditions.

2 - Beta Model-based Control Chart for Fraction Monitoring

Carla ten Caten, Profa. PhD., PPGEP/UFRGS, Av. Osvaldo Aranha, 99 - 5° andar, Porto Alegre, RS, 90.035-190, Brazil, tencaten@producao.ufrgs.br, Angelo Sant'Anna, Michel Anzanello

Modelo-based control charts often use multiple regression models. We propose a Beta model-based control chart (BMCC) for monitoring fraction that varies with the adjustment of control variables. The BMCC monitors deviances on Beta model's residuals. We use sensitivity analysis to compared BMCC with Hawkins (1991) and Haworth's(1996) methods.

3 - Analysis Methods for Non-regular Fractional Factorial Designs

Shilpa Shinde, Arizona State University, 1249 E Spence Avenue Apt#343, tempe, AZ, 85281, United States of America, scvmadha@asu.edu, Douglas Montgomery

Non-regular designs are very effective alternatives to regular fractional factorials. Their use is restricted due to the lack of robust analysis techniques. We present a new analysis and variable selection technique which will help identify significant effects in a non-regular design.

4 - Exact Inference for Progressively Type-I Censored Exponential Failure Data

David Han, Assistant Professor, University of Texas at San Antonio, One UTSA Circle, San Antonio, TX, 78249, United States of America, david.han@utsa.edu, N. Balakrishnan, G. Iliopoulos

Progressively Type-I censored life-test is discussed under the assumption of exponential distribution. For small sample sizes, a practical modification is proposed to guarantee a feasible test under this scheme. We then obtain the exact sampling distribution of the MLE of the mean parameter under the condition ensuring its existence. Using the exact method as well as the asymptotic and bootstrap methods, we then discuss construction of confidence intervals and their performance via simulations.

■ WD31

C - Room 5C, Level 3

Quality Management I

Contributed Session

Chair: Karl Majeske, Associate Professor of Quantitative Methods Management, Oakland University, School of Business Administration, Rochester, MI, 48309, United States of America, majeske2@oakland.edu

1 - CUSUM Control Charts for Respiratory Syndromic Surveillance

Huifen Chen, Professor, Chung-Yuan University, Department of Industrial and Systems Eng., Chung-Yuan University, Chungli, 320, Taiwan - ROC, huifen@cycu.edu.tw, Chaosian Huang

This work applies CUSUM charts for detecting outbreaks of the respiratory syndrome. The data, daily ambulatory-care visits based on population of size 160 thousand, are from Taiwan National Health Insurance Research Database. We construct a standardized CUSUM chart based on residuals of a fitted regression model with an ARMA error term using the 2005 and 2006 data. The CUSUM chart seems to be able to detect aberrations of respiratory syndrome when used to monitor the 2007 and 2008 data.

2 - An Integrated Approach for Multivariate Process Control in Automobile Manufacturing

Xiaoyu Ma, PhD Student, Industrial&manufacturing engineering department, wayne state university, 4815 4th Street, detroit, MI, 48202, United States of America, eb1946@wayne.edu, Alper Murat, Kai Yang, Adel Alaeddini

Increasing availability of multivariate process data demands us to develop effective analysis techniques. We developed a comprehensive approach that uses statistical and optimization techniques. It performs abnormal signal detection, influential features selection in optimized fashion during multivariate statistical control practice. This approach can help root cause analysis in automobile manufacturing process and examples with real data are presented.

3 - Sustaining Quality Performance Through Collective Mindfulness

Hung-Chung Su, Student, University of Minnesota, 3-150 321-19th Avenue South, Minneapolis, MN, 55455, United States of America, suxxx051@umn.edu, Kevin Linderman

Organizational mindfulness is an emerging construct that has not receive enough attention in the quality management. We provide evidence of the five dimensions of organizational mindfulness and examine its impact on innovation, improvement and the reliability of quality performance. We discuss the implications for sustaining quality performance and possible contributions to the organizational learning and dynamic capability literature.

4 - Dynamic Part Fitting to Improve Automotive Body Quality

Karl Majeske, Associate Professor of Quantitative Methods Management, Oakland University, School of Business Administration, Rochester, MI, 48309, United States of America, majeske2@oakland.edu

The gaps and flushness between assemblies, such as door-to-fender, represent a highly visible automotive body quality characteristic. Traditional design and assembly methods attach a door to the body by bolting hinges into established mounts. This technique uses vision system data to orient parts during final assembly to optimize quality.

■ WD33

C - Room 6B, Level 3

Optimization Models in Data Mining with Applications in Biomedicine

Sponsor: Computing Society
Sponsored Session

Chair: Petros Xanthopoulos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, petros.xanthopoulos@gmail.com

1 - Early Detection of Cardiovascular Disease
Tsung-Lin Wu, tlwu@isye.gatech.edu, Eva Lee

Cardiovascular diseases are the No 1 cause of death in US. Coronary heart disease is caused by atherosclerosis, the narrowing of the coronary arteries due to fatty build ups of plaque, producing angina pectoris, heart attack or both. We present novel early detection based on classification of traditional risk factors and novel biomarkers. The results can detect risk conditions of arteries and allow clinicians to perform early intervention. This work is joint with cardiologists at Emory U.

2 - Robust Data Mining with Application in Biomedicine and Engineering
Petros Xanthopoulos, University of Florida, 303 Weil Hall, P.O. Box 116595, Gainesville, FL, 32611, United States of America, petros.xanthopoulos@gmail.com, Panos Pardalos, Mario Guarracino

Supervised and unsupervised learning under uncertainty has become a very important problem in data analysis. In this talk we present some algorithms based on robust optimization for addressing data uncertainty issues.

3 - Rule Extraction From Support Vector Machines and Applications to Medical Diagnosis
Sara Nourazari, University of Oklahoma, 100 East Boyd, SEC T 301, Norman, OK, 73019, United States of America, sara.n@ou.edu, Theodore Trafalis

Among the classification methods, the propositional if-then rules are very popular providing a transparent classification decision. In the case of high-dimensional data, SVMs often perform significantly better but suffer from incomprehensibility. In this work we evaluate different techniques to extract expressive rules from SVMs and apply those in real life cases such as medical diagnosis.

4 - Network Based Models for Analysis of SNPs
Zeynep Ertem, Texas A&M University, 1313 Zachry, College Station, TX, 77840, United States of America, zeynepsertem@gmail.com, Sergiy Butenko

Constructing associated graph-theoretic models becomes more important as communicating vast amount of information accumulated in the laboratories each day is getting harder. Single Nucleotide Polymorphisms (SNPs) are of paramount importance in DNA related studies due to their role in variation of species. In this talk, we first survey metwork based models arising in computational biology and then concentrate on applications of cluster-detection algorithms to analyze SNP data.

5 - Parametric Support Vector Machines
Altannar Chinchuluun, Dr, Centre for Process Systems Engineering, Imperial College London, London, United Kingdom, a.chinchuluun@imperial.ac.uk, Ashwin Arulselvan, Stratos Pistikopoulos

Support vector machines have been extensively studied and used in practice as a data mining tool especially in the field of biomedicine. We study the parametric support vector machine, where in we introduce the degree of misclassication as the parameter. Multiparametric prorgamming techniques are used for the resulting multiparametric mixed integer programs.

■ WD35

C - Room 8A, Level 3

Ranking and Internet Applications

Sponsor: Applied Probability
Sponsored Session

Chair: Mariana Olvera, Columbia University, 500 W. 120th Street, Mudd Building, Room 306, New York, NY, 10027, United States of America, molvera@ieor.columbia.edu

1 - User Selection Process for More Profitable Display Advertising
Ana Radovanovic, Research Scientist, Google Research, 76 Ninth Ave., New York, NY, 10011, United States of America, anaradovanovic@google.com

One of the key performance objectives in display advertising business is maximizing the proportion of user clicks out of all of the shown ads by a given advertiser. However, the click probability significantly depends on users we are showing a certain ad to. We introduce a self-organizing online policy for updating user members' lists and show that this policy allows us to achieve nearly optimal long-term proportion of clicks out of all online inventory that is handled by a publisher.

2 - Implicit Renewal Theory for Ranking Algorithms
Mariana Olvera, Columbia University, 500 W. 120th Street, Mudd Building, Room 306, New York, NY, 10027, United States of America, molvera@ieor.columbia.edu, Predrag Jelenkovic

We present a stochastic framework to analyze the qualitative large scale behavior of a family of ranking algorithms, in the same spirit of Google's PageRank algorithm, via implicit renewal theory. Our analysis is based on a stochastic recursion constructed on a tree, and the techniques we develop can be applied to both linear and non-linear recursions. We extend prior work to allow a general correlation structure among the different inputs of the algorithm.

■ WD36

C - Room 8B, Level 3

Quality Management II

Contributed Session

Chair: Scott Dellana, Associate Professor, East Carolina University, Bate 3102, Dept of Marketing & Supply Chain Mgmt, Greenville, NC, 27858, United States of America, dellanas@ecu.edu

1 - A Robust Technique to Process Qualitative Customer Data and Build Satisfaction Models
Jose Luis Ribeiro, Dr., UFRGS, Av. Osvaldo Aranha 99, Porto Alegre, RS, 90035-190, Brazil, ribeiro@producao.ufrgs.br, Maria Auxiliado Tinoco

Customer survey may be used to collect qualitative data and build satisfaction models. However, due to respondents' lack of engagement, customer survey is usually contaminated with noise. Following robust regression principles, we developed a technique to process qualitative data according to its consistence, supporting the construction of robust satisfaction models.

2 - Supply Chain Quality Management Practices and Perceptions: A Preliminary Empirical Study
Scott Dellana, Associate Professor, East Carolina University, Bate 3102, Dept of Marketing & Supply Chain Mgmt, Greenville, NC, 27858, United States of America, dellanas@ecu.edu, John Kros

Recent global supply quality problems have underscored the need for a better understanding of quality across the supply chain. Studies in supply chain quality are few, limited, and with mixed results warranting more extensive study. We examine quality management practice by industry class and supply chain organizational position and compare agreement between perceived supplier quality management practices reported by customers and quality practices reported by their supplier groups.

■ WD37

C - Room 8C, Level 3

Stochastic Processes

Contributed Session

Chair: Tianke Feng, Industrial and Systems Engineering, University of Florida, 303 Weil Hall, P.O. Box 116595, University of Florida, Gainesville, FL, 32611, United States of America, fengtk@ufl.edu

1 - Sharp Bounds for the Distribution of Critical-path Length

Munevver Mine Subasi, Assistant Professor, Florida Institute of Technology, 150 W. University Blvd, Melbourne, FL, 32901, United States of America, msubasi@fit.edu, Ersoy Subasi, Andras Prekopa

In PERT we are frequently concerned with the problem to estimate the values of the probability distribution or expectation of the critical-path length. We develop a bounding technique to obtain sharp bounds for the values of the distribution of the critical-path length under moment information and the assumption that the random length of each arc follows a beta distribution.

2 - Evolutionary Computation-based Statistical Estimation Models for Complex System Analysis Based on Count Data

Emily Zechman, Assistant Professor, Texas A&M University, 3136 TAMU, College Station, TX, 77843, United States of America, ezechman@tamu.edu, Seth Guikema, Royce Francis

Count data is ubiquitous in engineering practice, and forecasting future counts of events based on past data is a critical problem. Examples include forecasting power outages and estimating the risk of traffic accidents. This research will explore flexible, data-adaptive regression models for count data that preserve insights into system behavior while allowing exploration of new combinations of model structures. A new evolutionary computation-based method will be developed and demonstrated.

3 - The Replacement Problem in Manufacturing Stochastic Systems

Eva Selene Hernàndez Gress, PhD, Universidad Autónoma del Estado de Hidalgo, Abasolo 600 Col. Centro, Pachuca, 42000, Mexico, evah@uaeh.edu.mx

The Replacement Problem is modeled with Linear and Dynamic Programming. This problem can be modeled also as a finite, irreducible, homogeneous Markov Chain. The transition probabilities matrix and the optimal basis associated to the Linear Programming model are perturbed to find regions of feasibility and optimality. Some perturbations bounds of the transition probabilities are explored and a perturbation bound for the optimal basis is also proposed.

4 - Markov Decision Processes with Uncertain Rewards

Chin Hon Tan, PhD Student, Department of ISE, University of Florida, 303 Weil, University of Florida, Gainesville, FL, 32611, United States of America, chinhon@ufl.edu, Joseph Hartman

Sequential decision problems can often be modeled as Markov decision processes. Classical solution approaches assume that the parameters of the model are known. However, the rewards are often estimated and uncertain in practice. In this paper, we look at the marginal change in the value function as a result of the error in the reward estimate and identify the region in which a policy remains optimal. We illustrate this work with a stochastic lot-sizing problem.

5 - Sequential Stochastic Assignment Problem with Postponing Decisions

Tianke Feng, Industrial and Systems Engineering, University of Florida, 303 Weil Hall, P.O. Box 116595, University of Florida, Gainesville, FL, 32611, United States of America, fengtk@ufl.edu, Joseph Hartman

The sequential stochastic assignment problem has wide applications in abandonment problems and health care management, and has been well studied. It assumes that jobs arrive randomly with random values. Upon arrival, a job's value is known and the decision maker immediately decides whether to accept or reject it. In this research, we study the value of postponing decisions by allowing a decision maker to hold jobs. We analyze the optimal threshold policies for this version of the problem.

■ WD38

C - Room 9A, Level 3

Algorithms for Real-Time Equilibrium and Relocation Problems

Sponsor: Optimization/Linear Programming and Complementarity (Joint Cluster ICS)

Sponsored Session

Chair: Miguel F. Anjos, University of Waterloo, 200 University Avenue West, Waterloo, ON, Canada, anjos@stanfordalumni.org

1 - Parametric Complementarity Problems for Online Optimal Control

Mihai Anitescu, Computational Mathematician, Argonne National Laboratory, Math and Computer Science Division, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, anitescu@mcs.anl.gov, Victor Zavala

We demonstrate that if points along the solution manifold of a nonlinear model predictive control problem are consistently strongly regular, it is possible to track the manifold approximately by solving a single linear complementarity problem (LCP) at each control step. We derive a fast, augmented Lagrangean tracking algorithm and demonstrate the developments through a numerical case study.

2 - Real-time Optimization and Differential Variational Inequalities

Victor Zavala, Argonne National Laboratory, Math and Comp. Science Div., Bdg 240, 9700 S Cass Ave, Argonne, IL, 60439, United States of America, vzavala@mcs.anl.gov, Mihai Anitescu

We present new insights into how to achieve higher frequencies in real-time optimization. The basic idea is that, instead of solving a full NLP problem at each sampling time, we solve a single, truncated QP problem. We prove that this corresponds to a time-stepping scheme applied to a differential variational inequality. We propose a fast and stable scheme using augmented Lagrangian regularization and projected Gauss-Seidel to track the solution manifold.

3 - A Stochastic Optimization Model for Ambulance Relocation

Joe Naoum-Sawaya, University of Waterloo, 200 University Av W, Waterloo, Canada, jnaoumsa@engmail.uwaterloo.ca, Samir Elhedhli

In this talk, we present our recent work on implementing a real time ambulance relocation system for the Region of Waterloo Emergency Medical Services. We formulate a stochastic optimization model and devise a heuristic that finds good solutions quickly. Results using the Region of Waterloo EMS data are presented.

■ WD39

C - Room 9B, Level 3

Algorithms and Applications for Integer Programming

Sponsor: Optimization/Integer Programming

Sponsored Session

Chair: Yongpei Guan, University of Florida, 303 Weil Hall, Gainesville, FL United States of America, guan@ise.ufl.edu

1 - Fast Algorithms for Special Cases of the Minimum Cost Flow Problem

Bala Vaidyanathan, Operations Research Advisor, FedEx Express, 3680 Hacks Cross Road, Memphis, TN, 38125, United States of America, bala.vaidyanathan@gmail.com

We consider special cases of the minimum cost flow problem when the nodes lie on a line, a circle, or a tree. We show that the properties of these problems can be exploited to develop specialized algorithms that run significantly faster than minimum cost flow algorithms for general networks. These problems find applications in areas such as transportation, electric power transmission, production planning, telecommunications, computational biology, and computational music.

2 - Polyhedral Results for MIPs with Cardinality Constraints

Ilksen Icyuz, University of Florida, 303 Weil Hall, Gainesville, 32611, United States of America, eceicyuz@ufl.edu, Jean-Philippe Richard

We consider several mixed integer programs arising from applications that contain various forms of cardinality constraints. For these models, we review existing polyhedral results and obtain new strong valid inequalities based on disjunctive and lifting techniques. We also characterize situations in which these inequalities are sufficient to completely define the associated convex hulls. Finally, we present the results of a computational study aimed at testing the strength of these new cuts.

3 - Strong Formulations for Lot-Sizing Problems with Disruptions

Zhili Zhou, University of Florida, 303 Weil Hall, Gainesville, FL, 32611, United States of America, zlzhou@ufl.edu, Yongpei Guan

Most previous research on lot-sizing problems assumed no disruptions. However, disruptions occur in practice, which lead to extra outsourcing or production costs, as compared to the normally scheduled case. We formulate this problem as a robust integer program, and derive facet-defining inequalities for the problem. Final computational experiments show the effectiveness of our proposed approach.

4 - New Cutting Planes for Cardinality Optimization

Ismael De Farias, Texas Tech University, Lubbock, TX, United States of America, ismael.de-farias@ttu.edu, Ming Zhao, Rajat Gupta, Ernee Kozyreff

We study the cardinality optimization polytope and extensions, particularly the set of the minimum 0-norm optimization problem. We present new cutting planes for them and computational results on their use in branch-and-cut.

■ WD40

C - Room 9C, Level 3

Robust Optimization

Contributed Session

Chair: Bacel Maddah, Assistant Professor, American University of Beirut, P.O. Box 11-0236 Riad El Solh, Beirut, 1107-2020, Lebanon, bm05@aub.edu.lb

1 - Handling Uncertainty in Supplier Selection using Robust Optimization

Sheela Siddappa, Technical Architect, Infosys Technologies Limited, Electronic City, Bangalore, India, sheela_siddappa@infosys.com, Paresh Kumar Marwaha

Selecting the right set of suppliers to procure items can help reduce company's expense and improve customer satisfaction. This research tries to account for uncertainty in supplier's performance, capacity, and cost while selecting the suppliers. We develop a two step process 1) select suppliers based on the uncertainty in their performance 2) estimate procurement quantity from each supplier based on the uncertainty in supplier's capacity, cost, etc. A Robust Optimization methodology is adopted.

2 - The Relational Algebra of Constraint Sets in Robust Optimization

G. N. Srinivasa Prasanna, International Institute of Information Technology - Bangalore, 26/C Electronics City, Bangalore, India, gnsprasanna@iiitb.ac.in

A relational-algebra for identifying, classifying, & visualizing relationships among different constraint sets (input assumptions) in a robust optimization (RO) framework is presented. Set-theoretic relations between alternative constraint sets are specified in an expression-based query language (composed of set-disjointness, union, intersection, etc.) We can compare, visualize & analyze different sets of assumptions, facilitating decision-support in general, & RO in particular.

3 - Loading of Ships at Refineries when Arrival Times are Uncertain - A Robust Optimization Approach

Jens Bengtsson, Norwegian School of Economics and Business Administration, Helleveien 30, Bergen, Norway, jens.bengtsson@nhh.no, Patrik Flisberg, Mikael Rönnqvist

Ships that arrive to refinery ports are either served from product or component tanks. Arrival times of ships are uncertain and as such the inventory levels in the tanks will be uncertain and can in extreme cases be full or empty. Both these outcomes may be costly to the refiner. In this paper we take the arrival time uncertainty into account and analyze the production planning and loading problem by using robust optimization.

4 - The Newsvendor Problem with Ambiguous Demand Distribution

Bacel Maddah, Assistant Professor, American University of Beirut, P.O. Box 11-0236 Riad El Solh, Beirut, 1107-2020, Lebanon, bm05@aub.edu.lb, Ebru Bish, F. Jordan Srour, Kyle Lin

We study the newsvendor problem when the demand distribution is "ambiguous" in terms of being within a given Kullback-Leibler distance from a nominal distribution. Our approach is novel as no precise estimate of demand parameters (e.g., moments, percentiles, and range) is required. We derive the optimal newsvendor ordering policy in this setting.

■ WD41

C - Room 10A, Level 3

Metaheuristics II

Contributed Session

Chair: Fan Wang, Prof., Sun Yat-sen Business School, Sun Yat-sen University, No.135 West Xinggang Road, Guangzhou, 510275, China, fanwang@gmail.com

1 - A Modified Particle Swarm Optimization Algorithm

Junhyuk Park, Pohang University of Science and Technology, Nam-Gu, Hyoja-Dong, POSTECH Eng 4-207, Pohang, Korea, Republic of, sacarlee@postech.ac.kr, Byung-In Kim, Jongsung Lee

In classical PSO algorithms, the global best solution has a strong influence on the entire population. As a result, particles may rapidly converge to a premature global best solution without exploring enough search space. In this presentation, we extend the searching capability of particles by limiting the influence of global best solution. We compare the performance of the algorithm with several existing algorithms.

2 - A Genetic Algorithm for the Team Formation Problem

Paul Rubin, Michigan State University, The Eli Broad Graduate School of Managem, Michigan State University, East Lansing, MI, 48824, United States of America, rubin@msu.edu, Lihui Bai

We consider the team formation problem that assigns individuals with various values of attributes to teams so that the differences across teams with respect to each attribute are minimal. The problem is formulated as a mixed integer linear program and solved by a genetic algorithm with a constraint programming solver. Numerical results on randomly generated as well as real problems are reported.

3 - Exploration of a Functional Programming Approach for Developing a Metaheuristic

Dennis Drinka, Exploration of a Functional Programming Approach for Developing a Metaheuristic, University of Alaska Anchorage, 3211 Providence Drive, Anchorage, AK, 99508, United States of America, afded@uaa.alaska.edu

This presentation explores the use of a functional programming approach to drive a metaheuristic for solving a combinatorial optimization problem. In particular, it explores the use of LINQ to Objects to implement a tabu search procedure. It will demonstrate the use of this approach on the All Units Quantity Discount problem and describe how functional programs can easily be embedded within existing imperative programming solution approaches.

4 - Self Adaptation GA Applied to Routing Problems

Jaime Mora Vargas, Tecnológico de Monterrey, Research and Graduate Division, Campus Estado de México, Mexico, jmora@itesm.mx], Nestor Velasco-Bermeo, Miguel Gonzàlez-Mendoza

Mathematical Programming (MP) has proven to be an effective strategy to tackle down optimization problems. Traditional methods fail to solve such problems due to the "combinatory explosion", an exponential increase of the solution space theorically identified as "NP-Hard" problems, based on such tendency new strategies have been proposed; the combination of mathematical programming and hybrid metaheuristics, the later having as main characteristic the adaptation ability to the environment's changes without the need to fine tune the parameters or re-run the method. GA's have proven to be one of the most successful methods to solve most of the classic optimization problems. Though the benefits of such algorithms disappear when situation analyzed changes. Based on such inconvenient a new approach is proposed. A hybrid GA with MP and the incorporation of "auto-adaptation" lets the algorithm not just to evolve solution candidates but its own parameters based on the current state (individual's aptitude according to each generation). The problems solved are ; Vehicle Routing Problem With Time Window (VRPTW) and Multi-depot Vehicle Routing Problem With Time Window (MDVRPTW).

5 - A Compromised Large-scale Neighborhood Search Heuristic for Heterogeneous VRP

Fan Wang, Prof., Sun Yat-sen Business School, Sun Yat-sen University, No.135 West Xinggang Road, Guangzhou, 510275, China, fanwang@gmail.com, Yi Tao

We addressed the Heterogeneous VRP with fixed costs and routing costs in which a limited fleet of different vehicles is available for sending goods to customers with known demand along the network with the objective of minimizing the total cost. We propose a compromised large-scale neighborhood search heuristic where the neighborhood aims to relax the subset-disjoint restriction during the process of multi-exchange neighborhood search.

■ WD42

C - Room 10B, Level 3

Optimization Algorithms

Sponsor: Optimization/Computational Optimization and Software (Joint Cluster ICS)
Sponsored Session

Chair: Ilya Safro, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439, United States of America, safro@mcs.anl.gov

1 - Beyond Fisher's Linear Dicriminant Function
Shuichi Shinmura, Professor, Seikei University, 3-3-1 Kichijouji-kitamachi, Musashino, 180-8633, Japan, shinmura@econ.seikei.ac.jp

Fisher founded linear discriminant function (LDF). LDF assume two groups are the same normal distribution, nevertheless few data satisfy this assumption. If data satisfy this, error rate equals to the minimum error rate (MNM). Therefore, LDF should be defined by MNM criterion. Revised IPLP-OLDF looks for the estimate of MNM using mixture of LP and IP. Evaluation of 13,500 models shows the mean of error rates of Revised IPLP-OLDF using LINGO are less than those of LDF & logistic regression.

2 - A Separation Heuristic for Gap Inequalities
Konstantinos Kaparis, Dr., University of Southampton, Southampton, SO17 1BJ, United Kingdom, K.Kaparis@soton.ac.uk, Laura Galli, Adam Letchford

Laurent and Poljak introduced a class of valid inequalities for the max-cut problem, called gap inequalities, which include many other known inequalities as special cases. Even though they have received limited attention they can make very good cutting planes for the Max-Cut problem. We describe a separation heuristic for these and we present computational results which illustrate the potentials of the proposed scheme.

3 - Polynomial Complexity Algorithm for Integer Transportation Problem
Vladimir Tsurkov, Prof., Computing Center of Russian Academy of Sciences, Vavilov Str., 40, Moscow, 119333, Russia, tsur@ccas.ru, Alexander Tizik

A net optimization large scale problem from telecommunication area is solved by means of the known method of column generation. The intermediate problem has transportation kind of restrictions. Algorithm of polynomial complexity is proposed. Method is based on iterative solutions of two-dimensional knapsack problems.

4 - Multiscale Approach for the Network Compression-friendly Ordering
Ilya Safro, Argonne National Laboratory, 9700 S. Cass Avenue, Argonne, IL, 60439, United States of America, safro@mcs.anl.gov

We present a fast multiscale approach for the network minimum logarithmic arrangement problem. This type of arrangement plays an important role in a network compression. The algorithm is of linear complexity and exhibits good scalability which makes it practical and attractive for using on large-scale instances. Its effectiveness is demonstrated on a large set of real-life networks.

■ WD44

C - Room 2, Level 2- Mezzanine

Network Modeling in Healthcare

Sponsor: Health Applications
Sponsored Session

Chair: Eva Enns, Stanford University, 117 Encina Commons, Stanford, CA, 94035, United States of America, evaenns@stanford.edu

1 - Modeling HIV Spread in Africa using Sexual Contact Network Data
Benjamin Armbruster, Northwestern University, 2145 Sheridan Road (Tech Bldg), Evanston, IL, 60208-3119, United States of America, armbruster@northwestern.edu, Stephane Helleringer

Using a unique data set from the Likoma Network Study, we examine the structure of the sexual contact network, how it changes over time, and how this affects models of disease spread.

2 - The Impact of the Health Delivery Supply Chain on Adherence to HIV Treatment
Jessica McCoy, Stanford University, Stanford, California 94305, United States of America,jhmccoy@stanford.edu, Eric Johnson

Adherence to HIV treatment is a predictor of viral suppression, and transmission rates are much lower in adherent populations. The health delivery supply chain in a resource-limited region potentially creates or removes barriers for patients seeking regular treatment. We develop a model to gain insights about the impact that the supply chain has on patients' ability to be adherent (and hence on HIV prevalence) in a community.

3 - Controlling Epidemics over Multi-level Co-evolving Networks
Achla Marathe, Asociate Professor, Virginia Tech, CRC XV VBI, Blacksburg, 24061, United States of America, amarathe@vbi.vt.edu, Stephen Eubank, Bryan Lewis, Jiangzhou Chen, Madhav Marathe

Human behavior, epidemics and social contact networks are closely intertwined and co-evolve. Effective planning and response strategies must take these complicated interactions into account. We will describe an interactionist approach for studying these co-evolving social systems with the goal of supporting public health epidemiology. Individual and collective behavioral adaptation is critical in these systems and will be highlighted via illustrative case studies.

4 - Optimal Link Removal for Epidemic Control Over Networks
Eva Enns, Stanford University, 117 Encina Commons, Stanford, CA, 94035, United States of America, evaenns@stanford.edu, Jeff Mounzer, Margaret Brandeau

Control of infectious diseases which spread through close contact often focuses on interrupting the network of contacts. We examine the problem of determining which links should be removed from a contact network to maximize infections averted, given a constraint on the maximum number of links that can be removed. We formulate the problem as a non-convex quadratically constrained quadratic program. We evaluate the performance of approximate and heuristic solutions.

■ WD45

C - Room 6, Level 2- Mezzanine

Health Care, Other

Contributed Session

Chair: S.Reza Sajjadi, Post- Doctoral Research Fellow, North Dakota State University, NDSU Department2485, 120A CIE, P.O.Box 6050, Fargo, ND, 58108-6050, United States of America, reza.sajjadi@ndsu.edu

1 - Feature Level Selection in Disease Clusters
Saylisse Davila, Arizona State University, 151 E Broadway Rd #210, Tempe, AZ, United States of America, saylisse@asu.edu, George Runger, Eugene Tuv

Most public health surveillance methods focus on detecting the presence of disease clusters. However, identifying the specific location of disease clusters can be equally important. Nowadays, health data is often recorded in large databases. Finding the specific location of these disease clusters among a large number of records and variables can be an intricate task. We will present a methodology that can be used to identify the ranges and/or levels of variables that define the clusters.

2 - Impact of Medicare Part D on Generic Drug Utilization in Long Term Care Facilities
Changmi Jung, Carnegie Mellon University, 4800 Forbes Ave., Rm 242, Pittsburgh, PA, 15213, United States of America, changmi@andrew.cmu.edu, Rema Padman, Shamena Anwar

This study examines the impact of Medicare Part D program on generic drug prescription rates in Long Term Care Facilities. We analyze prescription orders from a regional online pharmacy to induce a general pattern using the Difference in Difference method on four different therapeutic drug classes.

3 - A Comparison of Drug Price Increases in the Pharmaceutical Industry
Kathleen Martino, Rutgers University, 1 Washington Park, Newark, NJ, 07102, United States of America, martinok2@gmail.com, Yao Zhao

Motivated by the current events regarding prescription drug prices, this empirical study examines if factors such as therapeutic class, manufacturer, and active ingredient levels play a role in the established price of prescription drugs. We examine both the wholesale price set by manufacturers and the markup set by distributors for both brand and generic drugs. We also quantify the difference between brand and generic drug prices as a drug moves downstream from manufacturers to pharmacies.

4 - Optimization of the Dynamic Operational Decisions for Ambulance Dispatch: A Reallocation Model
Sandra Milena Santa, Universidad de los Andes, Carrera 1 N° 18A - 12, Bogotà, CU, Colombia, sm.santa30@uniandes.edu.co, Andres Correa, Ciro Alberto Amaya Guio, Nubia Milena Velasco Rodriguez

Ambulance dispatch as a response to some emergency medical services (EMS) needs to be executed effectively meeting time response and coverage demand requirements. Reallocation of ambulances gives the possibility of meeting and improving these standards response, but it is important to have in mind that these decisions carry transport costs and consume time. Therefore, we present a dynamic model as a decision support tool that allows evaluating the necessity to update location of ambulances.

5 - Patient Flow in a Multiple-Route High-Variability Primary Care Clinic
S.Reza Sajjadi, Post- Doctoral Research Fellow, North Dakota State University, NDSU Department2485, 120A CIE, P.O.Box 6050, Fargo, ND, 58108-6050, United States of America, reza.sajjadi@ndsu.edu, Jing Shi, Kambiz Farahmand

Simulation modeling of patient flow in an outpatient primary care clinic is considered in this study. In schedule-based clinics where patient arrivals follow the schedule given to the patients, inefficient layout and communication system as well as variability increase the waiting time of the patients in the clinics and thus result in patient dissatisfaction. Considering waiting time and distance traveled, the simulation model investigates a number of scenarios to improve the current situation.

■ WD46

C - Room 7, Level 2- Mezzanine

Statistical Modeling and Analysis in Healthcare Applications

Sponsor: Health Applications
Sponsored Session

Chair: Li Zeng, Assistant Professor, University of Texas at Arlington, Industrial & Manuf. Sys. Engr. Department, Arlington, Tx, 76019-0017, United States of America, lzeng@uta.edu

1 - Minimizing Rehospitalization Costs Through Machine Learning
Mohsen Bayati, Stanford University, 350 Serra Mall, Packard Building, room 278, Stanford, CA, 94305, United States of America, bayati@stanford.edu, Mark Braverman, Eric Horvitz

Nearly one in every five patients is rehospitalized within 30 days of their discharge. In 2004 the estimated cost of unplanned readmissions to Medicare was $17.4 billion. In this talk, I will demonstrate how online machine learning and optimization tools can be applied to electronic health records to identify patients with the highest risk of rehospitalization. We validated these predictions on a major hospital's database and obtained cost-effective policies for minimizing rehospitalizations.

2 - In-N-Out: An Energy Balance Model of Obesity
Joanna Lankester, PhD candidate, Stanford University, 300 Pasteur Lane, Grant S131, Stanford, CA, 94305, United States of America, jl3@stanford.edu, Margaret Brandeau, Julie Parsonnet

Obesity, which is associated with heart disease, diabetes, and other common and sometimes life-threatening conditions, has increased in prevalence dramatically over the last 50 years. To understand the rise in obesity, we are developing a model of body weight in the U.S. population from a perspective of energy balance. The model quantifies the changes over time in factors that influence body weight so that we can explore variability in obesity between individuals with similar energy intake.

3 - Reducing Medication Errors in Pediatrics
Michelle McGaha, PhD Graduate Student, Texas A&M University, 3131 TAMU, College Station, TX, 77843, United States of America, michelle.mcgaha@neo.tamu.edu, Kiavash Kianfar, Lewis Ntaimo, Amarnath Banerjee

Medication errors are common in the complex setting of pediatric medicine. We discuss the obstacles in determining the prevalence of pediatric medication errors and present a taxonomy chart of the most common pediatric medication errors, as well as defining characteristics for each error type. We discuss the challenges and highlight prevention strategies and meaningful use of health IT in reducing medication errors in the future.

■ WD47

C - Room 8, Level 2- Mezzanine

Project Management

Contributed Session

Chair: Eduardo G. Hernandez-Martinez, PhD, Tecnologico de Estudios Superiores de Coacalco, 16 de Septiembre 54, Coacalco, 55700, Mexico, eghm2@yahoo.com.mx

1 - Analyzing Robustness of Team Communication-performance Relationships
Deanna Kennedy, Assistant Professor, University of Washington, Bothell, 1501 Copperfield Pkwy #412, College Station, TX, 77845, United States of America, kennedy.deanna@gmail.com, Rebecca Perryman, Sara McComb

Patterns in team communication relate to time and cost performance. We examine optimality when tradeoffs are made between the two performance outcomes. Further, we analyze the robustness of communication patterns by estimating the performance of sampled data from hyperspheres centered at optimal points. Implications are discussed.

2 - Ensuring OR/MS Project Success: A Change Management Perspective
Robert Levasseur, Professor of Management, Walden University, 2614 Vista Cove Road, St. Augustine, FL, 32084-3069, United States of America, robert.levasseur@waldenu.edu

Research into the reasons for project failure suggests that a high percentage of those failures are the result of non-technical problems, such as poor communication and resistance to change. The purpose of this presentation is to explore ways in which OR/MS project leaders can increase the odds of project success by applying basic principles and practices of change management.

3 - Theory of Latency in integrated Concurrent Engineering
John Chachere, Senior Computer Scientist, Stinger Ghaffarian Technologies, 1060 Arbor Road, Menlo Park, CA, 94025, United States of America, john.m.chachere@nasa.gov, John Kunz, Ray Levitt

We observed Stanford and NASA teams using Integrated Concurrent Engineering (ICE) to accelerate conceptual design by a factor of ten. We assert that ICE teams manage ten enabling factors that decimate information response latency, and thus project duration. Latency is a unifying principle and a practical metric that can describe, evaluate and manage engineering design collaboration. ICE is the "Just in Time" of knowledge work; ICE flows information with minute latency and high reliability.

4 - New Method for Project Crashing using Excel Solver
Pamela Zelbst, Sam Houston State University, 1256 Avenue I, Huntsville, TX, 77341, United States of America, mgt_pjz@shsu.edu, Kunpeng Li, Bin Shao

We developed a new method for project crashing using Excel Solver. The method uses AON network. The Excel formulation is much simpler and straightforward than the traditional method using AOA network.

5 - A Discrete-event Approach for the Task Planning of PMBOK-based Projects
Eduardo G. Hernandez-Martinez, PhD, Tecnologico de Estudios Superiores de Coacalco, 16 de Septiembre 54, Coacalco, 55700, Mexico, eghm2@yahoo.com.mx, Guillermo Torres

This work presents an approach based on Supervisory Control Theory for the task planning of projects based on the PMBOK. The goal is a formal strategy to obtain automatically a gant chart considering all possible tasks concurrences according to times, resources availability and resources sharing. Unlike the graph methods reported on the PMBOK based on the user experience, the approach permits the time optimization establishing only the resources list and the restrictions of the tasks execution.

■ WD50

C -Room 11, Level 2- Mezzanine

Information Systems III

Contributed Session

Chair: Yun Huang, Northwestern University, 4146 Oakton st #2, Skokie, IL, 60076, United States of America, yun@northwestern.edu

1 - The Value of Information: Evidence of Decreasing Price Dispersion in India's Crop Market

Chris Parker, PhD Candidate, London Business School, Regent's Park, London, NW14SA, United Kingdom, cparker.PhD2007@london.edu, Nicos Savva, Kamalini Ramdas

This paper aims to measure the effect of a new text message based information service on price dispersion empirically. Our dataset contains information about several crops, with diverse supply chain characteristics, and information about the adoption level of the technology. Having information about multiple crops allows us to identify factors impacting different types of crops. Results show that adoption levels are associated with lower price dispersion between markets.

2 - Value From New Electronic Markets: A Diffusion Analysis of Two Equity Options Exchanges

Chris Parker, PhD Candidate, London Business School, Regent's Park, London, NW14SA, United Kingdom, cparker.PhD2007@london.edu, Bruce Weber

Two all-electronic options exchanges opened for trading in 2000 and 2004. The exchanges gained trading volumes in competition with four incumbent markets. To explain the markets' diffusion patterns, we model broker order routing decisions. The model generates hypotheses, which we test using a panel of quarterly disclosures from major brokerage firms. We conclude that firm heterogeneity is more influential than network effects in explaining the diffusions of the new markets at the broker level.

3 - An Online Retailer's Incentive to Become an Online Marketplace

Kihoon Kim, Assistant Professor, Korea University Business School, Anam-Dong, Seongbuk-Gu, Seoul, 136701, Korea, Republic of, kihoonk@gmail.com

When an online retailer develops into an online marketplace, the online retailer can invite other online retailers to sell the same product it deals with in the online marketplace. This paper investigates under what conditions the online retailer is advised to transform itself to the online marketplace, considering the online retailer's trade-off of its referral revenue against the loss of some of its loyal customers. We also characterize optimal pricing structures of the online marketplace.

4 - IOS Appropriation and Net Enablement

Mei Cao, University of Wisconsin-Superior, Department of Business and Economics, Superior, United States of America, mcao1@uwsuper.edu, Qingyu Zhang

The objective of the study is to uncover the nature of IOS appropriation and net enablement as an antecedent of supply chain collaboration. Reliable and valid instruments were developed through rigorous empirical analysis including structured interviews, Q-sort, and a large-scale study. Data were collected through a Web survey of U.S. manufacturing firms in various industries. Predictive validity is evaluated by demonstrating its strong relationship with supply chain collaboration.

5 - Encounter in Virtual Space

Yun Huang, Northwestern University, 4146 Oakton st #2, Skokie, IL, 60076, United States of America, yun@northwestern.edu, Roger Chen, Noshir Contractor, Hani Mahmass

Many virtual worlds such as massively multiplayer online role-playing games (MMORPGs) are often designed to mimic the real world along several dimensions, including the spatial requirements for engaging in activities. This paper examines the impact of virtual "geographical distance" between players in EverQuest II on the process of relation building in game. The results show that players are more likely to meet and interact with each other if they have more overlapping activity spaces.

■ WD53

C -Room 14, Level 2- Mezzanine

Operations/Finance Interface

Contributed Session

Chair: Amit Mitra, Auburn University, College of Business, Office of the Dean & Department of Manag, Auburn, AL, 36849-5240, United States of America, mitraam@auburn.edu

1 - Vicarious Learning From Operational Failures

Manpreet Hora, Georgia Institute of Technology, 800 W Peachtree St. NW, Atlanta, GA, 30308, United States of America, manpreet.hora@mgt.gatech.edu, Robert D. Klassen

The occurrence of a rare operational failure in a firm (incident firm) provides an opportunity for vicarious learning for other firms (knowledge-seekers). Employing a field experiment, we examine the firm-level characteristics that enable vicarious learning. Results suggest that saliency of the incident firm and complementarities between the incident firm and the knowledge-seekers have a positive association with vicarious learning.

2 - Investigating the Impact of Operational Variables on Manufacturing Cost by Simulation Optimization

Wen-Chyuan Chiang, Prof., Collins College of Business, The University of Tulsa, The University of Tulsa, Tulsa, OK 74104, Tulsa, United States of America, wen-chyuan-chiang@utulsa.edu, Rui Zhang

We focus on the relationship between operational variables (setup time, scrap rate, downtime rate) and the manufacturing cost. Keeping such parameters low is beneficial for reducing the average variable cost, but the required maintenance will incur an additional fixed cost. Therefore, a simulation based optimization approach is applied to determine the optimal level of the operational variables for minimizing the average cost. Sensitivity analysis and explanations are also provided.

3 - Managing Operations Risks: An Options Perspective

Wei Chen, Katz Graduate School of Business, University of Pittsburgh, 233 Mervis Hall, Pittsburgh, PA, 15260, United States of America, wchen@katz.pitt.edu, Jennifer Shang

When dealing with demand and supply uncertainties, operations managers must also consider risks such as exchange rate variation, distribution cost surge, and political upheaval. These uncertainties can significantly influence a firm's profitability. We address these risks from the perspectives of financial markets, operations control, and stochastic programming, and show that real options is a useful framework for understanding risk hedging in operations.

4 - An Integrated Model Utilizing R&D Costs for Two-dimensional Warranty Policies

Jay Patankar, Professor, The University of Akron, Department of Management, College of Bus. Administration, Akron, OH, 44325-4801, United States of America, jgp@uakron.edu, Amit Mitra

Some consumer durables, such as automobiles, involve warranties involving two attributes. These are time elapsed since sale of the product and usage of the product at a given point in time. An avenue to impact warrant costs is through research on product development. The objective then becomes to determine warranty parameters, while constraining the sum of the expected unit warranty costs and research and development costs per unit sales, under a limited research and development budget.

■ WD54

C -Room 15, Level 2- Mezzanine

Technology Management

Sponsor: Technology Management/New Product Development

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 - Better Selection or Efficient Contracting?: A Model of Knowledge Vendor Selection and Contracting

Zhijian Cui, PhD Candidate, INSEAD, Constance de Blvd, Fontainebleau, France, Zhijian.CUI@insead.edu, Sameer Hasija

We are studying the vendor selection and contracting issue for knowledge driven processes. In particular, we study three vendor selection process: (1)Selection is based on initial talks with the vendor and subsequently the contract is negotiated with the selected vendor. (2)The vendors are informed about the SLA and asked to bid for the contract. (3) The vendors are asked to propose a contract to the client.

2 - Innovation in Top-Down and Bottom-Up Strategy Processes
Fabian Sting, INSEAD, Boulevard de Constance, Fontainebleau, France, fabian.sting@insead.edu, 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 for Competing Firms: Case of Joint Development
Gulru Ozkan, Assistant Professor, Clemson University, Department of Management, 101 Sirrine Hall, Clemson, SC, 29634, United States of America, gulruo@clemson.edu, Cheryl Gaimon

We introduce a stochastic game on knowledge sharing (KS) and knowledge development (KD) strategies for two NPD firms. First, leader sets allocations of profit, then firms decide on KS for joint development of a new product. Next, firms jointly pursue KD and launch the product. Insights include impact of uncertainty.

4 - A Decision Model to Manage Network Security Technologies for Information Assurance
Soumyo Moitra, Senior Member of Technical Staff, Software Engineering Institute, Carnegie Mellon University, 4500 Forbes Ave, Pittsburgh, PA, 15213, United States of America, smoitra@sei.cmu.edu

This paper describes a model to manage technologies to protect informational assets. The focus is on the valuation of information and a methodology to arrive at the value at risk is presented. This assessment is used by the model to evaluate the benefits of different levels of security technologies. Sensitivity analysis with respect to the value of information is presented.

■ WD55

C -Room 16, Level 2- Mezzanine

Inventions, Innovation and Technology Management

Sponsor: Technology Management/New Product Development
Sponsored Session

Chair: Kun Liu, Assistant Professor, Wayne State University, 5201 Cass Ave, Detroit, United States of America, ek9525@wayne.edu

1 - Abandonment of Patented Inventions in Innovation-Intensive Industries
Kun Liu, Assistant Professor, Wayne State University, 5201 Cass Ave, Detroit, United States of America, ek9525@wayne.edu

Little research has examined how firms abandoned some inventions in innovation-intensive industries. Distant innovation search is associated with a greater technological distance between newly acquired inventions and abandoned inventions, as well as a younger average age of abandoned inventions. Abandoning younger inventions and more focused abandonment of inventions are associated with greater market value as measured by Tobin's Q.

2 - Continuous Quality/Time/Cost Tradeoffs
Bruce Pollack-Johnson, Associate Professor of Mathematical Sciences, Villanova University, 800 Lancaster Avenue, Villanova, PA, 19085, United States of America, bruce.pollack-johnson@villanova.edu, Matthew Liberatore

We use an example of a translation 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.

3 - Launching Technologically Advanced Products in Segmented Markets
John N Angelis, Rochester Institute of Technology, 105 Lomb Memorial Drive, Rochester, United States of America, jangelis@saunders.rit.edu

We focus on how competing profit-maximizing firms should set price and quality for a new technologically-advanced product sold to a segmented market. We analyze a closed-loop Stackelberg game with perfect information. If the late entrant possesses a large enough cost disadvantage, it should only target the least innovative segment. We also find that a firm with a large cost advantage may not necessarily earn higher profits by being the first mover.

4 - Realizing the Value of RFID in a Global Enterprise
Ann Marucheck, Professor, Kenan-Flagler Business School, McColl Bldg CB 3490, UNC-Chapel Hill, Chapel Hill, NC, 27599, United States of America, ann_marucheck@unc.edu, Noel Greis, Monica Nogueira, Anders Duus, Hong Tham Nguyen

For many organizations, understanding the potential benefits of RFID and justifying its investment continue to be challenges. In this research, we comprehensively study over 4000 cases of RFID projects as reported in the IDTechEX database. Specifically, we contrast the benefits realized by early adopters of RFID with more recent adopters. We further suggest measures that can determine how RFID provides economic value to an enterprise and identify the drivers of determining that value.

■ WD56

C - Room 1, Level 1

Simulation and Optimization II

Contributed Session

Chair: Xueping Li, Assistant Professor, University of Tennessee, 408 East Stadium Hall, Knoxville, TN, 37996, United States of America, Xueping.Li@utk.edu

1 - Allocating Manpower to Minimize Lmax in a Job Shop
Benjamin Lobo, North Carolina State University, 400 Daniels Hall, College of Engineering, Raleigh, NC, 27695, United States of America, bjlobo@gmail.com, James Wilson, Thom Hodgson, Russell King, Kristin Thoney

Most job shops are constrained not only by machines, but also by the number of workers available to operate these machines. Different worker allocations to machine groups can impact the Lmax value of a schedule. Using a relaxation of the problem to generate a lower bound on Lmax, we develop a procedure to allocate workers to machines that minimizes this lower bound. Computational experience is presented.

2 - Improved Fully Sequential Procedure with Mean and Variance Update
Huizhu Wang, Georgia Institute of Technology, 765 Ferst Dr, Atlanta, GA, 30332-0205, United States of America, huizhuwang@gmail.com, Seong-Hee Kim

Ranking and selection (R&S) procedures compare a number of simulated systems and try to find a system with the best performance measure. Fully-sequential R&S procedures are shown to be efficient but its probability of correct selection tends to be higher than the nominal level especially for a large number of systems. We study sources for conservativeness and present a procedure with improved efficiency.

3 - Simulation-based Optimization and Stochastic Programming
Tahir Ekin, PhD Candidate, George Washington University, 2201 G Street, NW Funger 415, Washington, DC, 20052, United States of America, ekin@gwu.edu, Refik Soyer, Nicholas Polson

We provide a simulation-based approach to optimization and stochastic programming. First, we consider a Monte Carlo solution to linear programming and then show that it naturally extends to two-stage stochastic programming with uncertainty. One advantage of our approach is that it is straightforward to add parameter uncertainty and does not need derivative information.

4 - Parametric Moment Closure of Non-linear State Dependent Stochastic Systems
Ritesh Arora, Graduate Research Assistant, Missouri University of Science and Technology, Dpt. of Engg. Management & Systems Engg., Rolla, MO, 65409, United States of America, ra95d@mail.mst.edu, Ivan Guardiola

This research highlights the use of parametric moment closure approximations for non-linear stochastic systems. A general birth-and-death non-linear stochastic process will be analyzed and closed under various underlying parametric distribution assumptions. It results that closure under neglect is considerably less robust than parametric closure. We highlight this theoretical endeavor through an analysis of aphid population stochastic model.

5 - Simulation and Optimization of Supply Chain Models for Supercomputing
Xueping Li, Assistant Professor, University of Tennessee, 408 East Stadium Hall, Knoxville, TN, 37996, United States of America, Xueping.Li@utk.edu, Zhe Zhang

Cache design is a great challenge in data management in supercomputing and a key component to improve the performance by storing data for future access. It is in the similitude of behaviors of a supply chain in which suppliers attempt to meet the demands from customers. We develop, simulate and optimize supply chain models for the cache design of supercomputers and evaluate the performances.

■ WD57

C - Room 2, Level 1

Portfolio Analysis

Contributed Session

Chair: Mark Zschocke, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, mszschoc@uwaterloo.ca

1 - The Efficient Frontier for Weakly Correlated Assets

Xili Zhang, Research Associate, School of Business Administration,South China University of Technology, 381 Wushan Road, TianHe District, Guangzhou, 510641, China, zhangxili831@gmail.com, Michael J. Best

Best and Hlouskava have shown that for a Markowitz portfolio selection problem having a diagonal covariance matrix and no short sales constraints, the efficient frontier is traced out in a monotonic fashion whereby assets are reduced to zero and subsequently remain at zero in order of their expected returns. We show that if the correlation matrix of the assets is "nearly" diagonal (in a sense to be made precise) then the efficient frontier will be traced out in a similar way.

2 - Sharpe Ratios and Implied Risk Free Rates

Michael J. Best, Professor, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L 3G1, Canada, mjbest@uwaterloo.ca

For the usual mean-variance Markowitz portfolio optimization model having just a budget constraint, the choice of a market portfolio implies a unique risk free rate. However, practical portfolio optimization problems have many inequality constraints. These constraints may cause kinks or points of non-differentiability on the resulting efficient frontier. We show that choosing a kink point as a market portfolio results in a continuum of implied risk free rates and give a formula for them.

3 - Goal Programming Models for Mutual Funds Portfolio Selection From Global Markets

Mehrdad Tamiz, Professor, Kuwait University, College of Business Administration, Kuwait City, Kuwait, mtamiz@yahoo.co.uk

A vast number of criteria can be taken into consideration in portfolio selection other than expected return and variance of return. This talk examines several factors representing criteria in a Goal Programming setting for Portfolio Selection of mutual funds. The selection is from 20 mutual funds from 10 countries representing 7 regions, with 7 factors that belong to mutual funds attributes, macroeconomics and regional preferences.

4 - Servitization, Alliance, and Firm Value

Yeonsung Yoo, Korea University Business School, Anam-dong, Seongbuk-Gu, Seoul, 136-701, Korea, Republic of, yooys@korea.ac.kr, Hosun Rhim

We examine impacts of strategic alliance to the shareholder value by measuring the stock market reaction associated with companies' alliance announcements. Firms are categorized to understand the impacts of servitization and productization. Sample includes Fortune 500 companies.

5 - Competitive Project Portfolio Management

Mark Zschocke, University of Waterloo, 200 University Avenue West, Waterloo, ON, N2L3G1, Canada, mszschoc@uwaterloo.ca, Benny Mantin, Beth Jewkes

We develop a Competitive Project Portfolio Management (CPPM) model wherein two competing firms consider investing into two projects targeting, separately, a mature and an emerging market. The returns firms obtain from investments into these markets follow an s-shaped curve and depend on both firms' actions. We find that different forms of interactions may arise and outline optimal CPPM strategies. We also discuss the market conditions that can lead to these outcomes.

■ WD58

C - Room 3, Level 1

Financial Engineering II

Contributed Session

Chair: Stephen Stoyan, University of Southern California, 3715 McClintock Avenue, GER 240, Los Angeles, CA, 90089, United States of America, stoyan@usc.edu

1 - Corporate Cash Holding, Production and Investments Applied to the Agribusiness Sector

Astrid Prajogo, Princeton University, ORFE Deparment, Sherrerd Hall, Princeton, NJ, 08544, United States of America, aprajogo@princeton.edu, John Mulvey, Davi Valladao

We propose a multistage stochastic program of a firm facing uncertain investment opportunities and a convex cost of external financing. The model endogenously determines the best production, investment, financing and cash holding policies over the planning horizon. The implications of corporate cash holdings are illustrated for the agricultural sector.

2 - Efficient Monte Carlo Barrier Option Pricing Under a Jump-Diffusion Process

Samim Ghamami, University of Southern California, University Park Campus, Los Angeles, CA, United States of America, ghamami@usc.edu, Sheldon Ross

We present efficient simulation procedures for pricing barrier options when the underlying security price follows a geometric Brownian motion with jumps. Metwally and Atiya [2002] developed a simulation approach in the same setting for pricing knock-out options, but no variance reduction was introduced. We improve upon M&A's approach by innovative applications of well-known variance reduction techniques. We also show how to use simulation to price knock-in options.

3 - Optimal Execution Strategy in the Presence of Price Impact

Mauricio Junca, University of California, 4141 Etcheverry Hall, Berkeley, CA, United States of America, mjunca@berkeley.edu

An investor needs to execute a long position in the asset by selling at discrete points in time, affecting the price of the asset and possibly incurring in a fixed transaction cost. The objective is to maximize the discounted revenue. This problem is formulated as an impulse control problem and we characterize the value function using the viscosity solutions framework. We also analyze the case where there is no transaction cost and how this formulation relates with a singular control problems.

4 - An Algorithm for Portfolio Problems with Discrete Choice Constraints

Stephen Stoyan, University of Southern California, 3715 McClintock Avenue, GER 240, Los Angeles, CA, 90089, United States of America, stoyan@usc.edu

We consider portfolio models that incorporate a comprehensive set of realistic financial constraints, one of which includes the number of securities to hold. Uncertainty is considered in the design through the use of stochastic programming. The resulting large-scale problem forms a mixed-integer program, where we present a model specific decomposition algorithm that generates solutions in reasonable time. Computational limitations involved with the approach will also be discussed.

■ WD61

H - Room 400, 4th Floor

Supply Chain, Risk Management

Contributed Session

Chair: Cigdem Gurgur, Professor, Purdue University, Doermer School of Business, 2101 East Coliseum Blvd., Fort Wayne, IN, 46805, United States of America, gurgurc@ipfw.edu

1 - Incentives to Invest in Multi-layer IT security Defense in Supply Chain Firms

Tridib Bandyopadhyay, Assistant professor, Kennesaw State University, 1000 Chastain Road, Kennesaw, GA, 30144, United States of America, tbandyop@kennesaw.edu, Dengpan Liu, Srinivasan Raghunathan

Supply chain firms have integrated business processes. This makes their IT risk interdependent. Multilayer IT security defense works like stage-gates, bringing interdependency between the efficacies of the successive layers. Thus SC firms face a complex inter-firm, inter-layer IT security investment decision scenario. We provide a game theoretic model that captures above multi-faceted interdependencies of IT security risk in SC firms, and analyze their incentives to invest in IT security.

2 - Supplier Selection in Make-to-order Environment with Risks
Tadeusz Sawik, Professor, AGH University of Science & Technology, Department of OR & IT, Krakow, 30059, Poland, ghsawik@cyf-kr.edu.pl

A mixed integer programming approach that uses conditional value-at-risk via scenario analysis is proposed for supplier selection and order allocation in supply chains with risks. Given a set of customer orders for products, the decision maker needs to decide from which supplier and when to purchase parts required for each order to meet its due date and to mitigate the impact of low probability supply disruptions and high probability supply delays.

3 - A Multi-Product Risk-Averse Newsvendor with Exponential Utility Function
Sungyong Choi, Rutgers University, 1 Washington Street, Room #1072, Newark, NJ, 07102, United States of America, sungyongchoi@gmail.com, Andrzej Ruszczynski

We consider a risk-averse multi-product newsvendor using an exponential utility function. We study the asymptotic behavior of the solution with respect to the number of products and degree of risk aversion. Then, under reasonable conditions, we obtain closed-form approximation which are easy to compute and much more accurate than the risk-neutral solution. Then we obtain the analytical and numerical insights for the interplay between risk aversion and demand dependence structure.

4 - Flexible Supply Contract Design using Options in Apparel Supply Chain
Bong-Sung Chu, Keio University, 3-14-1, Hiyoshi, Kohokuku, Yokohama, Japan, superkensin@yahoo.co.jp, De-Bi Cao

The major risks in a supply chain mostly come from mismatch of supply and demand with the dynamic demand changes. To avoid the risks, nowadays, flexible supply contract models using options are attracting significant attention. This paper addresses the flexible supply contract design with various types of financial options which give holders the right and opportunity to be guaranteed a certain trading quantity without stock out or opportunity loss in a single-period two-stage supply chain.

5 - Competition, Diversification and Supplier Selection Under Supply Disruptions
Cigdem Gurgur, Professor, Purdue University, Doermer School of Business, 2101 East Coliseum Blvd., Fort Wayne, IN, 46805, United States of America, gurgurc@ipfw.edu

In this study we consider supplier selection and quantity allocation decisions for a single firm facing supply unreliability and demand uncertainty. We use a traditional newsvendor framework to determine the optimal number of suppliers to place an order with and the corresponding quantities of those orders. We explicitly address the strategic behavior of suppliers in pricing decisions and we show how the pricing decisions of the suppliers change in response to procurement decisions.

■ WD63

H - Room 404, 4th Floor

Decision Analysis VI

Contributed Session

Chair: Jing Ai, A Decision Analysis Approach to Enterprise Risk Management, The University of Hawaii at Manoa, Shidler College of Business, 2404 Maile Way C305, Honolulu, HI, 96822, United States of America, jing.ai@hawaii.edu

1 - Novel Methods to Support Decision Making and Communicating about Risks in Distributed Environments
Bonnie Ray, Manager, Risk Analytics, IBM T. J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY, 10598, United States of America, bonnier@us.ibm.com, Lea Deleris

I provide an overview of a current joint research initiative between IBM Research, IBM Dublin, and University College Cork, partially funded by IDA Ireland. The research focuses on development of new methods to 1)extract risk information from text to form probabilistic graphical models using NLP techniques, 2)reason about risk when probabilistic information is imprecise, 3)plan for risk in complex environments using stochastic CP techniques and 4)communicate about risks in distributed settings.

2 - A Comparison of Simultaneous Kelly Betting Strategies
Andrew Grant, University of Sydney, H69 Economics and Business Bldg, Cnr Codrington and Rose Sts, Darlington, NS, 2008, Australia, andrew.grant@sydney.edu.au, Peter Buchen

We consider the problem of Kelly betting on simultaneous games, and the relative performance of betting strategies that use multi-bets compared to those that do not. We develop a simulation model to test the performance of three Kelly betting strategies using the empirical odds distribution from the 2007-08 English Premier League Season. The results suggest that using multi-bets of all levels outperforms the portfolio optimization approach of betting on single game outcomes only.

3 - Census Uncertainty and Congressional Reapportionment
Dennis Leber, National Institute of Standards and Technology, 100 Bureau Dr, Gaithersburg, MD, 20899-8980, United States of America, dennis.leber@nist.gov, Jeffrey Herrmann

The U.S. Constitution requires a decennial census, the results of which are used for the reapportionment of congressional representatives. The census results are only estimates and contain uncertainty. The Census Bureau can quantify this uncertainty through statistical sampling, but this uncertainty is ignored during reapportionment. This talk will present decision methods that consider attribute value uncertainty and apply these methods to the problem of reapportioning congressional seats.

4 - A Decision Analysis Approach to Enterprise Risk Management
Jing Ai, A Decision Analysis Approach to Enterprise Risk Management, The University of Hawaii at Manoa, Shidler College of Business, 2404 Maile Way C305, Honolulu, HI, 96822, United States of America, jing.ai@hawaii.edu, Tianyang Wang

Enterprise Risk Management (ERM) is an emerging corporate risk management concept that proposes to manage risks in an integrated strategic system. One of the most important challenges in ERM is the modeling of corporate decision making process in light of dependent risks associated with fragmented business activities. This paper presents a decision analysis approach to accomplish this task. It serves as a practical guideline for managers to optimally allocate resources given risk considerations.

■ WD64

H - Room 406, 4th Floor

Health Care, Strategy and Policy

Contributed Session

Chair: Vikram Tiwari, Assistant Professor, University of Houston, 2200 Business Center Dr, Apt 5104, Pearland, TX, 77584, United States of America, vtiwari@Central.UH.EDU

1 - Clostridium Difficile: System Dynamics Modelling of Hospital Infection Outbreaks
David Lane, Reader in Management Science, London School of Economics, Houghton St., London, WC2A 2AE, United Kingdom, d.c.lane@lse.ac.uk, Diogo Quintas, Alec Morton

LSE and UK National Audit Office staff constructed a simulation model to understand and control Clostridium difficile outbreaks. Different contamination stages, various transmission mechanisms and bed, toilet and staff hand cleaning were represented. The model synthesised information from a range of sources. It also allowed users to explore and understand the complex consequences of the interaction of a number of transmission vectors and policy interventions aimed at combating outbreaks.

2 - Outcome Quality and Efficiency - A Healthcare Perspective
Scott Lindsey, University of Utah, Operations and Information Systems, Salt Lake City, UT, United States of America, scott.lindsey@business.utah.edu, Sriram Thirumalai

This study explores relationships between and operational drivers of outcome quality and efficiency within healthcare operations. In the hospital setting, these drivers include process standardization, operational focus, and operational effectiveness. The study involves the use of stochastic frontier analysis based on data from the U.S. Department of Health and Human Services and State of California. Study findings, limitations and directions for future research are identified.

3 - Comparison of Markov and Discrete Event Simulation Models for Advanced Prostate Cancer
Lanting Lu, Associate Research Fellow, Peninsula College of Medicine & Dentistry, Veysey Building, Salmon Pool Lane, Exeter, EX2 4SG, United Kingdom, lanting.lu@pms.ac.uk

This work compares discrete event simulation (DES) cost-utility model and Markov cost-utility model built for an economic evaluation of a health technology degarelix, for advanced prostate cancer, and highlights the differences in the assumptions, the input data requirements and outcome estimations. The DES model gives more accurate and detailed outputs and conducting a probabilistic sensitivity analysis using the simulation model is found to be more straightforward than using the Markov model.

4 - Operating Room Utilization Study
Jihan Wang, Ph.D Student, Wayne State University, 4815 4th Street, Rm. 2033, Detroit, MI, United States of America, aw0984@wayne.edu, Kai Yang, Susan Yu

The successful management of operating rooms (OR) is very important measurement to any hospital. The OR utilization is a well-acknowledged metric to evaluate the performance of the facility. This research investigated 11 factors that people think will impact the utilization, such as first case delays and case cancellations. We determined the most important factors affecting utilization through statistical analysis of the data from Detroit VA medical center.

5 - Incentive Games in Healthcare Delivery: Pay-for-Performance in Primary Care
Vikram Tiwari, Assistant Professor, University of Houston, 2200 Business Center Dr, Apt 5104, Pearland, TX, 77584, United States of America, vtiwari@Central.UH.EDU, Ana Groznik

In existing compensation system, primary care physicians' reimbursement from health insurance companies is not tied to patients' long-term health outcome. Using stylized two-stage game theoretical models we compare some structural options of payments for physicians in the pay-for-performance market. We identify the tradeoffs faced by physicians and insurance companies and derive necessary conditions for different reimbursement structures to be optimal (tied to different patient characteristics).

■ WD65

H - Room 408, 4th Floor

Supply Chain, Shipping and Transportation

Contributed Session

Chair: Fatih Mutlu, Assistant Professor, Qatar University, Industrial Engineering Department, Doha, 2713, Qatar, fatihmutlu@qu.edu.qa

1 - Cost Benefit Analysis of the Cargo Screening Processes using Alternative Evaluation Methods
David Menachof, Peter Thompson Chair in Port Logistics, University of Hull Logistics Institute, Cottingham Road, Hull, HU6 7RX, United Kingdom, D.Menachof@hull.ac.uk, Uwe Aickelin, Galina Sherman, Peer-Olaf Siebers

Cost benefit analysis using three different methods, scenario analysis, decision trees and simulation, are conducted. These methods are examined in a real world situation and compared to actual data using different probabilistic methods of estimating costs for port security risk assessment studies. Results show that in simple situations, all methods can be equally used. As complexity increases, we show how these tools can be used and focus on the limitations of each method.

2 - Distributor's Integrated Inventory and Shipment Decisions
Sudarsan Rangan, Texas A & M University, 4217 TAMU, College Station, TX, United States of America, srangan@mays.tamu,edu, Ismail Capar, Malini Natarajarathinam

This analysis is based on a problem faced by a spare parts distributor that supplies n retailers. The distributor has to decide on his inventory system and replenish retailer inventories using a VMI policy. We analyze this problem to provide optimal inventory acquisition and shipment decisions to minimize the overall cost at the distributor.

3 - The Impact of Ship Unloading Time Variability on Port Selection
Cesar Meneses, Research Assistant, Arizona State University, University Drive and Mill Avenue, Tempe, AZ, 85287, United States of America, cesar.meneses@asu.edu, Rene Villalobos

We develop a port selection model based on additional inventory costs caused by the variability of service times observed between the arrival of a ship to a port and the time a container is released from the port. In particular, we seek to minimize total landed costs by selecting the proper port.

4 - Contract Problems Between a Retailer and a For-Hire Carrier
Fatih Mutlu, Assistant Professor, Qatar University, Industrial Engineering Department, Doha, 2713, Qatar, fatihmutlu@qu.edu.qa

We study transportation contract problems between a retailer and a for-hire carrier delivering retailer's replenishments. We model a decentralized carrier-retailer channel and design frameworks to set contract terms according to individual incentives. The terms are i) freight rate, which is based on a two-part tariff structure, and ii) shipment size. We also analyze the centralized channel to benchmark the channel profits. We propose modifications on the initial contracts to assure coordination.

■ WD67

H - Room 412, 4th Floor

Transportation, Freight II

Contributed Session

Chair: Dung-Ying Lin, Assistant Professor, National Cheng Kung University, No. 1 University Road, Department of Transportation and Commun., Tainan City, Taiwan - ROC, dylin@mail.ncku.edu.tw

1 - An Integrated Analysis on Global-US Freight Network
Jiahui (Carol) Wang, Research Assistant, University of Oklahoma, 202 W. Boyd St., Room 124, Norman, OK, 73019, United States of America, jiahuiwang@ou.edu, Guoqiang Shen, P. Simin Pulat

This research studies on US international freight transportation by an integrated view on global freight network and domestic freight network, in which, the international freight flows are extended between US ports to final destinations/origins (state, census tract, traffic analysis zone..., and the final census block level). This research also provides insights into the impact of international freight flows on domestic freight flows starting from each port.

2 - Discrete Time Formulation for the Assignment Problem Applied in Cross Docking Facilities
Georgios Saharidis, Professor, University of Thessaly and Kathikas Institute of Research and Technology, Pedion Areos, Volos, 38334, Greece, saharidis@gmail.com, Mihalis Golias

A cross-docking facility is a freight distribution facility representing a critical point in a supply chain. The scheduling of the inbound trucks at a cross docking facility is a classical assignment problem. In this paper two mathematical formulations are presented to schedule inbound trucks to doors at a cross-docking facility, and compared to the classical machine scheduling formulation.

3 - Scheduling Commercial Vehicle Queues at a Canada-US Border Crossing
Michael Haughton, School of Business & Economics, Wilfrid Laurier University, Waterloo, ON, Canada, mhaughton@wlu.ca, K.P. Sapna Isotupa

Using the context of queue operations at a major Canada-U.S. commercial border crossing for truck-borne trade flows, we report on a computer simulation study to predict the likely impacts of smoothing those flows. We quantify the operational and resource efficiencies of flow smoothing, not only for trans-border trucking companies and other commercial organizations involved in trans-border supply chains but also for government authorities with regulatory jurisdiction at border crossings. Our study achieves two major goals. First, it extends the queueing literature's range of settings in which queue management systems based on flow smoothing are studied. Second, it adds quantitative precision to the post-9/11 discourse on reducing impediments to the performance of commercial trucking operations that support trans-border supply chains.

4 - Quantifying the Value of Information Sharing in Supply Chain Inventory Management
Dung-Ying Lin, Assistant Professor, National Cheng Kung University, No. 1 University Road, Department of Transportation and Commun., Tainan City, Taiwan - ROC, dylin@mail.ncku.edu.tw, Nai-Wen Hsu

We first develop a model in which each stakeholder in the supply chain independently chooses the optimal inventory policy that has the lowest total expected cost (TEC) with stochastic demand. Then a model recognizing the inventory coordination is developed to estimate the total expected cost of the coordinated supply chain. The value of information sharing in supply chain inventory management is quantified by the difference of TECs between these two models.

■ WD68

H - Room 415, 4th Floor

Strategy/Strategic Planning II

Contributed Session

Chair: Michael Bean, Forio Business Simulations, 333 Bryant Street, San Francisco, CA, 94133, United States of America, mbean@forio.com

1 - A Representation Model and Innovation Heuristics for Business Ecosystems of Product-Service Systems
Minjeong Baek, Master Student, Seoul National University, 599 Kwanakro, Kwanakgu, Seoul, Korea, Republic of, kelly706@snu.ac.kr, Changmuk Kang, Yoo S. Hong

A business ecosystem is growing more complex in recent days, as more products and services are integrated as a product-service system, and more stakeholders are involved. This study presents a rigorous model for representing and analyzing a business ecosystem consisting of various stakeholders that interact with products and services. Based on this model, six heuristic rules for innovating an ecosystem and industry cases have been proposed.

2 - The Demand-side Dynamics of Firms' Intra-industry Exit in a Geographically Fragmented Industry
Lalit Manral, Assistant Professor, University of Central Oklahoma, 100 N Universtiy Drive, Edmond, OK, 73034, United States of America, lmanral@uco.edu, Kathryn Harrigan

This paper explores the demand-side dynamics of firms' selective exit from geographic sub-markets in a geographically fragmented industry. It provides theoretical arguments and empirical evidence to explain how the demand-side structural conditions differentially influence firms' choice to manage their geographic scope over time. A unique panel dataset drawn from a natural experiment in the US long-distance telecommunications services industry during 1984-1996 is used to test the hypotheses.

3 - Strategic Capacity Investment and Pricing Decisions for Substitutable Products with Partial Flexibility
Sharethram Hariharan, Graduate Research Associate, Oklahoma State University, 322 Engineering North, OSU Stillwater, Stillwater, ok, 74078, United States of America, sharethramh@gmail.com, Tieming Liu, Ho-Yin Mak, Z. Max Shen

We study the capacity investment and responsive pricing decisions for a firm facing random demands for two substitutable products. Resources are partially flexible. A resource can be used to produce the other type of product, but with some efficiency loss. We evaluate the impacts of demand variability, correlation and risk-aversion on these decisions.

4 - Creating Web-based Simulations and Interactive Data Visualizations
Michael Bean, Forio Business Simulations, 333 Bryant Street, San Francisco, CA, 94133, United States of America, mbean@forio.com

Simulations and interactive data visualizations that run in browsers have the advantages of global accessibility, simple distribution, and the ability to monitor and collect data on usage. However, simulations need to be modified in order to effectively use the online medium. Usability design is critical to create simulations that will be used by a diverse, global audience with limited knowledge of simulation, short attention spans, and unarticulated use objectives.

■ WD69

H - Salon F, 6th Floor

Reverse Logistics II

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Theresa Barker, PhD, University of Washington, Box 352650, Seattle, WA, 98115, United States of America, barkertj@u.washington.edu

1 - An Optimization Model to Determine Product Servicing Policies in Green Supply Chains
Ruth Gledhill-Holmes, PhD Student, University of Central Florida, 4000 Central Florida Blvd, Orlando, FL, 32816, United States of America, ruth_gledhill_holmes@yahoo.com, Ola Batarseh, Dima Nazzal

This research considers the possible service policy options necessary to extend and maximize a product's usable life (hence resulting in reduced production rates and the associated environmental benefits of this) in conjunction with the possible recovery options for maximizing the re-capture of end-of-use products (hence resulting in reduced waste, reduced need for first-use materials, and recovery of value for the manufacturer).

2 - Integrating Environmental Considerations into Pricing and Production Planning Models
Dima Nazzal, Assistant Professor, University of Central Florida, 4000 Central Florida Blvd., Orlando, FL, 32816, United States of America, dnazzal@mail.ucf.edu, Ali Bozorgi

We propose and test a multi period optimization model that integrates the environmental impact of a product into the production and pricing decisions. The model considers the trade-off between economic and environmental objectives.

3 - A Model for Reverse Logistics Under Uncertainty
Theresa Barker, PhD, University of Washington, Box 352650, Seattle, WA, 98115, United States of America, barkertj@u.washington.edu, Zelda Zabinsky

Many mixed-integer linear programming models have been developed for reverse logistics. These models typically require producers to make certain network design decisions in advance, such as how to collect the return product and where to perform testing. We present an integrated MILP model that combines high-level and detailed network design decisions, along with chance-constrained programming to analyze the tradeoffs between various network configurations.

4 - Creating Value Through Product Stewardship and Take-Back
Ronald Lembke, Associate Professor, Supply Chain, University of Nevada, MGRS /0028, Reno, NV, 89557, United States of America, rtl@unr.edu, Zac Rogers, Dale Rogers

Secondary markets provide a place for unwanted items to be bought and sold, which diverts them from landfills, reducing the products' ecological impact and creating economic value. Secondary markets divert a large number of products from landfills and create jobs, resulting in substantial economic value in the process. Although not reflected in current government metrics, a conservative estimate is that the secondary market represents 2.28 percent of the 2008 U.S. GDP.

■ WD70

H - Salon G, 6th Floor

Optimization Models in Air Traffic Management

Sponsor: Aviation Applications
Sponsored Session

Chair: Andrew Churchill, Graduate Research Assistant, University of Maryland, 1173 Martin Hall, College Park, MD, 20742, United States of America, churchil@umd.edu

1 - The Impact of Induced Technological Change on Air Traffic Management
Megan Ryerson, Institute of Transportation Studies, 109 McLaughlin Hall, UC Berkeley, Berkeley, CA, 94720, United States of America, msmirti@berkeley.edu

Short-haul aviation is a focus of transportation policy today due to growing aircraft diversity and uncertainty surrounding carbon emissions policies. We develop an analytic total logistics cost model of short-haul corridor serving multiple passenger groups and find that turboprops, alone and in a fleet mix with jets, minimize cost for levels of policy seen today. This aircraft mix in response to a carbon emissions policy has implications for air traffic management.

2 - Converging Upon Basic Feasible Solutions Through Dantzig-Wolfe Decomposition
Joseph Rios, NASA, Mail Stop 210-15, Moffet Field, CA, 94035, United States of America, Joseph.L.Rios@nasa.gov, Kevin Ross

We derive an important property for solving integer programs by examining the master problem in Dantzig-Wolfe Decomposition. Namely, if a linear program can be decomposed appropriately, a mapping exists between basic feasible solutions in the master and original problems. This has implications for integer programs where the convex hull has mostly integer corner points. We highlight the significance through experiments on a large-scale traffic flow model for the National Airspace System.

3 - Collaborative Strategies for Traffic Management in the Airspace Flow Program
Amy Kim, amykim0603@gmail.com, Mark Hansen

We investigate methods that aim to minimize the user-cost impact of a future AFP that employs rerouting and ground delay. Methods are assessed using a simple flight cost specification; the deterministic part represents flight costs known to the FAA, while the stochastic part represents costs known only to the airline. Models featuring different allocation schemes, user inputs, and timing of information gather are compared. We explore tradeoffs between information quality and timeliness.

4 - Assessing the Impact of Stochastic Capacity Variation on Coordinated Air Traffic Flow Management
Andrew Churchill, Graduate Research Assistant, University of Maryland, 1173 Martin Hall, College Park, MD, 20742, United States of America, churchil@umd.edu, David Lovell, Michael Ball

In this research, an integer optimization model for coordination between air traffic flow management initiatives and a three parameter characterization of resource capacity are used to understand the effects of random capacity variations. Employing the optimization model within a Monte Carlo simulation, the results suggest that each of the three parameters characterizing capacity have marginally increasing impacts over a wide range of conditions.

■ WD72

H - Salon J, 6th Floor

Facility Logistics Session: Warehouse Order Picking

Sponsor: Transportation Science and Logistics Society
Sponsored Session

Chair: Russell Meller, Hefley Professor of Logistics and Entrepreneurship, University of Arkansas, 4207 Bell Engineering, Fayetteville, AR, 72701, United States of America, rmeller@uark.edu

1 - Boosting Productivity in Multiple-Aisle Order-Picking by Cellular Bucket Brigades

Yun Fong Lim, Assistant Professor, Singapore Management University, 50 Stamford Road #04-01, Singapore, Singapore, yflim@smu.edu.sg

We introduce a new design of bucket brigades for order-picking in multiple, parallel aisles. Workers pick products from one side of an aisle when they proceed in one direction and they pick from the other side of the aisle, possibly for other customer orders, when they proceed in the reverse direction. We assume hand-off times are significant and propose simple rules for workers to share work. The new design can be substantially more productive than traditional bucket brigades.

2 - Using Storage Profiles with Bucket Brigade Order Picking to Improve Productivity

Don Eisenstein, Professor of Operations Management, University of Chicago, Booth School of Business, 5807 South Woodlawn Avenue, Chicago, IL, 60637, United States of America, Don.Eisenstein@chicagobooth.edu, Yeming Gong

We compare bucket brigade and zone order picking protocols using various storage profiles. We find that the flexibility of a bucket brigade protocol can lead to some considerable advantages in productivity.

3 - Modeling the Throughput Performance of a Picking Machine Order-Fulfillment Technology

Jennifer Pazour, PhD Candidate, University of Arkansas, 4207 Bell Engineering Center, Fayetteville, AR, 72701, United States of America, jpazour@uark.edu, Russell Meller

Picking machines are an example of a stock-to-picker piece-level fulfillment technology that consists of two or more pick stations, a common storage system, and an integrated conveyor system. We develop a stability function model based on queuing theory that is capable of determining if a picking machine will be able to meet a throughput requirement. We then illustrate how a manager could use our analytical model to answer picking machine design questions.

■ WD73

H - Salon K, 6th Floor

Joint Session TSL/ SPPSN: Mitigating Disaster Impact Through Planning for Emergency Response

Sponsor: Transportation Science and Logistics Society/ Public Programs, Service and Needs
Sponsored Session

Chair: Elise Miller-Hooks, University of Maryland, 1173 Glenn Martin Hall, College Park, MD, 20742, United States of America, elisemh@umd.edu

1 - A Robust P-center Model for Emergency Facility Location Planning

Chung-Cheng Lu, Assistant Professor, National Taipei University of Technology, 1 Section 3, Chung-Hsiao E. Road, Information and Logistics Management, Taipei, 106, Taiwan - ROC, jasoncclu@gmail.com

This study deals with the p-center problem with uncertain travel times between emergency facilities and affected areas which may arise in large-scale disasters. The uncertain travel times are represented by intervals and a robust optimization approach that minimizes the worst-case deviation from optimal solutions was developed. Numerical experiments were conducted to demonstrate the effectiveness of the approach and to examine the tradeoff between robustness and optimality.

2 - Locating Support Facilities for Large Scale Emergencies

Anurag Verma, Graduate Student, Texas A&M University, Industrial and Systems Engineering, College Station, TX, 77843-3131, United States of America, anuragverma@tamu.edu, Gary Gaukler

We provide large scale emergency facility location models that account for the unavailability of a disaster response facility depending on its location and the position of the disaster. We find that the locations suggested by the models in this paper significantly reduce the expected cost of transportation of supplies when we consider the damage a disaster causes to the support facilities and areas near it.

3 - Decision Support for Urban Search and Rescue

Lisa (Lichun) Chen, lcchen@umd.edu, Elise Miller-Hooks

The urban search and rescue (USAR) team deployment problem seeks an optimal deployment of USAR teams to disaster sites so as to maximize the expected number of saved lives over the search and rescue period. A multistage stochastic program that captures problem uncertainty and dynamics is presented. A column generation-based technique is proposed for its solution. The techniques is illustrated on a case study involving the 2010 Haiti earthquake.

4 - Using TRANSIMS for On-line Transportation System Management During Emergencies

Adel Sadek, Associate Professor, University at Buffalo, the State University of New York, 233 Ketter Hall, Buffalo, NY, 14260, United States of America, asadek@buffalo.edu, Daniel Fuglewicz, Alan Blatt, Yunjie Zhao

The topic of transportation systems management during emergencies has recently received national attention. This study has two primary objectives: (1) to assess the level to which the TRANSIMS model can be used for the online management of transportation systems during emergencies; and (2) to develop any additional functionality needed for that. As a case study, the research uses the Buffalo-Niagara area known for its winter weather and numerous snow storms.

■ WD74

H - Room 602, 6th Floor

Joint Session TSL/ Service Science: Emergency Transportation, Logistics, and Evacuation Service

Sponsor: Transportation Science and Logistics Society/ Service Science
Sponsored Session

Chair: Tao Yao, Assistant Professor, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu

1 - Distributing Supplies in a Multi-city Infectious Disease Outbreak

Fernando Ordonez, Associate Professor, University of Southern California, Department of Industrial and Systems Eng, 3715 McClintock Ave, Los Angeles, CA, 90007, United States of America, fordon@usc.edu, Yingtao Ren

We consider the distribution of medicine to mitigate a multi-city infectious disease outbreak under parameter uncertainty. We build a two-stage stochastic programming model which has integer variables in both stages. This problem is solved with a modified Bender's method to recover dual information from the second stage MIP and to speed up convergence. We illustrate the use of the model and the algorithm in planning an emergency response to a hypothetical national smallpox outbreak.

2 - Evacuation Planning Under Uncertainty: A Distributional Robust Chance-Constrained Approach

Tao Yao, Assistant Professor, Pennsylvania State University, 349 Leonhard Building, University Park, PA, 16802, United States of America, tyy1@engr.psu.edu, Byung Do Chung, Bo Zhang

This talk provides a Chance-constrained Programming approach for evacuation transportation planning which are robust to uncertainty. We focus on demand uncertainty with partial distributional information and develop an approximation scheme to reformulate the problem as a deterministic convex program which is then proved to be safe and computationally tractable. Numerical experiments are provided to illustrate the performance of the proposed approach.

3 - Demand Management for Evacuation Planning

Douglas Bish, Assistant Professor, Grado Department of Industrial and Systems Engineering, Virginia Tech, Blacksburg, VA, 24061, United States of America, drb1@vt.edu

In hurricane evacuations traffic often overwhelms the infrastructure, causing congestion that can increase the risk to the population. Supply management strategies are used in evacuation planning, but they are often insufficient. We study the use of demand management strategies that attempt to structure the evacuation demand in order to minimize congestion. Specifically, we study network flow problems that incorporate important aspects of evacuee behavior and evacuation management issues.

4 - Optimal Evacuation Routing Under Dynamic Stochastic Risks

Chi Xie, Research Fellow, The University of Texas at Austin, 1 University Station, Austin, TX, 78712, United States of America, chi.xie@mail.utexas.edu, Tao Yao, Travis Waller

We propose a risk-based modeling framework and solution procedure for dynamic evacuation planning under hazardous material releases, which integrates the latest atmospheric dispersion modeling and network flow modeling techniques. A robust dynamic evacuation routing model is presented for devising evacuation plans that minimize the most risky exposure to the evacuating population under time-dependent, uncertain hazardous effluents.

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Durango-Cohen, Pablo SC72, TB72
Durchholz, Matthew TD51
Durlofsky, Louis WC56
Durukan Sonmez, Ayse WC08
Duthie, Jennifer IS-M, TC74
Dutta, Goutam TD17
Dutta, Salil K WA17
Dutta, Shantanu TA49
Duus, Anders WD55
Duzgun, Ruken SC44
Dyduch, Justyna WC04
Dyer, James SA63
Dziecichowicz, Michael TD57

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Eagen, Brendan MA43
Eapi, Gautam WC30
Easton, Todd TB34
Easwaran, Gopalakrishnan MB13
Eaton, Derek TB51
Ebe, Todd WD19
Ebrahimi, Nader MB28
Ebrahimy, Neda MD14
Ebtehaj, Milad TB66
Eckerd, Stephanie WA14
Eckhause, Jeremy TC62
Eckhoff, Philip TC44
Eckstein, Jonathan MA41
Edgington, Theresa WC15
Edirisinghe, Chanaka TA41, TD57
Edmunds, Thomas SC52
Edvardsson, Bo SD22
Edwards, Conrad WB42
Edwards, J. Riley TC69
Edwards, Thomas TC36
Eftekhar, Mahyar TB13
Egbelu, Pius TD12
Ege, Gul MB33, TD46
Egging, Ruud TB02
Ehrenmann, Andreas TC01
Ehrhardt, Richard TD65
Eijgenraam, Carel MD25
Eirinakis, Pavlos SB32
Eiselt, Ha MC08, SB08
Eisenstein, Don MC72, WD72
Ekici, Ali SC12, TA07, WB42
Ekin, Tahir WD56
Ekren, Banu TC72
Eksioglu, Burak SC25, MD09
Eksioglu, Sandra MB08, TD59, WC07
El-Nashar, Ahmed WA41
El Ouardighi, Fouad TC67
Elble, Joseph SD32
Eldemir, Fahrettin TC72
Eldred, Michael SA27
Elhafsi, Mohsen WB65
Elhedhli, Samir TA34, WD38
Elias, R. S. WB57
Eliazar, Iddo WA35, WC35
Elizondo, Monica SA59
Elkins, Debra WB52
Elliott, Joshua SC41
Ellis, Kimberly TD72, WD18
Ellner, Paul SD29
Elmachtoub, Adam MB12
Elmaghraby, Wedad SB15, SC09, MB19, TA46
Elsayed, Elsayed SA69, SB30, SC52, TC33, TD28, TD30, WB29
Elster, Anne C. SD32
Elwany, Alaa TB29
Emadi, S MB09
Enders, Paul TD35
Eng Larsson, Fredrik WC62
Engau, Alexander TC32
Engineer, Faramroze G. TB07
England, Darin MB44
Enns, Eva WA45, WC44, WD44
Ensor, Kathy TD58
Epelman, Marina SB43
Epstein, Rafael SA03
Erat, Sanjiv SD15, WA55
Erden, Zeynep TC55
Erdogan, S. Ayca SB45, MD44
Erenay, Bulent WA66, WB66, WD08
Erenay, Fatih Safa MD43
Eren, Ezgi SB47, MC47
Eren, Zeynep Feliz TB64
Erenguc, Selcuk TB41
Erera, Alan SA71, SC73, SD73, MB73, TA73
Ergun, Ozlem SA24, SC25, SD36, SD46, MA35, TB25, WB69, WB70, WC34
Erhun, Feryal SC14, SD16, SD36, MA24, MD15, TA12, WD11
Erickson, Jared MC33
Erickson, John WB49
Erkin, Zeynep SC44
Erkip, Nesim MA11, MD12
Erkoc, Murat SC22, WD10
Erol, Serpil IS-T
Errico, Fausto WB74
Ertem, Alp TA66
Ertem, Mehmet MA52

Ertem, Zeynep WD33
Eryilmaz, Atilla TA50
Erzurumlu, Sinan SC57, WA55
Esenduran, Gokce WB03
Esher, Leslie MB63
Espinosa, J. Alberto SD49
Espinoza, Daniel SB03, TD39
Espiritu, Jose SB29, SD22, WC41, WD02
Etemadnia, Hamideh TD25
Eterovic, Francisco WB58
Ettehad, Amin SD03
Ettl, Markus SA17, MA56
Etzion, Hila MA49
Eubank, Stephen TC34, WD44
Eurek, Kelly SB03
Evans, Gerald TD56
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Fabri, Peter MA45, TC26
Fagnant, Daniel WB25
Fahey, Mark WC42, WC42
Faircloth, Sheri SD05
Faissol, Daniel SC52
Fajardo, David SC24, WB70
Fampa, Marcia H.C. WA01
Famuyiwa, Femi SD55
Fan, Carol E. TC51
Fan, Huiyuan MD34
Fan, Lin TC01
Fan, Lingling MC42
Fan, Neng SC38, TC42, TD34
Fan, Wei MB72, TB72, TC74, WD25
Fan, Yueyue SA04, WA03
Fang, Jiarui WB33
Fang, L. WB57
Fang, Ming MB48, MC17
Fang, Xiang MB11, TC11, WA14
Fang, Xin TC11
Farahat, Amr WD10
Farahmand, Kambiz IS-M, WD45
Farias, Vivek SB09, SB19, SD19, MC09, MC10, TA37
Farokhi Sadabadi, Kaveh WD27
Farris, Scott TD36
Farrokhvar, Leily WC57
Farvaresh, Hamid WB27
Farzan, Azin TD10
Farzaneh, Mohamadreza WA27, WA66
Fasano, J.P. SC40
Fasolo, Barbara SC60, TB60
Fathi, Yahya WA74, WB05
Faturechi, Reza WB69
Faulin Fajardo, Javier SC73, WC67
Favreau, Jean MA03
Fazel-Zarandi, Mohammad M. MC08
Fearing, Douglas SA05, TD70
Federgruen, Awi SC37, TD13, WC13
Feinberg, Eugene SA35
Felder, Frank WB01
Feldman, Gilad MD27
Feldman, Jacob MC46
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Felli, Jim SC60
Feng, Annabelle SD13, MB10
Feng, Baichun MD63
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Feng, Ti Kan SC32
Feng, Tianjun SC09, TC63
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Feng, Wei TB73, TD31
Feng, Wen-Hsin SD45
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Feng, Zhuo TB27
Ferguson, John TD62
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Fernandez, Antonio IS-T
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Ferrand, Yann TB45
Ferreira, Liliana TA03
Ferrell, Bill SD16
Ferrio, Jeff MC17
Ferris, Mark WC36
Fidan, Neslihan TB42
Figliozzi, Miguel SB73, TB73, WB73
Figueira, Jose WB04
Filomena, Tiago SB01
Finardi, Erlon WA01
Fine, Charles SA12, SC54, MA25
Finley, Cathy MA04
Finney, Sheena WC72
Fischer, Marc MD17
Fisher, Donald SA74
Fisher, Marshall TD13
Fisher, Michele MD17
Fixson, Sebastian SB55, WB54
Flach, Bruno MB59, WB05
Flamm, Kenneth MD55
Flanigan, Marie WB08
Flapper, Simme Douwe IS-T, TD65
Flatberg, Truls TC02
Fleischhacker, Adam MD10
Fleming, Lee SA55, TA68
Fleten, Stein-Erik MB02, WA01
Fliescher, Moritz WD15
Flisberg, Patrik MA03, TB03, WD40
Flores, Hector TA23
Flory, John TA28
Fodstad, Marte MB38, TB02, TC02
Fogliatto, Flavio SB28
Fontana, Matthew TC41
Fontane, Frédéric TD72
Fontenot, Dean TB36
Forma, Iris TB16
Forman, Abbe WC49
Forrester, Richard MB36
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Førsund, Finn TA71, TC71
Forsythe, Joseph WB41
Foster, Justin MC04
Foulis, Phillip TC26
Foulk, Victor MC18
Fouque, Jean-Pierre SA58, SB58
Fourer, Robert SD48, MC33, MD18
Fowler, John SD16, MB16 TA07, TA43, TA46, WD03
Fox, Bill MD51, TD51
Francalanci, Chiara SA49
Franceschetti, Massimo SB53
France, Stephen IS-M
Francis, Royce WD37
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Franden, Michael TD48
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Frank, Jeremy WA61
Fransoo, Jan TA12, WB33, WD11
Frazier, Peter SB56, MA32, MC56, TD32, WA56
Fredendall, Lawrence TA44
Freeman, Jared IS-M
Frei, Frances TD13
Frenk, Hans WC23
Freundt, Tjark MD17
Frey, Jesse MB52
Fridgeirsdottir, Kristin SC11, SC20, SD19, TD23
Fried, Jeremy MC03
Friel, Terri SA18
Fries, Art SD29
Friesz, Christine WB33
Friesz, Terry SA72, TB08, TD66
Frisk, Mikael MA03, TB03
Froehle, Craig TB45
Fry, Michael SA73
Fry, Michael MB08, WA56
Fu, Leiming WB58
Fu, Mengying MB16
Fu, Michael SD51, SD56, TB58, WA37
Fuchs, Erica SC54, WC55
Fuegener, Andreas WC61
Fuglewicz, Daniel WD73
Fujisawa, Katsuki TC57
Fukasawa, Ricardo TD39
Fukushima, Yuta IS-M
Fuller, David TA01, IS-T, TA34, WC19
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Furmans, Kai TD14, WC72
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Gaidarev, Peter IS-M
Gaimon, Cheryl SD54, MA54, TA54, WD54
Gal-Or, Esther TB23
Galati, Matthew MD40
Galindo, Gina MD08, WA72
Gallego Arrubla, Julian A. SD42, MC03
Gallego, Guillermo SC19, SD20, TC20, TD19
Galli, Laura WA18, WD42
Gallien, Jérémie MA25, TB09, TC10
Gallino, Santiago WA09
Galvani, Alison MD52, TA07, WA63
Gamarnik, David SA09, SC37, SD27
Gamboa, Dorabela IS-T
Gan, Chee Chun WA66
Gan, Xianghua SD13
Gandhi, Anshul MD50
Gandhi, Varun WC03
Ganesan, Rajesh SA70
Ganguly, Subhamoy MD21
Gans, Noah WB13, WC13
Ganzfried, Sam TA05
Gao, Chunhua MA70
Gao, Feng TB21, WD02
Gao, Lu TB72
Gao, Oliver IS-M
Gao, Shanxing MD55
Gao, Song SA74, SB74, SC74
Gao, Yang SC74, MB74
García, Alfredo SA01, TA05
García, Diego SD60
Garcia, Natalia TA64
Garcia, Reinaldo C. MB21, WA66
Garcia del Valle, Alejandro SC73, WC67
Garcia-Gonzalo, Jordi TA03
Gardner, L. Leslie MC36
Gardner, Lauren SC24, WB70
Garg, Amit WC61
Garg, Dinesh WB18
Garifullin, Maxim SA56
Garrett, Walter WB71
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Garrow, Laurie MD19, TD70
Gatchel, Robert WA26
Gaukler, Gary TC52, TD52, WC10, WD73
Gaupp, Marty SB03
Gaur, Vishal TD02

Gautam, Appa MA71
Gautam, Natarajan SB47, SD42, MA53, MC47, TB35, TC35, TD50
Gaver, Donald SD29, TA51
Gavirneni, Srinagesh MA12, MB11, MC13, WC11
Gawdiak, Yuri TC62
Gay, David M. SD48, MD18, TC40
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Geisler, Eliezer MA54
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Gemmill, Doug TA36
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Gendreau, Michel SC73, SD73, MA46, TA69, TC73
Gendron, Bernard SC32
Geng, Qin TA20, TD66
Geng, Yue MD73, SD12, TB73
George, David MD37
George, Edward MB30
George, Elizabeth MD27
Gera, Amit TB50
Gerhardt, Katharina IS-T, MA22
Geunes, Joseph SB27, MA12, WA07, WD20
Geylani, Tansev TA53
Ghaddar, Bissan TC38
Ghadimi, Saeed MD33
Ghaffari, Hamid SC43, TB44
Ghafoori, Amir WC52
Ghamami, Samim WD58
Ghandehari, Mostafa TC25, WC30
Ghandi, Rajiv MB46
Ghasemkhani, Hossein SB50
Ghassemi, Farhad MB34, TC45
Ghate, Archis SB43, SC44, SD38, MA44, MB59, TA43, WC20
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Ghoniem, Ahmed TD27
Ghorbani, Sara SB24, SC24
Ghoseiri, Keivan WA25
Ghosh, Abhijit TA27
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Ghosh, Diptesh MB59
Ghosh, Pavel MA52
Ghosh, Priyanko TD17
Ghosh, Rahul MC50
Ghosh, Soumyadip MD37, TD50
Ghosh, Souvik TD50
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Gino, Francesca MD15
Girotra, Karan SA55, SC55, MA10, MB10, TA13, WA09
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Glick, Roger TD24
Glover, Charles N. SC34
Glover, Fred IS-T, WA32
Glowacka, Karolina WB47
Glynn, Peter TB56
Gnanlet, Adelina IS-T, WC22
Gocgun, Yasin MA44, TA43
Gocmen, Fikret SD20
Godfrey, Alan MD23
Godwin, T. MC69
Goel, Ankur SB10, TA02, TD55
Goentzel, Jarrod SD08, SD12, MA25
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Goes, Paulo TC49
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Goetschalckx, Marc TA73, TC72
Goez, Julio C. IS-M
Goh, Joel MB42, TC18
Goh, Samuel MA68
Goh, Thong MD29
Goic, Marcel SA03
Gokpinar, Bilal MC55
Golalikhani, Mohsen WB63
Golany, Boaz MB52, MC25
Golbeck, Steven MD58
Goldberg, David SC37, SD27
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Goldberger, Stephen WB58
Golden, Bruce SC45, MC44, MC46
Golden, Linda WA71
Goldfarb, Donald SC39, SD41, MA40, WB38
Goldgar, Rick SA54
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Goldis, Evgeniy MC04
Goldsman, Dave TC36
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Golovnya, Mikhail SB48
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Gong, Min WC57
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Gontko, Dawn WD18
Gonzales, Daniela TD59, WC07
Gonzalez, Ed WA20
Gonzalez, Gerardo SA18
Gonzalez, Jaime WA62
Gonzalez, Magaly WA23
González, Virginia MB21
Gonzalez, Maria-Teresa SA15, MA21
González-Mendoza, Miguel WD41
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Goodchild, Anne TB73, WB73
Goodson, Justin MB32
Gopaladesikan, Mohan WA73
Gopal, Anand SA49, WB11
Gopal, Ram SA50, MB50, WB50
Gopalappa, Chaitra MD44, WC31
Gopolan, Ram MC69
Gordon, Peter TC52
Gorman, Michael SA69, SC69
Gosai, Dipa TD17
Gosavi, Abhijit MC20, WB66
Gose, Alex SB45
Gotoh, Jun-ya TC57, TD58
Gottumukkala, Raju IS-T
Gottwalt, Sebastian SD50
Gouveia, Luis MC53
Goyal, Manu WB11
Goyal, Munish TB17, WC23
Goyal, Sandeep WC10
Goyal, Vineet MA19, WA19
Goycoolea, Marcos SB03, MC39
Gozbasi, Ozan SB43
Grabanik, Genady MC23
Gralla, Erica MA25
Gramacy, Bobby TA56
Gramacy, Robert B. MB30
Granado, Joe Alex SB29
Granados, Nelson SC50
Grande, Darby IS-M
Grant, Andrew WD63
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Grasas, Alex SA13
Grasman, Scott SC73, TC59, WA02, WB57, WB66
Graveney, Mike WB71
Graves, Stephen SA05, SA11, SC14, MA46, MB15, WB65
Gray, Alexander SC26
Gray, John SD69
Green, Linda SA43, SD09, MD45
Gregoire, John SC32
Gregory, John TC48
Greiner, Russell SA27
Greis, Noel WD55
Gresham, George WB49
Greve, H. R. SB71
Gribkovskaia, Irina WC18
Griffin, Jacqueline SB12
Griffin, Paul SB12, SC14, TC64
Griffiths, Gareth TA61
Grimit, Eric MA04
Griswold, Julia TD05
Griva, Igor MD41
Groenevelt, Harry SC57, WC65
Groer, Chris MA27
Groleau, Thomas WB36
Gromoll, Christian TC37
Grosse-Ruyken, Pan TA12
Grossman, Tom TC18, TD36
Grossmann, Bernd MB54
Grover, Martha SD28, TB28, WC28
Groznik, Ana WD64
Grubesic, Tony MD08, TB52
Grund, Matthew WB51
Grushka-Cockayne, Yael SC36
Gu, Waner IS-T
Gu, Weihua TD05
Gu, Wenjun TA61
Gu, Zonghao MD32
Guajardo, Jose WA09
Guan, Xiaohong WD05
Guan, Yihan SC26, MB44, TA45, WA26
Guan, Yongpei MC01, TB42, TC39, WD39
Guardiola, Ivan MD53, WD56
Guarracino, Mario SB47, WD33
Gue, Kevin WC72
Guéré, Emmanuel SD39
Guerra, Andres SB41
Guide, Jr., Daniel TC09
Guikema, Seth WD37
Gui, Luyi TB25
Gul, Serhat TA43
Guler, Kemal TB05
Gulpinar, Nalan SB02
Gulsen, Mehmet SB20
Gumus, Mehmet SC13, TD09
Guner, Ali WA25
Güner, Ertan IS-T, TB66
Gunes, Ayse WC31
Gunes, Canan WA67
Gunes, Evrim TB24
Gungor, Zulal WD17
Gunluk, Oktay MA39, TD39
Gunn, Eldon MA03, TA03
Gunnec, Dilek TB55
Gunnerud, Vidar MB02
Guo, Cui MB26
Guo, Hangfei TB05
Guo, Jian SB26
Guo, Ju'e MD21, WA21
Guo, Junyu TB52
Guo, Pengfei SA23, TC13, TC14
Guo, Xiaolei TB74
Guo, Xin SB58, TD68
Guo, Yan SB26
Guo, Zhiling SB49
Guojun, Chen SA71
Gupta, Alok MA50, MD49, TC49
Gupta, Aparna TD57, WA21, WB57
Gupta, Diwakar MA05, MA57, MC72, MD45, TB09, TB43, WB44
Gupta, Gagan TD15
Gupta, Himanshu SA01
Gupta, Lokesh MC14
Gupta, Pramod SA26
Gupta, Rajat WD39
Gupta, Saurabh MB33
Gupta, Shubham MB70
Gupta, Varun MD50, TB50
Gupte, Akshay TA39
Gur Ali, Ozden MB44, WA31
Gurbaxani, Vijay MB49
Gurgur, Cigdem WD61
Gurnani, Haresh SB15, SC13, MA57, MC15, TB09, WD10
Gurumurthi, Suri TC14
Gurvich, Itai SB37, SD10, MD11
Gutfraind, Alexander MA52, TB47, WA24
Gutierr, Brittni IS-T, WB02

IS-M Interactive Session, Monday (12:30- 1:30) ***IS-T Interactive Session, Tuesday (12:30- 1:30)***

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Gutierrez, German WA56
Gutierrez, Karla WC41
Gutierrez, Ruben Huamanchu MB71
Gutman, Alex TA63
Güvenen, Orhan TC59
Guyse, Jeffery L. TC63
Guzelsoy, Menal WB39
Guzman, Luceny TA21
Gwaltney, Jeff MA08

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Ha, Albert TA14
Ha, Sangtae MD50
Haaland, Ben SC28, TA29, TB30
Haas, Peter MA56
Haber, Eldad MC41
Hackebeil, Gabe MC40
Haensel, Alwin TD67
Hafalir, Isa MA05
Hafer, John WB49
Hafer, Lou TD40, WA40, WB40
Hafizoglu, Baykal TB35, WA10
Hafiz, Rayan IS-M
Haftendorn, Clemens TA01
Haghani, Ali SA71, MB22, MD05, TC16, TC30, TD25, WA25, WB41, WD27
Haghnevis, Moeed MB16, MC22
Hagtvedt, Reidar SB12
Hahn, Gene MD22
Hahn, Gerd WA11
Hahn, Joe SA63
Hahn, Jungpil SD49
Haight, Robert MC03
Hajbabaie, Ali TD74
Hajibabai, Leila MB73
Haksoz, Cagri TA02
Hale, Trevor MC21
Hall, J. Brian SD29
Hall, John WB24
Hall, Nicholas G. SA05, SB11, TC47
Halskau, Øyvind WC18
Hamedi, Masoud TD25, WA25
Hammer, Peter L. MB26
Ham, Myoungsoo SA16
Ham, Sung MA15
Hampshire, Robert SB46, TA06, TB50, TD31
Han, David WD30
Han, Jerry SB20
Han, Jieling WC61
Han, Kunsoo SA49
Han, Lanshan MB45, TB38
Han, Sung Won SA31
Hanagandi, Vijay MC17
Hanany, Eran MC09
Handal, Jady TA62
Handley, John SD26
Hang, Jun SA09, SC68, TB08, WA12
Hanna, Rosine SA22
Hannah, Lauren SB26, SC27, MA34, TA32
Hannouf, Malek WC44
Hans, Erwin WC05
Hansen, Jared WC49
Hansen, Lars Peter MA58
Hansen, Mark TA70, TB70, WD70
Hansen, Sean SD49
Hansman, John SD70
Hanson, Timothy MD30
Hao, Chanyu TA47
Hao, Haijing TB64
Hao, Jin-Kao WA32
Hao, Lin MB68
Harchol-Balter, Mor MA35, MD50, TB50
Hardgrave, Bill WC10
Hardin, J. Michael TD36
Hardin, Jill SC07
Hargaden, Vincent WB22
Hariharan, Sharethram WD68
Harker, Patrick TC46
Harmon, Robert WA54
Harper, Tiffany MC51
Harrigan, Kathryn WD68
Harris, Anthony SC45
Harris, Greg SB34
Harris, John MC46
Harris, Shannon WA62
Harris, Stuart SD63
Harrison, Anthony WD27
Harrison, J. Michael SA37, SB19
Harrison, Julie TA71
Harrison, Terry MA46, WB37
Harrod, Steven TB69, WA11
Harsha, Pavithra SC19, MA02
Hart, Elaine MB04
Hart, Quinn TB03
Hart, William MA18, MA52, MC40, TA52, TD40, WB40
Hartman, Gregory WB63
Hartman, Joseph WD37
Hartvigsen, David WC37
Hartz, Arthur MC45
Haruvy, Ernan MA15
Harvey, Charles SA21
Hasan, Imran WC64
Hasan, Samiul MC74
Hasan, Shahab TC62
Hasdemir, Baris WC08
Hasenbein, John SA37, SB05, TA33, TA35
Hasheminia, Hamed TA31, TC67, WD20
Hasija, Sameer MA21, TB13, WB09, WC46, WD54
Hassanmirzaei, Foad IS-T
Haugh, Martin MA57
Haughton, Michael WD67
Hausman, Warren TD22
Havill, Jessen MC36
Hawkins, Caitlin WC64
Hawkins, Natasha WB52
Hay, David SB04
Hayez, Quantin TA18
Haymaker, John WB66
Hayya, Jack WA16
Hazen, Gordon IS-M
Hazra, Jishnu TC17
Hazy, Jim TB15
He, Miao MB34, TD15, WB33
He, Qie WB39
He, Qi-Ming MA14
He, Qing WA25
He, Rachel SD74
He, Ru MB54
He, Shuangchi SA37
He, Xiuli MD10, TB61
He, Yanyi SC04, MA01
He, Yuhong SB11
Head, Larry WA25
Heath, Jeffrey MC36
Heath, Michael MB41
Heath, Susan MC24
Heching, Aliza TB17
Hedman, Kory SC01, TD01
Heese, Seb TC14, TD61
Hefley, William SC23
Heidorn, Steve TA63
Heier Stamm, Jessica SC25, MA25
Heim, Gregory SA14
Heinimann, Hans Rudolf TA05
Heinrich, Timo MC05
Heinz, Stefan SB32
Heitz, Christoph SD23, MA23
Helgason, Richard WB15
Hellemo, Lars TB02
Helleringer, Stephane WD44
Helm, Jonathan SD44, TA43
Helton, Cary MA69
Hem, Øystein Dahl MB02
Henderson, Benjamin SC41
Henderson, Shane MC56, TD35, WA56, WB24
Hendricks, Kevin TA14
Hendrix, Kristin MB45
Henig, Mordecai MB03
Hennig, Frank TD73
Henrion, Max TB21, TB63, WA03
Henriques, Justin SC59
Henry, Devanandham TD28
Henry, Peter IS-M
Henry, Stephen MD39
Heo, Jun-Yeon TB22
Heragu, Sunderesh TC72, TD56
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MA13 Inventory and Capacity Management
MA14 Supply Chain Management II
MA15 Modeling the Psychology of B2B Relationships
MA16 Scheduling and Dispatching in Semiconductor Manufacturing
MA17 Panel Discussion: OR/MS Consulting - The Challenges
MA18 Tutorial: Why Python is Such a Cool Language for Optimization and Scientific Computing
MA19 Choice Modeling in Revenue Management
MA20 New Frontiers in Revenue Management Applications
MA21 Service Systems and Analytics
MA22 Responsive Disaster and Emergency Management
MA23 Complex Service Modeling
MA24 Decision-Making in Nonprofit Organizations
MA25 Humanitarian Supply Chains: Haiti and Beyond
MA26 Data Mining for Functional Data
MA27 Combinatorial Optimization III
MA28 Decision Analysis Approaches to Managing Uncertainty in Manufacturing and Service Systems Design & Operations
MA29 Quality and Reliability in Nano-scale Systems
MA30 QSR Best Student Paper Competition
MA31 Prediction Modeling and Analysis for Complex Systems
MA32 Advances in Approximate Dynamic Programming and Reinforcement Learning - I
MA33 Search and Integrated Methods in Constraint Programming
MA34 Stochastic Optimization in Energy
MA35 Routing in Queues
MA36 Online Teaching I
MA37 Analysis and Control of Queueing Systems
MA38 GO & MINLP in Network Applications
MA39 Mixed Integer Programming
MA40 Optimization Software for Problems Arising in Machine Learning
MA41 Optimization Algorithms and Error Analysis
MA42 Stochastic Programming - Models and Algorithms
MA43 Modeling in Healthcare
MA44 Stochastic Models in Healthcare
MA45 Modeling, Qualifying and Reducing Health Disparities
MA46 Panel Discussion: INFORMS Journals
MA47 Panel Discussion: Opportunities for OR in Biology and Medicine
MA48 Software Demonstrations
MA49 Pricing of Information Goods and Services
MA50 Agent-based Decision Support in Auctions and Negotiations
MA51 Military Vehicle Routing Problems I
MA52 New Models in National Security
MA53 Design and Operation of Sensor Networks
MA54 Sources for Knowledge and Incentives for Sharing (KLIC)
MA55 Models in Entrepreneurship
MA56 Simulation: Industrial Applications
MA57 Managing Risk in Supply Chains
MA58 Joint Session Quantitative Finance/ Bayesian Models: Bayesian Methods in Finance

MA59 Software Demonstrations
MA60 Decision Analysis for Terrorism and Natural Disasters
MA63 Sequential Decision Analysis
MA68 Virtual Worlds and Their Potential Impact on Business
MA69 Current O.R. Based Planning Tools Used by US Railroads, and Opportunities for Further Application of O.R.
MA70 Optimization in Sabre AirCentre Enterprise Operations Solutions
MA71 DEA Algorithms
MA72 Traffic Signal Systems: Monitoring, Modeling and Optimization
MA73 Consolidation and Network Design I: Location Problems
MA74 Innovations in Freight Systems Modeling

Monday, 11:00am - 12:30pm

MB01 Non-dispatchable Producers and Electricity Markets
MB02 Real Options Theory and Energy Applications
MB03 Forestry II: Harvest and Transportation Planning
MB04 Economic Modeling and Analysis of Highly Renewable Energy Systems
MB05 Mechanism Design
MB06 Tutorial: Risk Applications in Commercial Nuclear Power
MB07 Tutorial: Constructing Multiattribute Utility Functions for Decision Analysis
MB08 Achieving Sustainability Through Facility Location Optimization
MB09 Structural Estimation in Operations Management
MB10 Issues in Sourcing and Procurement
MB11 Consumer Driven Operations Management Models
MB12 Supply Chain and Inventory Management
MB13 Strategic Problems in Green Supply Chain Management
MB14 Panel Discussion: Excellence and Diversity in Academia
MB15 Panel Discussion: Meet the Editors - How to Publish Behavioral Research
MB16 Semiconductor Industry
MB17 OR/MS in Practice: Transportation Applications
MB18 Python for Optimization
MB19 Behavioral Issues in Revenue Management and Pricing
MB20 Consumer Learning and Revenue Management
MB21 Smart Electricity Distribution
MB22 Disruptive Event Management
MB23 Exploring Information to Enable Smart Services
MB24 Joint Session SPPSN/HAS: Models in Public Health
MB25 Threats to Life and Limb
MB26 Logical Analysis of Data
MB27 New Perspectives on Organization Science
MB28 Bayesian Modeling in Reliability and Risk
MB29 Financial Informatics and Statistics
MB30 Bayesian Inference and Model Selection
MB31 Operations Research at Jeppesen (The 2010 INFORMS Prize Winner)
MB32 Advances in Approximate Dynamic Programming and Reinforcement Learning - II
MB33 Optimization Applications in Retail
MB34 Dynamic Programming Applications in Health Care
MB35 Stochastic Networks and Applications
MB36 Teaching OR Through Active Learning I
MB37 Games in Queueing Networks
MB38 Global Optimization for Energy Systems
MB39 Geometric Aspects of Mixed Integer Nonlinear Programming Theory
MB40 Solving Nonconvex Optimization Problems with Couenne, an Open-Source Branch-and-cut Solver
MB41 Optimization Modeling and Methodologies for Clustering
MB42 New Models and Methods in Stochastic Optimization
MB43 Joint Session HAS/SPPSN: OR and Public Health Care
MB44 Pierskalla Finalists I
MB45 Quantitative Models for Improving Health Care Delivery Efficiency
MB46 Undergraduate Research Showcase II
MB47 Complexity and its Measure in Manufacturing/Enterprise Systems for Variety
MB48 Software Demonstrations
MB49 Contract Design and Global Sourcing of IT Services
MB50 Security, Incentives and Customization in Information Systems Design
MB51 Military Vehicle Routing Problems II
MB52 Reports from the Daniel Rose Technion-Yale Initiative in Homeland Security and Counterterror Operations Research
MB53 Network Design
MB54 Perspectives on Outsourcing and Offshoring of Knowledge Work
MB55 Innovation and Growth Through Varied Organization Structures
MB56 Simulation Optimization
MB57 Operational Flexibility and Supply Chain Network
MB58 Order Book Modeling
MB59 2010 Dantzig Dissertation Award Finalists
MB60 Portfolio Decision Analysis I
MB63 Risk in Human-Environment Systems
MB68 Social Media Analytics and Applications
MB69 Operations Research Application in Railroad Engineering
MB70 Joint Session AAS/TSL: Stochastic Models in Aviation
MB71 Stock Picking and DEA
MB72 Public Transit I: Transit Network Design, Assignment and Access
MB73 Consolidation and Network Design II: Network Design Problems
MB74 OD Estimation and DTA Model

Monday, 12:30pm –1:30pm

Interactive Session

Monday, 1:30pm - 3:00pm

MC01 Renewables, Emissions Trading and Climate Change
MC02 Valuation and Risk Management of Energy Demand Response and Carbon Emission
MC03 Forestry III: Fire Prevention and Management
MC04 Integrating Renewables in Power Markets: Addressing Uncertainty, Dynamics and Strategic Behavior
MC05 Auctions/Mechanism Design I
MC06 Tutorial: Fraud Detection in Online Transactions
MC07 Tutorial: Mathematical Approaches to Infectious Disease Prediction and Control
MC08 Competitive Location
MC09 Operations Economics: Dynamic Models
MC10 Algorithms for Revenue Management Models
MC11 Operations Management and Marketing
MC12 Sustainable and Responsible Supply Chain Management
MC13 Information and Coordination
MC14 Supply Chain Management III
MC15 Behavior in Inventory Decisions
MC16 Production and Scheduling I
MC17 Operation Research in the Chemical Industry
MC18 Modeling Languages I
MC19 Miscellaneous Topics in Revenue Management
MC20 Stochastic Approximation and Online Learning in Dynamic Pricing and Revenue Management
MC21 Sustainable Energy Services
MC22 Smart Energy and Utility Service – Smart Grids – Modeling and Optimization
MC23 Risk Management in Services
MC24 Simulation Modeling For Disaster Response
MC25 OR For the Public Interest
MC26 Mining Data Streams
MC27 Understanding and Improving Organizational Processes
MC28 Multivariate Methods for Manufacturing Process Improvement
MC29 Computer Experiments I
MC30 Recent Advances in Bayesian Hypothesis Testing and Model Selection

MC31 Statistical Learning
MC32 Joint Session ICS/ ENRE:
MC33 Algorithms & Solvers for SOCP & Stochastic SDP
MC34 Approximate Dynamic Programming in Operations
MC35 Its 'EZ' to use EZPublish CMS to Create and Maintain Your Community Website
MC36 Teaching OR Through Active Learning II
MC37 The Applied Probability Society Markov Lecture
MC38 Advances in Global Optimization
MC39 MIP - Root LP Basis and Cuts
MC40 COIN-OR's Coopr Package: Highlights and Applications
MC41 Large-Scale/PDE-Constrained Optimization
MC42 Developments in Stochastic Programming
MC43 Joint Session HAS/SPPSN: Optimization Models for Disease Management
MC44 Pierskalla Finalists II
MC45 Operations Research Applications in Long-Term Care
MC46 Undergraduate Research Showcase III
MC47 Emergent Dynamics and Behavior in Biology and Life Sciences
MC48 Software Demonstrations
MC49 Recommender Systems and Personalization
MC50 Cloud Performance and Capacity
MC51 DoD Supply Chain Modeling
MC52 Homeland Security: Challenges and Advances in Biodefense
MC53 Network Design in Telecommunications
MC54 Panel Discussion: Games and Exercises in Management of Technology and New Product Development Courses
MC55 Managing Innovation in Complex Product Development and Service Systems
MC56 Simulation Optimization and its Applications
MC57 INFORMS-FSS Best Student Research Paper Award
MC58 Risk Management and Regulation
MC59 Panel Discussion: The Academic Job Search
MC60 Group Decision Making
MC63 Portfolio Decision Analysis II
MC68 New Business Models for eBusiness
MC69 Fleet Management Models in Rail Transportation
MC70 Joint Session AAS/TSL: Aviation Policy: Evaluation of Congestion Management Alternatives
MC71 Panel: Studying Research with William W. Cooper
MC72 Public Transit II
MC73 Collaborative Logistics Applications
MC74 Network Science in Transportation

Monday, 4:30pm - 6:00pm

MD01 Modeling Benefits of Demand Management in Power Systems
MD02 Valuation and Management of Energy Storage
MD03 Forestry IV: Fire Prevention and Management
MD04 Sustained, Energy-Efficient Operation in Large Commercial Buildings and Industrial Plants
MD05 Auctions/Mechanism Design II
MD06 Tutorial: The Separation, and Separation-deviation Methodology for Group Decision Making and Aggregate Ranking
MD07 Tutorial: Meaningless Statements in Epidemiology
MD08 Public Sector Location Modeling I
MD09 Production/Inventory Systems with Disruptions
MD10 Supply Chain Management and Healthcare/ Pharmaceutical Industries
MD11 Patient Flow Models: Within Hospitals and Beyond
MD12 Editor's Favorites: IIE Transactions Scheduling and Logistics
MD13 Industrial Scheduling
MD14 Supply Chain Management IV
MD15 Productivity, Labour and Contract Simplification
MD16 Production and Scheduling II
MD17 Edelman Finalist Presentations
MD18 Modeling Languages II
MD19 Empirical Studies of Revenue Management
MD20 New Directions in Revenue Management
MD21 Carbon Emission Analysis in Energy Industry
MD22 Supply Chain/Electronic Hub and Outsourcing Services
MD23 Business Performance Management and Services Science
MD24 Operations Research and Homeland Security
MD25 OR For the Public Interest – Security and Infrastructure
MD26 Tutorial: System Monitoring and Diagnosis with Supervised Learning
MD27 Organizational Processes and Decision-Making
MD28 Design and Analysis of Experiments
MD29 Industrial Statistics in Asia
MD30 Bayesian Methods in Engineering and the Physical Sciences
MD31 Joint Session DM/MIF: Statistical Approaches in Data Mining
MD32 Computational Linear and Integer Programming
MD33 First-order and Stochastic Methods for Large-scale Convex Programming
MD34 Statistical Perspectives for Adaptive Dynamic Programming
MD35 Stochastic Networks
MD36 Online Teaching II
MD37 Control of Queues
MD38 Analytics Driven Best in Class e-Marketing Business Model
MD39 Advancements in Theory of Integer Programming
MD40 Recent Developments in COIN-OR Projects
MD41 Interior-Point Methods for Nonlinear Programming
MD42 Applications in Portfolio Optimization
MD43 Screening Policies in Health Care
MD44 Pierskalla Finalists III
MD45 Capacity Planning in Health Care
MD46 Undergraduate Research Showcase IV
MD47 Making Sense of Network Structure in Complex Systems
MD48 Software Demonstrations
MD49 Managing Technology Use
MD50 Power Management in Server Farms
MD51 Modeling for Defense Analysis I
MD52 Infectious Disease Modeling and Control I
MD53 Mobile Ad-hoc Network Simulation and Protocol Development
MD54 Technology Management Section 2010 Distinguished Speaker
MD55 Technology Management
MD56 Simulation Applications
MD57 Financial Services Tutorials
MD58 Stochastic Models in Finance
MD59 Panel Discussion: The Industry Job Search
MD60 Decision Analysis Society Awards
MD63 Decision Analysis I
MD68 Analytics: The Future of INFORMS
MD69 Railroad OR Models
MD70 Joint Session AAS/TSL: Tradeoffs in Delay Mitigation: Incorporating Network Effects, Competition and Emissions
MD71 Scale and Scope Economies in DEA
MD72 Public Transit III
MD73 Consolidation and Network Design III: Studies of Consolidation
MD74 Sustainabile Transportation Networks

Tuesday, 8:00am - 9:30am

TA01 Optimization and Equilibrium Modeling for Energy Markets - II
TA02 Energy Procurement and Contracting
TA03 Forestry V: Ecosystem Services
TA04 Power System Impacts of Electrified Transportation
TA05 Game Theory I
TA06 Tutorial: A Tutorial on Dynamic Optimization with Applications to Dynamic Rate Queues
TA07 Joint Session JFIG/HAS/SPPSN: Pandemic Planning and Modeling
TA08 Location Analysis
TA09 Economics of Service Quality Provision
TA10 Behavior in Pricing Management
TA11 Procurement Design Strategies under Supply Uncertainty
TA12 Strategic Issues in Supply Chain Management
TA13 Sourcing and Servicization
TA14 Supply Chain Management V
TA15 Coordination Issues in Supply Chains and Social Networks
TA16 Production and Scheduling III
TA17 Optimization Applications in Energy and Power Industries
TA18 OR/MS Software I
TA19 Pricing in Services
TA20 Managing Operations Through Promotions, Effort, and Quality
TA21 Energy Services
TA22 Models of Service Co-creation
TA23 Service Innovation
TA24 Joint Session SPPSN/MIF: Community-Based Operations Research
TA25 OR for the Public Interest – Health Care
TA26 Data Mining Contest
TA27 New Firms, Populations, and Industires
TA28 Prognostics and Predictive Maintenance
TA29 Optimization Methods in Quality, Statistics and Reliablity
TA30 Joint Session QSR/DM: Statistical Decision Making in Health Care Applications
TA31 Data Mining I
TA32 Interfaces Between Dynamic and Stochastic Programming
TA33 Stability, Sample Size, and Smoothing Techniques for Stochastic Programming
TA34 Interior Point Methods and Decomposition Methods for Large Scale Optimization
TA35 Stochastic Network Asymptotics
TA36 Accreditation Issues in OR/MS Education
TA37 Advances in Learning and Dynamic Optimization I
TA38 Applications of Complementarity Problems and Variational Inequalities
TA39 Integer Programming
TA40 Modeling and Computation in Stochastic Programming
TA41 Nonlinear Programming I
TA42 Stochastic Programming - Sampling Methodology and Applications
TA43 Operations Models in Health Care
TA44 Applications of OR to Healthcare
TA45 Optimization in Medical Decisions
TA46 Joint Session Invited Panels /JFIG: Success as a Junior Faculty
TA47 Large-Scale Networks and Applications
TA48 Software Demonstrations
TA49 The Role and Value of Information Technologies in Healthcare
TA50 Distributed Control of Information Networks
TA51 Modeling the Defense Analysis II
TA52 Sensor Placement for Homeland Security
TA53 Marketing Channels
TA54 Technology Sourcing, Capabilities and Service
TA55 Strategy, Organization and New Product Development
TA56 Joint Session SIM/QSR: Metamodeling for Deterministic and Stochastic Simulations
TA57 Computational Methods in Finance
TA58 Free-boundary Problems in Finance
TA59 Analytic Hierarchy Process
TA60 Soft Skills for Decision Analysts
TA61 Operations Management I
TA62 Modeling Equipment Failures and Maintenance in Aviation
TA63 Military Decision Analysis
TA64 Health Care, Modeling and Optimization I
TA65 Inventory Management I
TA66 Logistics I
TA67 Economics I
TA68 Social Interactions in Business: Models and Processes
TA69 Joint Session-RAS/TSL: Recent Advances in Transportation Planning Systems
TA70 Queuing Theory Applications in Aviation
TA71 DEA Models
TA72 Facility Logistics I
TA73 Supply Chain Design and Logistics Models
TA74 Signalized Intersection Performance Measurement Using Mobile Sensors

Tuesday, 11:00am - 12:30am

TB01 Wind Power Modeling
TB02 Stochastic Programming in Energy
TB03 Bioenergy and Forest Products: Strategic Planning, Logistics and Supply Chain
TB04 Understanding Competitive Behavior in Electricity Markets
TB05 Game Theory II
TB06 Tutorial: Decentralized Supply Risk Management
TB07 Daniel H. Wagner Prize for Excellence in Operations Research
TB08 Retail and Competitive Location Models
TB09 Retail Operations Management
TB10 Emerging Issues in Operations
TB11 Carbon Emissions and Operations
TB12 Supply Chain/Marketing Interface
TB13 Service Management in Humanitarian Operations
TB14 WORMS Keynote Session
TB15 Behavioral Operations
TB16 Scheduling I
TB17 OR for Service Delivery
TB18 OR/MS Software II
TB19 Dynamic Pricing
TB20 Airline Codesharing and Revenue Management
TB21 Renewable Energy – Analysis and Optimization
TB22 Optimizing Service Productivity
TB23 Joint Session Media Planning/ RMPS: Revenue Management for TV Advertising
TB24 OR for Public Policy
TB25 OR for the Public Interest – Energy
TB26 Analysis Frameworks for Complex Decision-Making Applications
TB27 Integer Programming I
TB28 Nanomanufacturing & Nanoinformatics III
TB29 Operations Research Invited Papers in QSR
TB30 Computer Experiments II
TB31 Data Mining III
TB32 Computationally Expensive Optimization Problems in Disaster Planning and Management
TB33 Metaheuristics
TB34 Computational Advancements in Integer Programming
TB35 Contemporary Topics in the Analysis of Queues
TB36 Communication Instructional Tools From Georgia Tech and Texas Tech
TB37 Advances in Learning and Dynamic Optimization II
TB38 Complementarity Problems and Algorithms
TB39 Advances in Mixed Integer Programming I
TB40 Decomposition in Linear and Stochastic Programming
TB41 Nonlinear Programming II
TB42 Algorithms and Applications for Stochastic Programming

TB43 Capacity Planning in Health Care Delivery Systems
TB44 Pierskalla Finalists IV
TB45 Improving Patient Flow
TB46 Panel Discussion: Operations Research/Management Science in Business Schools
TB47 Modeling and Analysis of Real-World Large Scale Networks
TB48 Software Demonstrations
TB49 On-line Markets
TB50 Joint Session Cloud/MIF: Stochastic Models for Cloud Computing
TB51 National Security Research at RAND I
TB52 Challenges in Defending Interdepedent Infrastructure Systems
TB53 Marketing Models of Boundedly Rational Consumers
TB54 KLIC: Management and Evolution of Knowledge
TB55 Incentives and Organizational Issues in R&D and Product/Service Design
TB56 Efficient Monte Carlo Methods with Applications to Risk and Finance
TB57 Problems in Financial Services
TB58 Financial Engineering: Models and Computation
TB59 Research and Development
TB60 Portfolio Decision Analysis III
TB61 Operations Management II
TB62 Software Demonstrations
TB63 Rare Events and Surprising States
TB64 Health Care, Modeling and Optimization II
TB65 Inventory Management II
TB66 Logistics II
TB67 Economics II
TB68 New Techniques for eBusiness Problems
TB69 Train Timetabling
TB70 Panel Discussion: Collision Course?: The North Airfield Safety Study at Los Angeles International Airport (LAX)
TB71 Networks and DEA
TB72 Transportation Asset Management
TB73 Emissions Modeling and Carbon Footprint Allocation in Logistics
TB74 Advances in Equilibrium Based Simulation Models

Tuesday, 12:30pm - 1:30pm

Interactive Session

Tuesday, 1:30pm - 3:00pm

TC01 Investment Decisions in the Energy Sector
TC02 Modeling LNG Value Chains
TC03 Economic Modeling and Analysis of US Bioenergy Policies
TC04 Planning and Scheduling in the Power Sector
TC05 Queueing Models I
TC06 Tutorial: The Trojan Horse of Time-Risk Preference Representations
TC07 Daniel H. Wagner Prize for Excellence in Operations Research
TC08 Reliability Issues in Location Models
TC09 Environmental Issues in Operations Management
TC10 Global Health Supply Chains
TC11 Supply Chain Management
TC12 Supply Chain Optimization
TC13 Delay Announcements
TC14 Supply Chain Management VI
TC15 Computer Science-Applications to OR I
TC16 Scheduling II
TC17 Logistics and SCM in India
TC18 Modeling Frameworks
TC19 Emerging Trends in Pricing and Revenue Management
TC20 Extensions to Traditional Pricing and Revenue Optimization Approaches
TC21 Resilient Power Distribution
TC22 Sustainable Value Chains
TC23 Joint Session Media Planning/ RMPS: Yield Ad Revenue Optimization in Media Ad Sales & Promotion Planning
TC24 Joint Session SPPSN/HAS: Public Health - Strategies for Population Protection
TC25 Traffic Management
TC26 Joint Session DM/QSR: Quality and Statistical Decision Making in Health Care Applications II
TC27 Integer Programming II
TC28 Panel Discussion: Analytical and Statistical Opportunities in Industries
TC29 Statistical Process Control
TC30 Reliability I
TC31 Data Mining II
TC32 Efficient Semidefinite Relaxations for Hard Optimization Problems
TC33 Computational Challenges in Large-Scale Network Design and Routing
TC34 Infectious Disease Modeling and Control
TC35 Control and Constrained Optimization In Stochastic Systems
TC36 Operations Research in High Schools – Project MINDSET and Outreach: A Panel Discussion
TC37 Approximations and Large Deviations Computations with Many Server Systems
TC38 Conic Programming Approaches for Nonconvex Optimization Problems
TC39 Mixed Interger Programming (MIP)
TC40 Solver Interface APIs I
TC41 Topics in Networks
TC42 Stochastic Integer Programming and Applications
TC43 Modeling for Medical Decision Making
TC44 Joint Session HAS/SPPSN: Mathematical Models for Infectious Disease Control
TC45 Scheduling in Health Care
TC46 Panel Discussion: Academic Administration and Operations Research/ Management Science: A Good Combination?
TC47 Teaching Project Management
TC48 Software Demonstrations
TC49 Competing (Overlapping,Sequential or Simultaneous) Electronic Markets
TC50 Getting More From Your Data with Google
TC51 National Security Research at RAND II
TC52 Port and Border Security I
TC53 Dynamic Linear Models
TC54 Contemporary Issues in Technology and Knowledge Management - I
TC55 New Product Development in the Health Care Industry
TC56 Agent-Based Modeling & Simulation - Overview and Tutorial
TC57 Optimal Investing
TC58 Optimization Methods in Finance Applications
TC59 Decision Support Systems I
TC60 Assessment, Aggregation and Bias
TC61 Operations Management III
TC62 Aviation Applications I
TC63 Behavioral Decision Analysis: Time, Ambiguity, Risk
TC64 Health Care, Modeling and Optimization III
TC65 Inventory Management III
TC66 Supply Chain, Competition I
TC67 Economics III
TC68 E-Business/Commerce
TC69 Hot Topics in Railroad Operations Research
TC70 Joint Session AAS/TSL: Robust Airline Scheduling
TC71 Panel: Future Directions for DEA Research
TC72 Facility Logistics II
TC73 Planning Models for Freight Transportation and Logistics
TC74 Network Design and Network Reliability

Tuesday, 4:30pm - 6:00pm

TD01 New Techniques in Power-System Transmission Planning and Market Clearing
TD02 Managing Energy and Commodity Supply Chains
TD04 Electricity and Gas Optimization
TD05 Queueing Models II
TD06 Tutorial: Auctions in Supply Chains/Procurement
TD07 Daniel H. Wagner Prize for Excellence in Operations Research
TD08 Public Sector Location Modeling 2
TD09 Competition and Cooperation in Supply Chains
TD10 Supply Chain Economics and Quality Issues
TD11 Managing Supply and Demand Uncertainty in Supply Chains
TD12 Supply Chain Systems (Consignment Stock)
TD13 Empirical Service Operations
TD14 Supply Chain Management VII
TD15 Computer Science-Applications to OR II
TD16 Manufacturing I
TD17 Analytics for Life
TD18 Optimization Software
TD19 New Directions in Revenue Management and Pricing II
TD20 Cargo Revenue Management
TD21 Customer Service Management in Energy & Utility Industry
TD22 Joint Session Service/Supply Chain: Manufacturing vs. Service Operations
TD23 Joint Session Media Planning/ RMPS: New Models in Online Advertising
TD24 Operations Research Applications in Disaster Management
TD25 Transportation, Intelligent Systems I
TD27 Large Scale Optimization
TD28 Reliability Applications in Homeland Security
TD29 IIE Transaction Sponsored Session
TD30 Reliability II
TD31 Data Mining IV
TD32 Hard Problems in Learning and Decision-Making
TD33 Approximate Dynamic Programming
TD34 Joint Session ICS/ Telecom: Network Flows
TD35 Pre-Hospital Care
TD36 Panel Discussion: Analytics Curriculum in the Business School. Are We Teaching the Skills Employers Seek?
TD37 Stochastic Models of Manufacturing and Service Systems
TD38 Conic Complementarity Problems and Related Topics
TD39 Advances in Combinatorial Optimization and Integer Programming III
TD40 COIN-OR Under the Hood
TD41 Clique Relaxation Models and Applications
TD42 Stochastic Optimization, Statitics, and Sparsity
TD43 Optimization and Data Mining in Healthcare Research
TD44 Optimization in Healthcare Scheduling and Planning
TD45 Joint Session HAS/SPPSN: Analyses of Several Public Health Problems and Solutions
TD46 Panel Discussion: Skills and Career Paths in Industry
TD47 Teaching Project Management with Computer Simulations
TD48 Software Demonstrations
TD49 Social Network Dynamics
TD50 Cloud Computing Management
TD51 Technology Intelligence and Strategy Through Methods
TD52 Port and Border Security II
TD53 Models of Multi-Category Choice Behavior
TD54 Contemporary Issues in Technology and Knowledge Management - II
TD55 Developing and Appropriating Value from Innovation
TD56 Agent-based Simulation Modeling Theory and Practice
TD57 Research in Credit, Liquidity and Contagion
TD58 Portfolio Selection
TD59 Decision Support Systems II
TD60 Risk Preference and Time Preference - From Theory to Practice
TD61 Operations Management IV
TD62 Aviation Applications II
TD63 Behavioral Decision Theory
TD64 Health Care, Modeling and Optimization IV
TD65 Inventory Management IV
TD66 Supply Chain, Competition II
TD67 Revenue/Yield Management
TD68 Business Process Reengineering
TD69 Transportation, Freight I
TD70 Discrete Choice Modeling for Airline Scheduling Problems
TD71 Airports, Regional Policy and DEA
TD72 Facility Logistics Panel: Physical Internet Initiative
TD73 Maritime Inventory Routing
TD74 Traffic Signals Systems and Traffic Flow Characteristics

Wednesday, 8:00am - 9:30am

WA01 Multi-stage Stochastic Optimization Applied to Energy Planning
WA02 Refinery Operations with Spot and Forward Markets
WA03 Challenges for the US Biofuels Industry: Economic and Technological Uncertainties
WA04 Decision Analysis II
WA05 Multicriteria Decision Making
WA06 Tutorial: New Developments for Solving Real World Optimization Problems by Marrying Simulation and Optimization
WA07 Supply Chain Optimization I
WA08 Joint Session Location Analysis/MIF: Public-Sector Facility Location
WA09 Empirical Studies in Operations Management
WA10 Operations Economics
WA11 Finance/Operations Link: Flow Models
WA12 Tactical and Operational Issues in Supply Chain Management
WA13 Incentives in Service Operations
WA14 Supply Chain Management VIII
WA15 Continuous Optimization
WA16 Manufacturing II
WA17 OR For Infrastructure Development in India
WA18 OR in Practice I
WA19 Computational and Robust Approaches to Inventory and Revenue Management
WA20 Challenges and Perspectives in Price Demand Relationship
WA21 Carbon Reduction Policy Analysis
WA23 Optimization in the Service Sector
WA24 Network Models for Counterterrorism
WA25 Transportation, Intelligent Systems II
WA26 Data Mining and Knowledge Discovery in Health Care
WA27 Linear Programming
WA28 Health Management of Complex Systems
WA29 Renewable Energy Integration Into Power Systems for Smart Operations
WA30 Reliability III
WA31 Forecasting I
WA32 Applications and Heuristics Methods in Integer Programming
WA33 Integrating Constraint Programming and OR
WA34 Joint Session ICS/Complex/QSR: Sensing, Prediction and Prognostics in Complex Systems
WA35 Advances in Anomalous Diffusion I
WA36 Panel Discussion: Research in Teaching Schools
WA37 Stochastic Control, Dynamic Games and Their Applications
WA38 Complementarity Problems
WA39 Joint Session OPTIM/ICS:
WA40 Solver APIs II
WA41 Vehicle Routing I
WA42 Computational Optimization and Applications I
WA44 Resource Allocation in Healthcare
WA45 Pierskalla Finalists V
WA47 New Directions in Project Management
WA48 Software Demonstrations
WA49 Machine Learning and Business Intelligence
WA50 Managing Workload Dependencies in the Cloud
WA51 Optimal Routing Through Military Networks
WA52 Decision Support for Military Operations
WA53 Marketing
WA54 Technology Assessment and Forecasting II
WA55 New Product Innovation Strategy
WA56 Simulation Optimization and Global Optimization of Expensive Functions
WA57 Recent Advances in Portfolio Optimization
WA58 Finance-Risk Management
WA61 Operations Management V
WA62 Aviation Applications III
WA63 Decision Analysis For Public Health
WA64 Health Care, Modeling and Optimization V
WA65 Inventory Management V
WA66 Transportation, Other
WA67 Simulation I
WA68 Innovation/Entrepreneurship I
WA69 Transportation, Rail
WA70 Planning and Strategies for Airline Operations
WA71 Resource Efficiency and Distribution Models in DEA
WA72 Joint Session TSL/SPPSN: Aiding Disaster Relief through Optimization
WA73 Supply Chain: Reverse Logistics. Cost of Quality
WA74 Optimal Sensor Location and Deployment

Wednesday, 11:00am - 12:30pm

WB01 Planning for Uncertainty in Energy Systems
WB02 Risk Management & Stochastic Programming in Gas and Power Systems
WB03 Environmental Legislation, Carbon Trading and Supply Chain Management
WB04 Decision Analysis III
WB05 Stochastic Optimization
WB06 Tutorial: Robust Vehicle Routing
WB07 Supply Chain, Closed-loop I
WB08 Location Modeling Applications
WB09 Behavioral Issues
WB10 Managing the Distribution Channel with Competing Products and Supply Risk
WB11 Empirical Research in Operations Management
WB12 Emerging Topics in Supply Chain Management
WB13 Dynamically Managing Customer Loyalty and Learning
WB14 Supply Chain Management IX
WB15 Convex Optimization
WB16 Remanufacturing
WB17 Decision Making in Interdependent Systems
WB18 OR in Practice II
WB19 Revenue Management of Opaque and Non-traditional Channels
WB20 Pricing and Revenue Management I
WB21 Green Supply Chain Management
WB22 Workforce Management
WB23 Municipal Waste Management, Analytics and Optimization
WB24 Joint Session SPPSN/HAS: Emergency Medical Services: New Directions
WB25 Transportation, Planning I
WB26 Joint Session DM/ICS: Bayesian Computational Issues in Data Mining
WB27 Network Optimization I
WB28 Prognostics and Health Management (PHM / Sensors / RFID)
WB29 Joint Session QSR/DM: Data Mining for Process Monitoring
WB30 Statistics/Quality Control I
WB31 Forecasting II
WB32 Computing Economic Equilibria
WB33 Business Analytics and Optimization Practices
WB34 Stochastic Optimization and Equilibrium Problems: Analysis and Stochastic Approximation Algorithms
WB35 Advances in Anomalous Diffusion II
WB36 Education I
WB37 Queueing Models of Call Centers
WB38 First-order Optimization Methods and Their Applications
WB39 Advances in Mixed Integer Programming II
WB40 Panel Discussion: COIN-OR Technology Forum
WB41 Vehicle Routing II
WB42 Computational Optimization and Applications II
WB44 Appointment Scheduling in Healthcare
WB45 Modeling and Optimizing Quality of Care and Efficiency of Delivery

WB46 Game-Theoretic Applications in Healthcare I
WB47 Project Scheduling and Risk Management
WB49 Systems Analysis and Design
WB50 Information Systems I
WB51 Analyses for Rotary Wing Aircraft
WB52 Assessing Terrorism Probabilities and All-Hazards Risk in the U.S. Department of Homeland Security
WB53 Operations/Marketing Interface I
WB54 Characterizing Uncertainty and Learning for Technology Choice Decisions
WB55 Sustainability and NPD
WB56 Human Decision-Making and Social Network Simulation
WB57 Financial Optimization in Energy and Communication Systems
WB58 Finance-Theory and Empirics
WB61 Operations Management VI
WB62 Aviation Applications IV
WB63 Game Theory and Homeland Security
WB64 Health Care, Modeling and Optimization VI
WB65 Inventory Management VII
WB66 Facilities Planning and Design
WB67 Simulation II
WB68 Innovation/Entrepreneurship II
WB69 Joint Session TSL/SPPSN: Risk and Recovery of Transportation Networks to Disaster
WB70 Emerging Applications in Aviation
WB71 Health and Education Applications of DEA
WB72 Facility Logistics III
WB73 Reducing Transportation Emissions and GHG
WB74 Public Transit IV

Wednesday, 1:30pm - 3:00pm

WC01 Technology Policy and Energy Markets
WC02 Energy I
WC03 Environmental Operations
WC04 Sustainability I
WC05 Dynamic Programming/Control I
WC06 Tutorial: Searching and Hiding on Networks
WC07 Supply Chain Optimization II
WC08 Facility Location I
WC09 Retail Operations and Assortment Planning
WC10 Track and Trace Technologies in Supply Chains
WC11 Supply Chain Issues & Sustainability
WC12 Retail Supply Chain Management
WC13 Managing Service Systems with Self-interested Actors
WC14 Supply Chain Management X
WC15 Organization Theory I
WC16 Flexible Manufacturing Systems
WC17 Supply Chain, Practice and Empirics
WC18 Industry Applications
WC19 Dynamic Optimization in Energy Pricing
WC20 Pricing and Revenue Management II
WC21 Service Contract and Incentive Design
WC22 Service System Design and Effectiveness
WC23 Service Management and Virtual Enterprise
WC24 Decision Making for Wildfire Response and Evacuation
WC25 Transportation, Planning II
WC26 Interface Between Efficient Data Collection and Flexible Data Modeling
WC27 Network Optimization II
WC28 Manufacturing Process Optimization
WC29 Maintenance Management and Service Logistics
WC30 Statistics/Quality Control II
WC31 Health Care, Therapy and Treatment
WC32 Computational Stochastic Programming
WC33 Optimization Strategies for Real-World Applications
WC34 Optimization on Graphs
WC35 Advances in Anomalous Diffusion III
WC36 Education II
WC37 Applied Probability
WC38 Theory and Applications in Copositive Programming
WC39 Column Generation in Integer Programming
WC40 Decision Analysis IV
WC41 Metaheuristics I
WC42 Optimization and Scheduling for Supercomputers
WC44 Cost Effectiveness Models in Health Care
WC45 Radiation Therapy Optimization
WC46 Game-Theoretic Applications in Healthcare II
WC47 Diversification in Projects
WC48 Tutorial: The Role and Challenges for Optimization in Competitive Electricity Markets
WC49 Intellectual Property Issues in Technology
WC50 Information Systems II
WC51 Analysis at US Army Aviation and Missile Command (AMCOM)
WC52 Homeland Security
WC53 Operations/Marketing Interface II
WC54 Innovation Management for Sustainability
WC55 Innovation and the Economy
WC56 Simulation and Optimization I
WC57 Risk Analysis
WC58 Financial Engineering I
WC61 Operations Management VII
WC62 Transportation,Operations
WC63 Decision Analysis V
WC64 Health Care, Processes
WC65 Inventory Management VI
WC66 Miscellaneous Applications of Operations Research
WC67 Simulation III
WC68 Strategy/Strategic Planning I
WC69 Reverse Logistics I
WC70 Fleet-Level Environmental Evaluation of New Aircraft and Technologies
WC71 Decision Support Models in DEA
WC72 Facility Logistics Interactive Session: Distribution Center Operations
WC73 Joint Session TSL/SPPSN: Methods to Support Regional Evacuation
WC74 Hazardous Material Transportation

Wednesday, 4:30pm - 6:00pm

WD01 Joint Session ENRE/QSR: Renewable Energy Integration into Power Systems for Smart Operations
WD02 Energy II
WD03 Interactive Multiple Criteria Decision Making
WD04 Sustainability II
WD05 Dynamic Programming/Control II
WD07 Supply Chain, Closed-loop II
WD08 Facility Location II
WD09 Service Operations
WD10 Pricing Issues in Supply Chain Management
WD11 Green Supply Chains
WD12 Different Approaches to Demand Management in Retail
WD15 Organization Theory II
WD16 Managing Product Variety
WD17 Manufacturing III
WD18 Business Applications
WD19 Practical Applications of Pricing and RM Theory
WD20 Pricing and Revenue Management III
WD22 Service System Development
WD23 Retail Managment
WD24 Joint Session SPPSN/TSL: Decision Support for Emergency Response and Public Safety
WD25 Transportation, Planning III
WD27 Networks and Graphs
WD28 Computer Models: Prediction and Calibration
WD29 Quality Improvement in Complex Systems
WD30 Statistics/Quality Control III
WD31 Quality Management I
WD33 Optimization Models in Data Mining with Applications in Biomedicine
WD35 Ranking and Internet Applications
WD36 Quality Management II
WD37 Stochastic Processes
WD38 Algorithms for Real-Time Equilibrium and Relocation Problems
WD39 Algorithms and Applications for Integer Programming
WD40 Robust Optimization
WD41 Metaheuristics II
WD42 Optimization Algorithms
WD44 Network Modeling in Healthcare
WD45 Health Care, Other
WD46 Statistical Modeling and Analysis in Healthcare Applications
WD47 Project Management
WD50 Information Systems III
WD53 Operations/Finance Interface
WD54 Technology Management
WD55 Inventions, Innovation and Technology Management
WD56 Simulation and Optimization II
WD57 Portfolio Analysis
WD58 Financial Engineering II
WD61 Supply Chain, Risk Management
WD63 Decision Analysis VI
WD64 Health Care, Strategy and Policy
WD65 Supply Chain, Shipping and Transportation
WD67 Transportation, Freight II
WD68 Strategy/Strategic Planning II
WD69 Reverse Logistics II
WD70 Optimization Models in Air Traffic Management
WD72 Facility Logistics Session: Warehouse Order Picking
WD73 Joint Session TSL/SPPSN: Mitigating Disaster Impact Through Planning for Emergency Response
WD74 Joint Session TSL/Service Science: Emergency Transportation, Logistics and Evacuation Service

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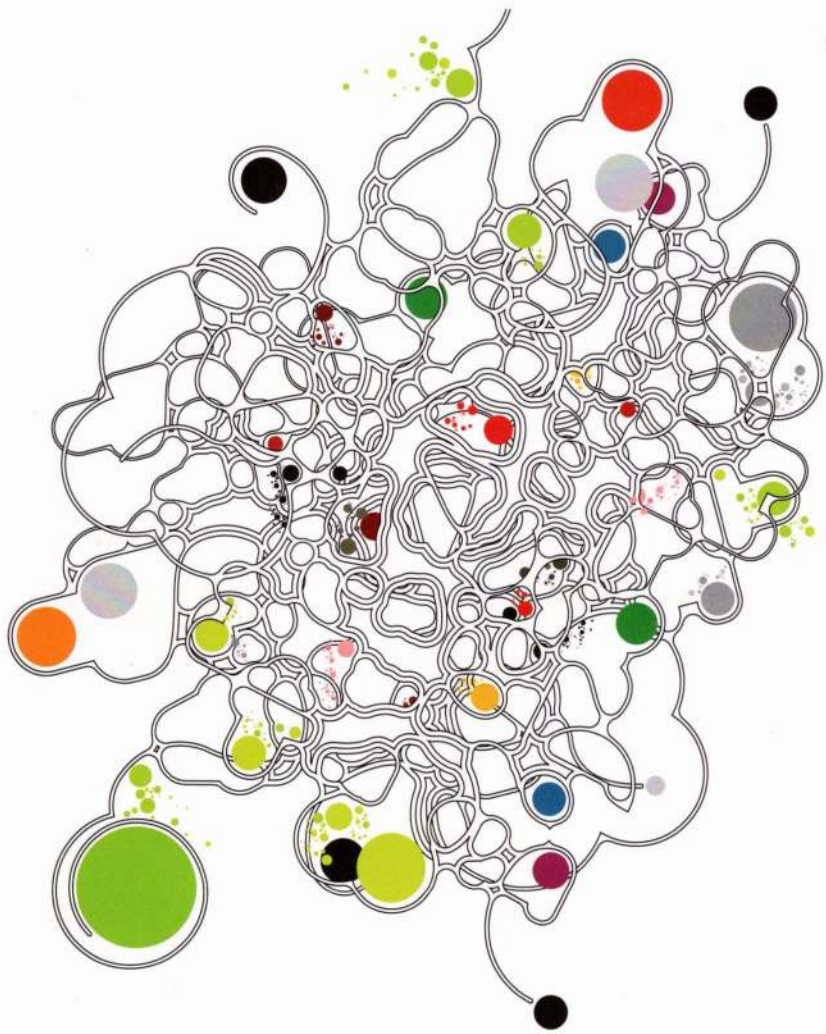
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